Measuring the Dutch clothing mountain

data for sustainability-oriented studies and actions in the apparel sector

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MEASURING THE DUTCH CLOTHING MOUNTAIN

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Credits

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MVO NEDERLAND

SAXION

SYMPANY
GEEF GOED DOOR

CIRCLE ECONOMY

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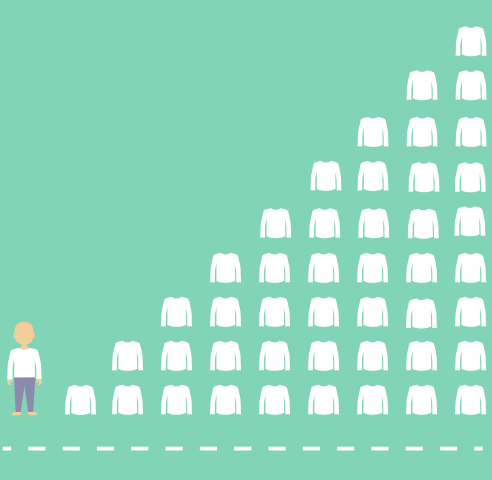
THE DUTCH CLOTHING MOUNTAIN

1. PURCHASE

46 items bought annually per person.

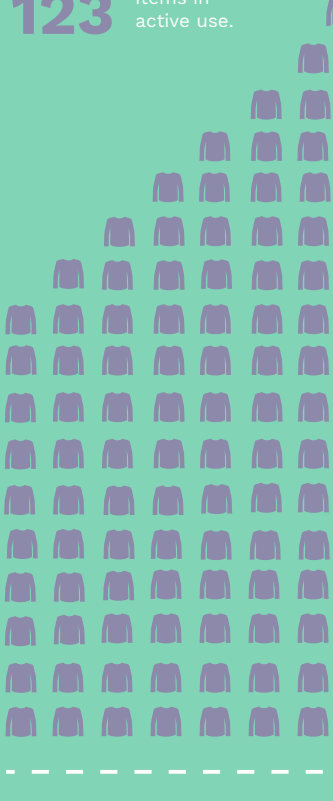


Source: GFK. Includes clothing, footwear and accesories.

2. USE

173
in each p
wardrobe

123 items in active use.



7

Source: Measuring the Dutch Clothing Mo
based on a small, non-represantative san
added on the basis of Euromonitor data (
account for 1 item).

items
personal
e.

50 items were not worn in the past year.

items in the wardrobe are second-hand.

untain. Wardrobe information is
mple. Underwear and socks are
sets or packages of underwear

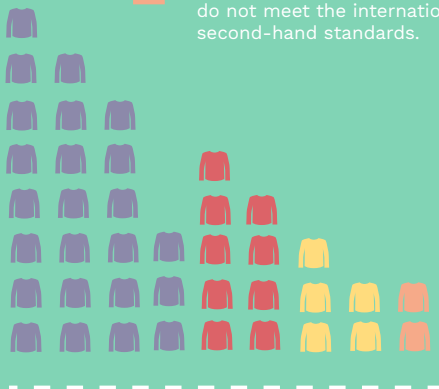
3. DISPOSAL

40 items are annually disposed of per person.

24 items are disposed with non-textile materials and therefore incinerated.

16 items are separately collected:

- **9** items are rewearable and suitable for the international second-hand market.
- **5** items are not suitable for reuse. These can be recycled.
- **2** items are potentioally rewearable according to the consumer, but do not meet the international second-hand standards.



3 **items per year are wasted before arriving to the consumer.**

Sources: MVO Nederland, CBS, Rijkswaterstaat & Measuring the Dutch Clothing Mountain. Destiny of separately collected textiles is based on container analysis (non-representative sample). Pre-consumer waste calculated on the basis of MVO Nederland percentage and GFK volumes.

SYMPANY GEEFGOEDDOOR

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The project 'measuring the Dutch clothing mountain' was funded by SIA's KIEM-VANG programme. Download the final report here

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INTRODUCTION

This report aims at sharing knowledge relevant for sustainability-oriented studies and actions in the Dutch apparel sector, with a focus on clothing volumes. The apparel industry is said to be one of the most polluting at a global level; however, we find that discussions of its environmental challenges or the actions needed to tackle them are often based on superficial or unreliable information. This information is frequently disseminated by word of mouth and non-scientific texts and finally accepted as valid. Moreover, some actors working on practice-based solutions for the environmental challenges of the apparel industry build solutions and projects based on these 'facts'. As a result, these actors risk focussing on topics that are not as critical or relevant as was originally thought. Clear, reliable data is needed to pinpoint the true challenges and bottlenecks within the fashion system.

One example is the popular sustainable fashion strategy of production on demand. This strategy is based on the common belief that 30% of the clothes that are produced within the ready-made industry do not reach the consumer and are wasted. The original source of this percentage is unknown, but it has been used repeatedly in publications and events in the Netherlands. If manufacturers are producing more than consumers actually want, starting by individual consumer demand may be an effective approach to diminish clothing waste. However, previous research has pointed out that this percentage is around 6% including production mistakes (see section 3.1). In this context, the efficacy of turning the whole supply chain up side down with the aim of reducing pre-consumer clothing waste may be questioned.

Another knowledge gap tackled by this report is that of national data. Sustainable fashion knowledge and actions within the Dutch context are often based on foreign publications. The UK and Scandinavia have been pioneers in the production of knowledge relevant

for the field, therefore local studies and actions tend to generalize that information, before applying it to the Dutch context. However, in this report we show that trends in purchase, use, and disposal of clothes can be different across western and northern European nations. For example, Euromonitor's data show that the amount of clothes bought per year by Dutch consumers has been diminishing slowly since 2007, while it has grown considerably in the UK and Denmark (see Chapter 1).

The information compiled in this report focuses on the volumes of clothes bought, used, and discarded by consumers in the Netherlands, assuming that most garments consumed locally are produced abroad. Some sections are based on information that was previously published elsewhere, while other knowledge was generated within this specific research project.

Chapter 1 focuses on the purchase phase and it is based on information published in Euromonitor databases and provided by the consumer research company GFK. What we intend with this chapter is to make this information more accessible to readers in the field. We focus on the Dutch apparel sector, presenting the data in a comprehensive way. For example, we compare retail volume per capita and retail value per item in order to promote the appropriation and dissemination of this information.

Chapter 2 presents data about the use phase, gathered within this research project. We visited 50 individuals equally distributed in terms of age, gender and domicile, and counted the amount of garments in their wardrobe, discriminating those clothes that had not been used during the last year and the ones that had been used by other people before (second hand). Moreover, the chapter includes a similar study of German wardrobes and compares the outcomes of both surveys.

Chapter 3 is about clothing disposal and includes data from a variety of sources. Pre-consumer waste information is based on a previous study done by MVO Nederland. Post-consumer waste data is gathered by a review of existing publications and statistical data. This information is complemented by a series of interviews with post-consumer textile collectors and sorters. Moreover, in the con-

text of this research we sort and analyse 200 kg of textiles disposed by Dutch consumers in detail.

Although the main scope of this publication is to promote realistic and accurate strategies to tackle the issue of clothing volumes in the Netherlands developed by others, we advance some recommendations to reduce overall clothing volumes based on the results of this research in chapter 4.

The time frame considered in this report is 2000-2017. Within this period, some significant events affecting the Dutch apparel sector took place. For instance, 2009 saw the critical point of the economic crisis (see fig. 0.1); moreover, this period coincides with the popularization of fast fashion; lastly, a growing awareness of the social and environmental effects of the clothing industry follows the collapse of the garment factory Rana Plaza in Bangladesh in 2013. These and other issues can be linked to the data presented in this report in order to put it in context.

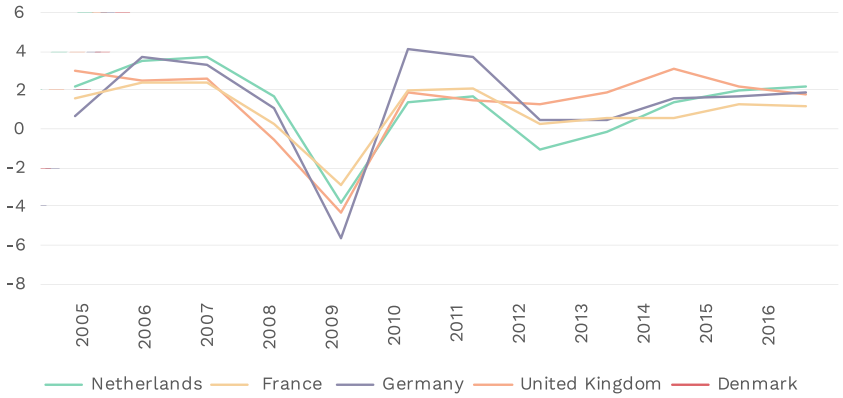


Figure 0.1: Real GPD Y-O-Y growth in the Netherlands and other countries in the region (%). Source: Euromonitor

With this report we hope to contribute to the development of a more responsible apparel sector in the Netherlands. However, we consider this a small first step towards the generation and dissemination of relevant knowledge. The lack of information in the sector is remarkable, hence the brief list of references included in the lit-

erature review. A structural plan for knowledge production is needed, in order to enable historical and international comparisons. We include some recommendations in chapter 4.

Are synthetic materials substituting natural ones in domestic consumption? Are Dutch wardrobes growing? Is the lifespan of products getting shorter? Which kinds of textile products are usually discarded via household waste and which via textile collection? What role do demographic characteristics of individuals play in the variables above? The answers to these and other questions are unknown for us, and we believe most of them have not been uncovered yet. Informed readers are encouraged to contact us with suggestions of sources that may not be included here.

CHAPTER 1: PURCHASE

1.1 RETAIL VOLUME

Figure 1.1 shows historical retail volume of apparel and footwear in the Netherlands and other countries in the region on the basis of Euromonitor's figures. This is the volume of sales to consumers, in this case the number of items of apparel and footwear sold annually in each country. This includes online retail and excludes second-hand clothes and informal retail such as street markets. Sometimes items include more than one garment, such as in packaging including several pairs of socks, and sets of underwear. Accessories such as hats and scarves are included but bags (travel goods) are excluded.

These volumes account for the number of items per capita shown in figure 1.2. According to Euromonitor (2017), the amount of clothing items sold per capita was growing slowly but steadily in Western and North European countries until around 2005. The popularization of fast fashion retailers, the economic crisis, environmental and economic policies or environmental awareness may have had particular effects in different countries. Figure 1.2 shows how after that year national consumption rates have differed. For example, in the UK annual individual purchases escalated up to 36.7 items in 2016, while Denmark reached its peak between 2007 and 2010, with 37.8 items. France and the Netherlands, on the other hand, have been slowly decreasing their volume per capita since 2007. In Germany developments have been more predictable, with a small increase in purchase rates during the last 15 years.

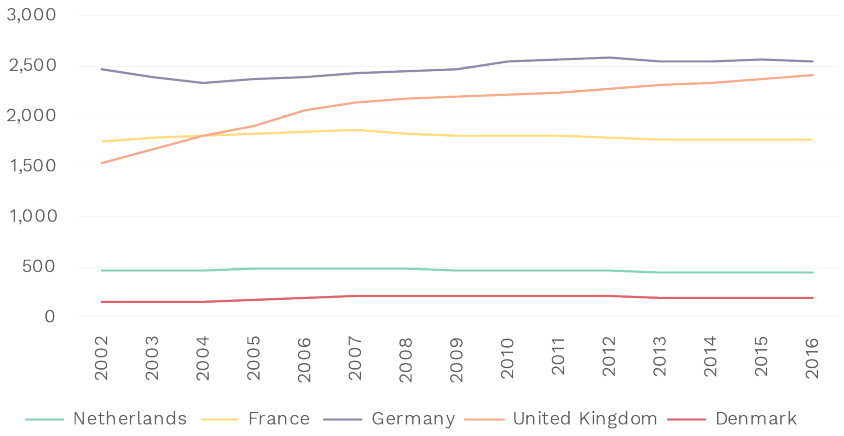


Figure 1.1: Market Sizes | Historical | Retail Volume |in million units. Source: Euromonitor statistics

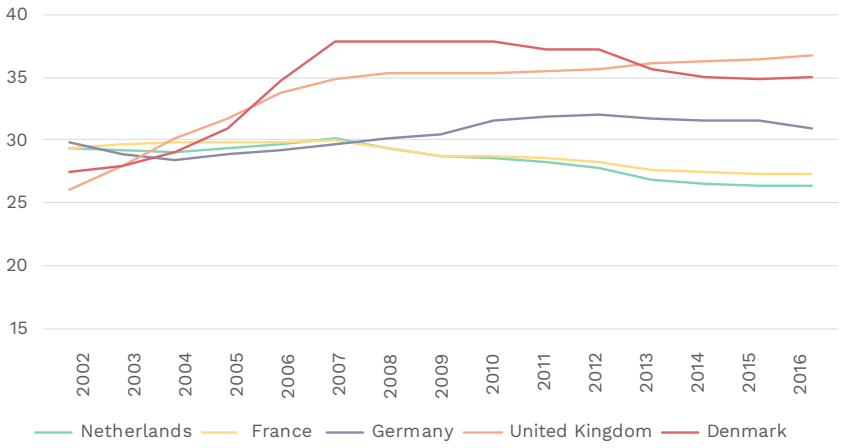


Figure 1.2: International Market Sizes | Retail Volume | units Per Capita . Source: Euromonitor statistics

According to Euromonitor, the average Dutch person bought 26 items of apparel and footwear in 2016. The peak of retail volume, approximately 30 items per capita, was in 2007. From 2009 onwards the amount of items per person decreased. The difference between 2002 and 2016 is three items (see fig 1.3).

When comparing these figures with reported volumes of post-consumer waste (see section 3.2.3), we note that Euromonitor's estimations for retail volume in the Netherlands are too low. The fact that informal retail, such as street markets, is not accounted for may partially explain this difference.

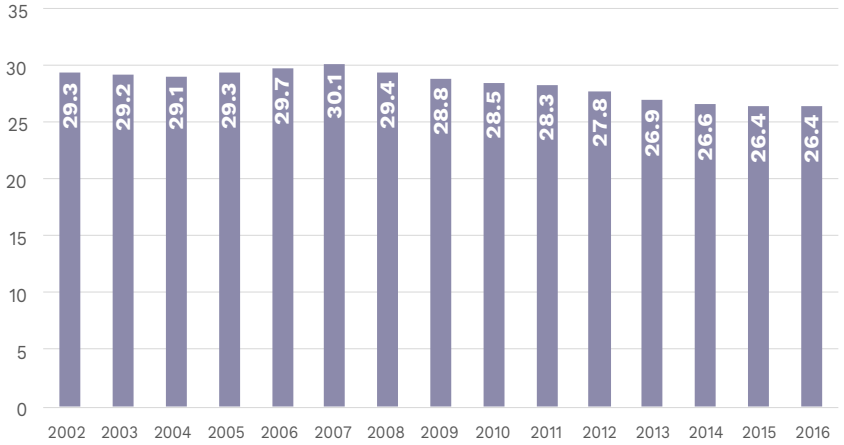


Figure 1.3: Dutch Market Size | Retail Volume | units Per Capita. Source: Euromonitor statistics

GfK (2017), a consumer research company operating in the Netherlands, estimates higher volumes in the sector of fashion, shoes and accessories. The main difference between Euromonitor and GFK methods is that the former is based on data provided by companies while the later accounts for consumer data. Moreover, GfK includes purchases of Dutch inhabitants made abroad, informal retail (e.g. street markets) and counts items sold in packages (e.g. including several pairs of socks) separately. Their estimates are illustrated in figure 1.4. These figures (which exclude second-hand items) seem more consistent with waste volumes (see section 3.2.3). Both organizations identify a reduction in the retail volume per capita. However, GfK recognizes this trend later in time, around 2011, and estimates an increase in the items bought from 2015.

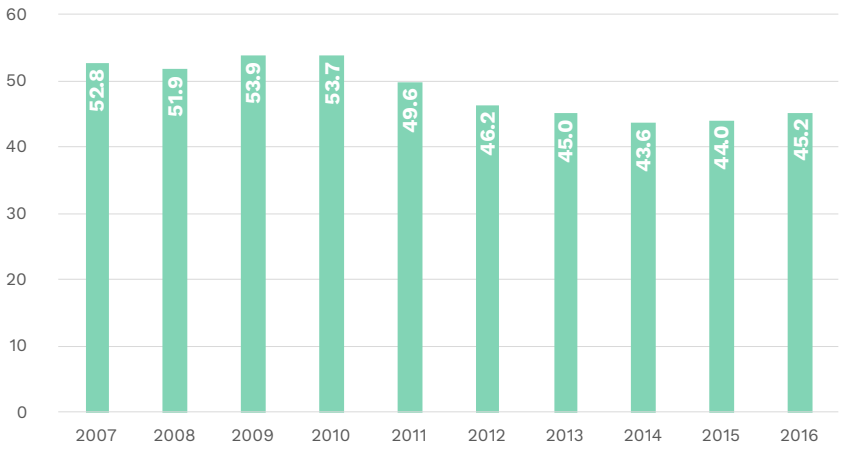


Figure 1.4: Fashion, shoes and accessories bought per capita (€). Source: GfK consumer panel. Market: Total Fashion, Shoes & Accessories (excluding jewellery, bijoux and watches).

1.2 RETAIL VALUE

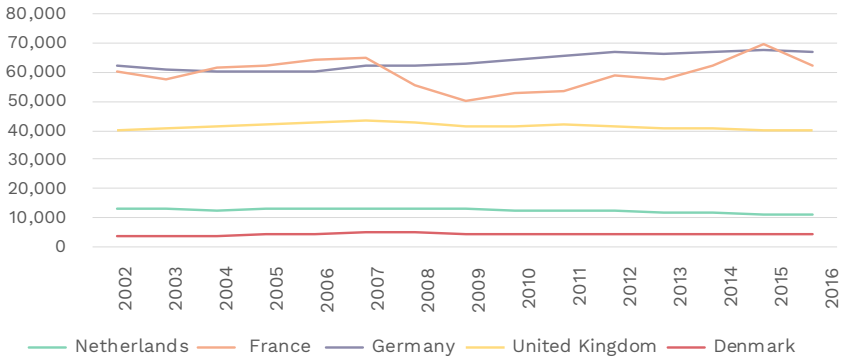


Figure 1.5: Market Sizes | Historical | Retail Value RSP | € million | Current Prices | Year-on Year Exchange Rates. Source: Euromonitor statistics

Figure 1.5 shows historical retail value in the Netherlands and other countries in the region on the basis of Euromonitor's figures. This is the total value of apparel and footwear sold to consumers per year,

per country. The value includes online purchases and excludes second-hand clothes and informal retail such as street markets.

In analysing figure 1.5, the influence of exchange rates (pounds to euro) must be considered. Year-on-Year exchange rates might say more about the irregular UK retail value line in fig 1.5 than actual retail value when it is accounted in pounds (see fig 1.6).

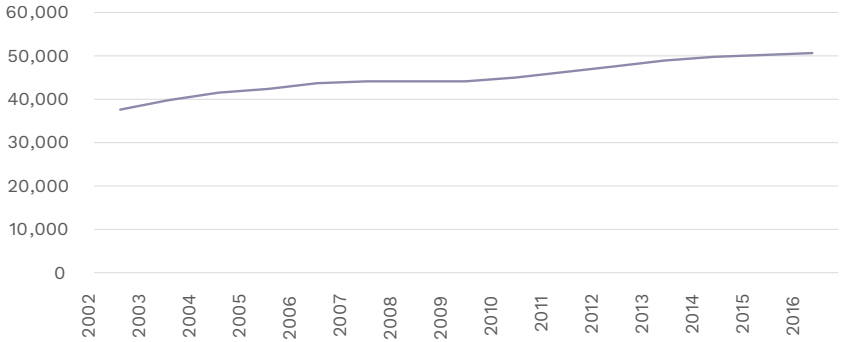


Figure 1.6: Market Sizes | Historical | Retail Value RSP | million £ | Current Prices | Year-on-Year Exchange Rates. Source: Euromonitor statistics

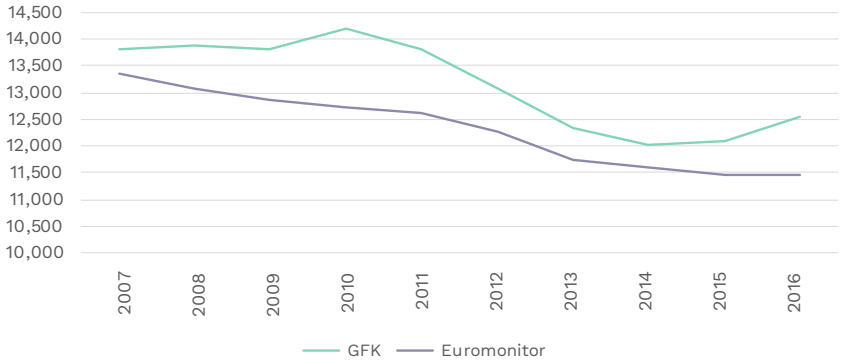


Figure 1.7: Total retail value and consumer spending in apparel and footwear (NL) according to Euromonitor and GFK (in mn €).

Figure 1.7 compares retail value changes in the Netherlands according to Euromonitor and consumer spending according to GfK since 2007. A general trend of lower value in the sector is identified by both organizations. However, there are significant differences around 2010. In line with differences in retail volume discussed above, GfK estimates a peak during 2010 while for Euromonitor the highest figures are those of 2007.

1.3 VALUE PER ITEM

Figure 1.8 shows international developments in the average value of each item (in €) according to Euromonitor. These are calculated by dividing retail value per retail volume annually. Again, the influence of exchange rates for the irregular representation of UK numbers should be taken into account. Rendering from these figures, the average value of French items has been stable at around €23, while German items have increased their value by around €1. The average value for Danish and Dutch items has dropped significantly, by around €3 during the last 15 years.

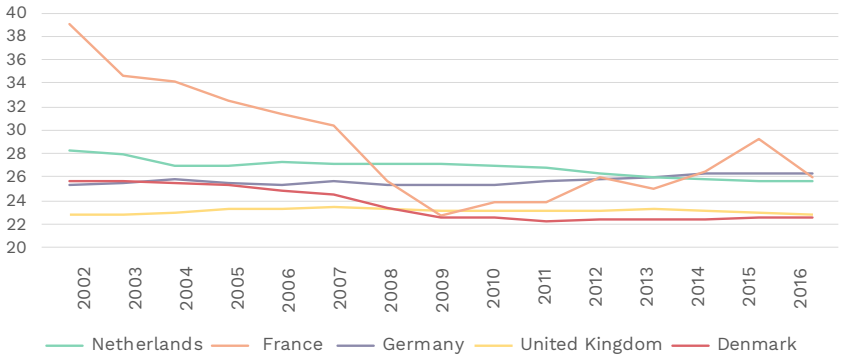


Figure 1.8: Market Sizes | Historical | Retail Value RSP | Unit Price | € per unit | Current Prices | Year-on-Year Exchange Rates. Source: Euromonitor statistics

Fig 1.9 compares average value per item in the Netherlands according to Euromonitor and GfK data. The methodological differences introduced in section 1.1 should be considered when analysing this figure. Estimates from both organizations are considerably differ-

ent, with Euromonitor's data pointing to an average price of €25-€27 per item during the last 10 years, while GfK indicates approximately €16. Furthermore, Euromonitor's figures show a decline in prices while according to GfK prices have been relatively stable. Overall, when compared with each other, Euromonitor estimates less items sold at higher prices, while for GfK more items have been sold at lower prices.

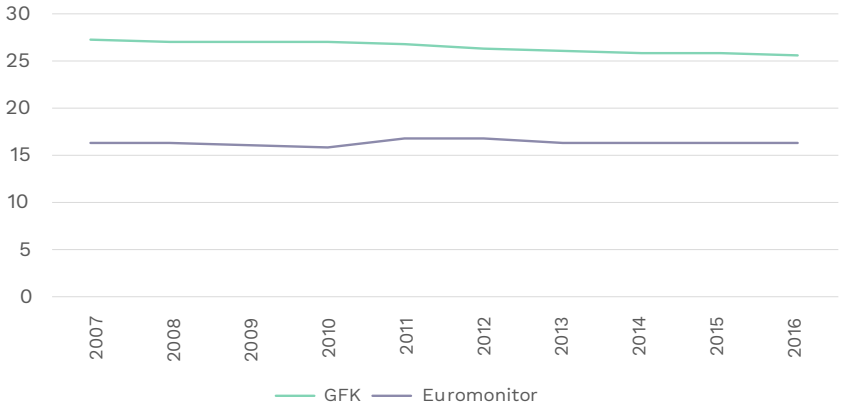


Figure 1.9: Average value per item of clothing and footwear according to Euromonitor and GfK (€).

Despite the difference between sources, clothing prices have become cheaper in comparison with the increase in all consumer prices (general inflation). Since 2002, the general inflation in the Netherlands rose by about 25%; therefore, clothing prices have been decreasing at least in relative terms (CBS n.d.).

1.4 (HOUSEHOLD) SPENDING ON CLOTHING, FOOTWEAR, AND TEXTILES

The national statistics office of the Netherlands (CBS, *Centraal Bureau voor de Statistiek*) maps household spending on textiles and clothes, excluding leather. Their estimates are not directly comparable with those of Euromonitor and GfK due to a difference in the items included (CBS includes home textiles and excludes

footwear, while Euromonitor and GfK exclude home textiles and include footwear). However, by looking at their figures next to each other (fig 1.10), other differences arise, with methodological issues probably playing a larger role than product categories. In any case, their estimates get closer in recent years. All three sources point to a reduction in annual spending during the last ten years. For Euromonitor and GfK, this coincides with a drop in retail volume per capita (amount of items bought per person) and retail value per item (price per product). We highlight the need for more detailed analysis of these issues in future research.

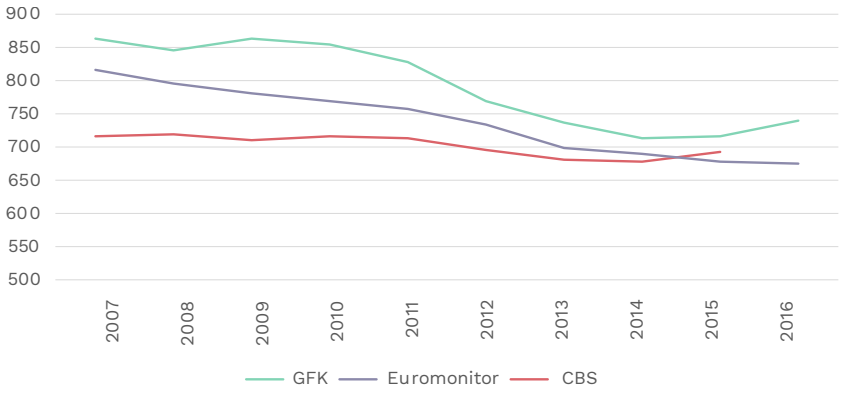


Figure 1.10: Annual retail value / spending per capita (€). Comparison of GfK, CBS and Euromonitor data.

CHAPTER 2: USE

2.1 INTRODUCTION

This chapter describes the methods and results of a wardrobe study of fifty individuals living in the Netherlands. The objective of this research was to find out how many garments are kept in Dutch wardrobes and how many have not been worn within the last year. Previous international studies have pointed out that wardrobe sizes have increased throughout history (Klepp & Laitala 2015); therefore, an assessment of the current state of affairs is a starting point for future historical studies. To our knowledge, there have not been previous studies of Dutch wardrobes that are quantitative and reliable. Ruigrok Netpanel (Vlek & de Jongh 2016) did an online survey for Marktplaats on the number of garments kept by Dutch consumers and how many are not in use. Nevertheless, this research is based on estimations of respondents collected by phone inquiry and it is therefore not accurate. By examining Dutch wardrobes and counting the number of garments owned we provide a more accurate approximation to this issue.

2.2 METHODOLOGY

2.2.1 Sampling and recruitment

The wardrobe study was carried out with fifty respondents living in the Netherlands. Although the sample is not representative of the Dutch population, an explicitly varied selection was made. Table 2.1 shows how respondents were distributed equally according to three criteria: gender, age and locality. The study was carried out by Lidian Bregman, a Fashion Management student from Amsterdam Fashion Institute as part of her graduation project. Recruitment of

respondents started by asking her family, classmates and friends and continued based on their indication in order to meet the sample requirements described above. The final sample includes fifty people. Most of the respondents living in small cities, towns and villages are from the north of the Netherlands.

Table 2.1: Distribution of 50 respondents according to sampling criteria

	Male			*Female*		
	Town / village	*Small City*	*Large City*	*Town / village*	*Small City*	*Large City*
	< 100.000 inhabitants	*100.000-300.000 inhabitants*	*> 300.000 inhabitants*	*< 100.000 inhabitants*	*100.000-300.000 inhabitants*	*> 300.000 inhabitants*
18-30	*RWR03*	*RWR09*	*RWR09*	*RWR01*	*RWR08*	*RWR06*
	RWR11	*RWR15*	*RWR15*	*RWR16*	*RWR22*	*RWR25*
	RWR33	*RWR14*	*RWR14*	*RWR36*	*RWR17*	*RWR07*
30-50	*RWR19*	*RWR30*	*RWR30*	*RWR23*	*RWR27*	*RWR41*
	RWR26	*RWR24*	*RWR24*	*RWR18*	*RWR29*	*RWR42*
	RWR32	*RWR28*	*RWR28*	*RWR31*	*RWR35*	*RWR43*
50 +	*RWR10*	*RWR20*	*RWR20*	*RWR02*	*RWR04*	*RWR38*
	RWR05	*RWR21*	*RWR21*	*RWR12*	*RWR44*	*RWR40*
	RWR13			*RWR34*		
Total	*9*	*8*	*8*	*9*	*8*	*8*

Table 2.4 shows the average number of garments owned by Dutch individuals in relation to the sample variables: gender, age and location. These results should be considered in perspective, taking into account that this is a non-representative sample. However, given that there are no previous studies with these characteristics, the table can be useful to formulate hypotheses for future studies including bigger samples.

Table 2.2: Template used for the wardrobe study

Garment type	*Number of garments in wardrobe*	*Of which unused*	*Of which second-hand*
Coats and jackets (including rain jackets and sport jackets)			
Shoes and boots (pairs)			
Bags (only bags used as clothing accessories, excluding shopping bags, for example)			
Scarves and shawls			
Hats			
Gloves (pairs)			
Suits			
Trousers			
Jeans			
Shorts (including sportswear)			
Sweaters and cardigans			
Short-sleeve T-shirts and tops			
Long-sleeve T-shirts and tops			
Blouses and Shirts			
Dresses			
Jumpsuits			
Skirts			
Other			

Columns 1 and 2 in table 2.4 show differences in the number of garments owned by men and women. On average, women in this respondent group own 60% more clothes than men (162 and 99 respectively). Moreover, women own more second-hand garments and almost double of the number of unused garments than men. Secondly, there are differences in the number of garments owned by the three age categories. Columns 3 to 5 show that respondents with an age between 18-30 own on average more garments

(170) than those with an age between 30-50 (134) and 50+ (75). The number of second-hand clothes is also the highest in this group. Thirdly, the number of garments varies in relation to locality (columns 6-8). Respondents living in large and small cities own more garments (149 and 140 respectively) than respondents living in villages/towns (104). Women between 18-30 years old living in large cities own most of the second-hand and unused garments.

Table 2.3: Individual outcomes of the wardrobe count

Respondent number [1]	Age category [2]	Gender [3]	Locality [4]	Estimated number of garments [5]	Total number of garments [6]	Unused garments [7]	Percentage use [8]	Second-hand garments [9]	Percentage second-hand [10]
RWR01	18-30	Female	Town/village	125	171	48	72%	5	3%
RWR02	50+	Female	Town/village	80	83	28	66%	0	0%
RWR03	18-30	Male	Town/village	100	91	22	76%	1	1%
RWR04	50+	Female	Small city	75	211	117	45%	5	2%
RWR05	50+	Male	Town/village	80	72	17	76%	0	0%
RWR06	18-30	Female	Big city	150	244	71	71%	22	9%
RWR07	18-30	Female	Big city	200	216	32	85%	19	9%
RWR08	18-30	Female	Small city	60	149	17	89%	26	17%
RWR09	18-30	Male	Small city	80	70	2	97%	6	9%
RWR10	50+	Male	Town/village	40	43	9	79%	0	0%
RWR11	18-30	Male	Town/village	85	32	6	81%	7	22%
RWR12	50+	Female	Town/village	40	44	6	86%	0	0%
RWR13	50+	Male	Town/village	70	78	32	59%	0	0%
RWR14	18-30	Male	Small city	120	193	31	84%	15	8%
RWR15	18-30	Male	Small city	60	148	8	95%	1	1%
RWR16	18-30	Female	Town/village	300	242	74	69%	0	0%
RWR17	18-30	Female	Small city	200	260	69	73%	16	6%
RWR18	30-50	Female	Town/village	75	108	32	70%	9	8%
RWR19	30-50	Male	Town/village	106	67	18	73%	0	0%
RWR20	50+	Male	Small city	50	45	9	80%	0	0%

RWR21	50+	Male	Small city	60	57	10	82%	0	0%
RWR22	18-30	Female	Small city	170	198	62	69%	23	12%
RWR23	30-50	Female	Town/village	130	159	37	77%	6	4%
RWR24	18-30	Male	Small city	75	112	27	76%	1	1%
RWR25	18-30	Female	Big city	250	309	102	67%	29	9%
RWR26	30-50	Male	Town/village	100	94	21	78%	4	4%
RWR27	30-50	Female	Small city	90	118	32	73%	4	3%
RWR28	30-50	Male	Small city	54	62	16	74%	0	0%
RWR29	30-50	Female	Small city	100	107	29	73%	8	7%
RWR30	30-50	Male	Small city	80	118	26	78%	5	4%
RWR31	30-50	Female	Town/village	225	254	75	70%	19	7%
RWR32	30-50	Male	Town/village	80	127	52	59%	9	7%
RWR33	18-30	Male	Town/village	40	52	16	69%	3	6%
RWR34	50+	Female	Town/village	60	92	25	73%	4	4%
RWR35	30-50	Female	Small city	300	306	116	62%	26	8%
RWR36	18-30	Female	Town/village	80	70	16	77%	6	9%
RWR37	50+	Male	Big city	50	50	15	70%	0	0%
RWR38	50+	Female	Big city	75	96	26	73%	4	4%
RWR39	50+	Male	Big city	45	41	10	76%	0	0%
RWR40	50+	Female	Big city	45	55	15	73%	0	0%
RWR41	30-50	Female	Big city	150	212	65	69%	18	8%
RWR42	30-50	Female	Big city	100	155	30	81%	14	9%
RWR43	30-50	Female	Big city	80	101	36	64%	5	5%
RWR44	50+	Female	Town/village	100	79	26	67%	0	0%
RWR45	18-30	Male	Big city	175	249	69	72%	22	9%
RWR46	18-30	Male	Big city	120	141	38	73%	3	2%
RWR47	30-50	Male	Big city	200	205	62	70%	0	0%
RWR48	30-50	Male	Big city	40	43	13	70%	5	12%
RWR49	30-50	Male	Big city	50	56	12	79%	0	0%
RWR50	18-30	Male	Big city	150	218	47	78%	8	4%

Table 2.4: Average number of garments in Dutch wardrobes according to sampling variables

	Gender		Age			Locality		
	Female [1]	Male [2]	18-30 [3]	30-50 [4]	50+ [5]	Town/village [6]	Small city [7]	Large city [8]
Average total	162	99	170	134	75	104	140	149
Average second-hand	10	4	12	7	1	4	9	9
Average unused garments	47	24	41	39	23	30	37	40

Table 2.5 shows the composition of the average wardrobe within this sample regarding number of clothes, number of second-hand clothes, and number of unused clothes per garment category. The larger garment groups are those of upper wear, such as T-shirts, shirts and sweaters (rows 11-14). Hats, scarves and shawls, skirts, dresses, and jumpsuits (rows 4-5 and 15-17) are the garment types more commonly unused. Second-hand pieces are more common in accessories (bags and hats, rows 3 and 5) and dresses (row 15).

Table 2.5: Number of garments per category

	Total number of garments	Average per person	Total unused	Percentage unused	Total second-hand	Percentage second-hand
Coats and jackets (including rain jackets and sport jackets) [1]	284	6	55	19%	16	6%
Shoes and boots (pairs) [2]	482	10	117	24%	9	2%
Bags (only bags used as clothing accessories, excluding shopping bags, for example) [3]	230	5	36	16%	20	9%
Scarves and shawls [4]	253	5	90	36%	14	6%
Hats [5]	166	3	70	42%	14	8%
Gloves (pairs) [6]	108	2	27	25%	3	3%

Suits [7]	*54*	*1*	*16*	*30%*	*2*	*4%*
Trousers [8]	*475*	*10*	*124*	*26%*	*21*	*4%*
Jeans [9]	*411*	*8*	*111*	*27%*	*28*	*7%*
Shorts (including sportswear) [10]	*273*	*5*	*78*	*29%*	*9*	*3%*
Sweaters and cardigans [11]	*705*	*14*	*156*	*22%*	*51*	*7%*
Short-sleeve T-shirts [12]	*1282*	*26*	*353*	*28%*	*75*	*6%*
Long-sleeve T-shirts [13]	*586*	*12*	*187*	*32%*	*9*	*2%*
Blouses and shirts [14]	*576*	*12*	*149*	*26%*	*34*	*6%*
Dresses [15]	*193*	*4*	*69*	*36%*	*17*	*9%*
Jumpsuits [16]	*49*	*1*	*21*	*43%*	*2*	*4%*
Skirts [17]	*149*	*3*	*53*	*36%*	*10*	*7%*
Other [18]	*225*	*5*	*79*	*35%*	*25*	*11%*
Total	*6501*	*130*	*1791*	*28%*	*359*	*6%*

2.4 COMPARISON WITH GERMAN WARDROBES

In the context of this research, Lisa Duscha, a Textile and Fashion Engineering and Management student at the Saxion University of Applies Sciences in Enschede did a similar wardrobe study in Germany. Although these samples are not representative of the national population, respondents were selected using the same criteria. The investigation mainly took place in the west and north-west of Germany. Some results of this survey are shown in table 2.6.

The wardrobe sizes in the German group are somewhat bigger than in the Dutch group. Both studies show that women own more clothes than men, which also applies for the number of second-hand and unused garments. However, within the German group there are smaller differences between genders. Male German respondents owned more garments than Dutch ones (135 to 99).

Columns 3-5 show differences in the number of garments in relation to age. In the Dutch group, respondents aged 18-30 have the

largest number of garments in their wardrobe. This differs from Germany where respondents aged 30-50 have bigger wardrobes (178 pieces). Although respondents in this group have more garments in their wardrobe, it is those between 18-30 years old than own the majority of second-hand garments (21 pieces in average). In both countries, the number of second-hand garments is the highest in this age category. Moreover, in both countries respondents living in large cities own the greatest number of garments. However, the numbers in the German group are more homogeneous.

In the Dutch group, it was the same sector (young females living in large cities) that owned larger wardrobes and more second-hand garments; however, this relation is not found in Germany. Within this group, second-hand clothes are infrequent in big cities. Lastly, in both countries the number of unused garments is related to wardrobe size. The average percentage of unused garments is 28% in the Netherlands and 30% in Germany. The garment categories more commonly unused are similar, as are those including second-hand items.

Table 2.6: Average number of garments in German wardrobes according to sampling variables.

	Gender		*Age*			*Locality*		
	Female [1]	*Male [2]*	*18-30 [3]*	*30-50 [4]*	*50+ [5]*	*Town/village [6]*	*Small city [7]*	*Large city [8]*
Average total	*183*	*135*	*161*	*178*	*138*	*162*	*141*	*174*
Average second-hand	*19*	*6*	*21*	*11*	*6*	*12*	*19*	*6*
Average unused garments	*58*	*38*	*53*	*60*	*31*	*57*	*33*	*55*

2.5 CONCLUSIONS INCLUDING QUALITATIVE ASPECTS

In addition to the quantitative aspects discussed above, there are a few qualitative findings concluded from this research. To begin with, people with larger wardrobes are not aware of what they own. Moreover, 28-30% of all garments owned by respondents are not actively used within one year. These garments could be reused or recycled to substitute the production of new clothes and materials.

One suggestion for consumers is to limit their wardrobes to usable numbers, so that they can keep track of what they own and consider it at the moment of buying. On the other hand, motivations to keep clothes among respondents were not always practical. Some of the reasons mentioned were their sentimental and financial value. Moreover, respondents hoped for a future body change that would enable them to wear old garments again. For example, one respondent argued: 'I keep the garment, although it is not my style but I got it as a present'. Another respondent claimed that 'although the garment is broken and not repairable, I keep it because I have paid a lot for it'.

Many respondents were not interested in second-hand clothing. Second-hand is more common among younger women in large cities, which means there is potential for more reuse in those groups. Additionally, the number of unused garments is also the highest in this group, meaning that there are enough garments suitable for exchange. Lastly, a promising field of intervention is that of promoting the practice of using second-hand clothes in other groups. Actions may vary from private initiatives (such as developing more sophisticated and easy to use digital platforms for clothing exchange, or specific laundry services to reduce concerns related to hygiene) to public policy (such as advertisement campaigns highlighting the value of reuse). This line of intervention may contribute to use existing resources more intensively and to partially substitute the production of new items.

Figure 3.7: Sympany's staff training volunteers to identify rewearable and non-rewearable garments.

CHAPTER 3: DISPOSAL

The Netherlands has (and wants to maintain) a leading position in waste management and recycling (Dubois et al. 2016). Textile waste management plays a role and therefore the disposal phase has been researched in more depth than purchase and use. Four relevant publications regarding the end-of-life stage of textiles were found (FFact 2014; Eureco 2010; Kellermann 2016; Wijnia 2016). These publications focus on different periods in time and on either pre- or post-consumer textile waste. This information was complemented with statistical data from CBS (n.d.), the National Office of Statistics, and Rijkswaterstaat (n.d.), Department of Waterways and Public Works. Moreover, within this project we developed a textile container analysis (section 3.4) and interviews with local sorting actors (section 3.2.2), leading to the data presented in this chapter.

3.1 PRE-CONSUMER WASTE VOLUMES

The issue of pre-consumer waste volumes, obsolete inventory, or clothes that do not reach the consumer, has been a recurrent topic of discussion in the fashion community of the Netherlands. These are finished textile products which are unfit for sale at a regular retail store. A common statement found in literature and lectures is that 30% of the clothes produced never reach the consumer. Matevosyan (2014) for example, relies upon these numbers, of which the source is unknown. In response to this issue, MVO Nederland conducted research in 2016 to obtain a more realistic estimation. The organization found that from the clothing purchased by the Dutch retail sector 4,2% was unsold in 2015. If unsold products by producers and wholesalers are included, the overall percentage is 6.5% (Wijnia 2016). This coincides with estimations from interna-

tional authors, for example, Niinimaki (2011) estimated an unsold inventory between 5 and 10% for Western Europe countries.

Most produced goods are sold, however many of them with price reduction across the different steps of the supply chain. MVO Nederland found that 0.9% of items are sold with discount by manufacturers, while at wholesalers discounted products are 12.4 %, and at retailers 31 %. Therefore, the “30% myth” may be due to a confusion of discounted items with unsold ones.

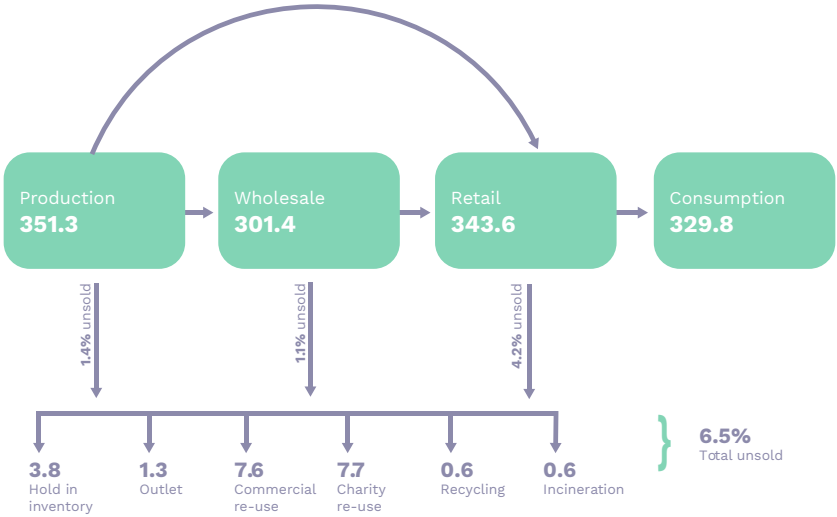


Figure 3.1: Volumes flowing through the Dutch apparel network in 2015 estimated by Wijna on the basis of the Euromonitor's retail volume. Source: Wijna, 2016

The above analysis, which does not include returns, is illustrated in figure 3.1. The qualitative analysis of MVO Nederland’s research indicates that clothing companies sell their unsold inventory to sorting companies under strict regulations, to ensure that the items do not enter the ‘black’ market. Luxury brands often discard their garments for destruction to maintain their brand’s name. Charity organization Sympany alone received in 2015 a total amount of 100,000 pieces of apparel and shoes from apparel brands and retailers (Wijnia, 2016).

3.2 POST-CONSUMER TEXTILE WASTE

3.2.1 Volumes of textile waste

Post-consumer textile waste includes used products that have been discarded by the consumer after use (e.g. used clothing, footwear, accessories, home textiles, and other household soft goods, disposed within general household waste or collected separately). Available data on post-consumer textile waste indicates that volumes have increased during the period discussed. CBS and Rijkswaterstaat provide data on separately collected textiles (CBS) and textiles found in household waste (Rijkswaterstaat). These volumes are presented in figure 3.2. We note that recent volumes of separately collected textiles should be higher than CBS estimations. See sections 3.2.2 and 3.3 for other sources.

3.2.2 Local collecting and sorting organizations

In the context of this research project, we invited all collecting and sorting actors operating in the Netherlands for an interview. However, only three among the main organizations agreed to participate. Together they employ around 330 people (NL) and collect around half of all separately collected textiles in the Netherlands, considering Ffact (2014) estimations for 2012. The findings of these interviews have been anonymized and are presented below.

The volume of post-consumer textiles collected by our interviewees has grown during the last years. Together they collected 46kton in 2013, 48.2kton in 2014, 54.4kton in 2015 and 53kton in 2016. Taking the 90kton of separately collected textile calculated for 2012 by Ffact (2014) as a reference, we estimate a total volume of approximately 92kton collected in 2013, 96kton in 2014, 109kton in 2015, and 107kton in 2016. These figures are considerable higher than CBS's estimates (see fig 3.2). However, these volumes may differ according to changes in the actors operating in the sector. Our interviewees may now collect a different portion of the total volume when compared to 2012.

Figure 3.2: Total textile waste volume in the Netherlands (kton). Sources: CBS & Rijkswaterstaat. ** provisional.

A main issue discussed by interviewees is the economic sustainability of their organizations, which has been challenged by a lower resell value of the items collected during the last decade. They identify a lower quality in the clothing in circulation, which tend to age faster. Moreover, in their eyes the economic crisis affected the disposal behaviour of consumers; clothes were worn longer before being disposed. Lastly, in 2009 new regulations were introduced in order to separate more textile waste from regular household waste. These regulations oblige collectors to take all textile waste with no selection of quality at the source. As a result, they now receive more items that are not suitable for reuse, such as worn-out clothes, underwear, and non-clothing textiles.

These issues have influenced the economic value of the items collected during the last decade, with bigger volumes sorted to non-rewearable grades. One respondent indicated that 10 years ago about 80% of the collected items were graded as rewearable, while today this is about 55%. For another sorting actor, rewearable

grades comprised 50-60% of their offer before the economic crisis, while they are now close to 30%.

Charities appear to collect more rewearable quality than other actors. The percentage of actual clothing is slightly higher for them as well; charities reported about 80% and other collecting companies about 65%. This might be due to the association people have with these organizations. In any case, they estimate a decrease in the amount of rewearable clothing within textile waste between 20 and 30% over the past ten years.

Rewearable grades are sorted according to quality (A, B, C) and garment type (e.g. men's jeans), based on the specific demand of clients. These grades vary according to company and change over time depending on clients' preferences and needs. The main destinations for Dutch rewearable grades are Africa and Eastern Europe.

Collectors pay municipalities € 0.10-0.50 per kilo collected, although some pay more to place their containers at the best locations. Other collecting costs, including transportation and manpower, are about € 0.10-0.18 per kilo. They indicated that they currently get between € 0.50 to € 4.50 per kilo for rewearable grades. Shoes have a value between € 0.50 and € 3.50. The value of non-rewearable grades is generally € 0- 0.22 per kilo with the exception of wool (€ 0.60-1.20 per kilo). Clients downcycling post-consumer textiles into cleaning cloth pay them € 0.10-0.25 per kilo. For the lowest quality recyclable grades, sorters have to pay € 0.05-0.07 to get it processed. None of the collected textiles goes into landfill; this is taken up in the contract with local as well as international clients. For material not suitable for the categories described above, sorters pay € 0.09-0.13 for incineration.

Some sorters import post-consumer textiles because Dutch rewearable grades are in high international demand, but good quality rewearables are often cheaper abroad. One respondent indicated a cost of € 0.20-0.40 per kilo for imported post-consumer textiles. The following countries were mentioned: Italy, France, Austria and Sweden.

Our interviewees mentioned their preference for above-the-ground containers and manual pick up. They argue that people tend to part more easily from their emotional items in this way. Moreover, above-the-ground containers tend to include less non-textile waste than underground ones, and pollution or damage resulting from underground collection is avoided.

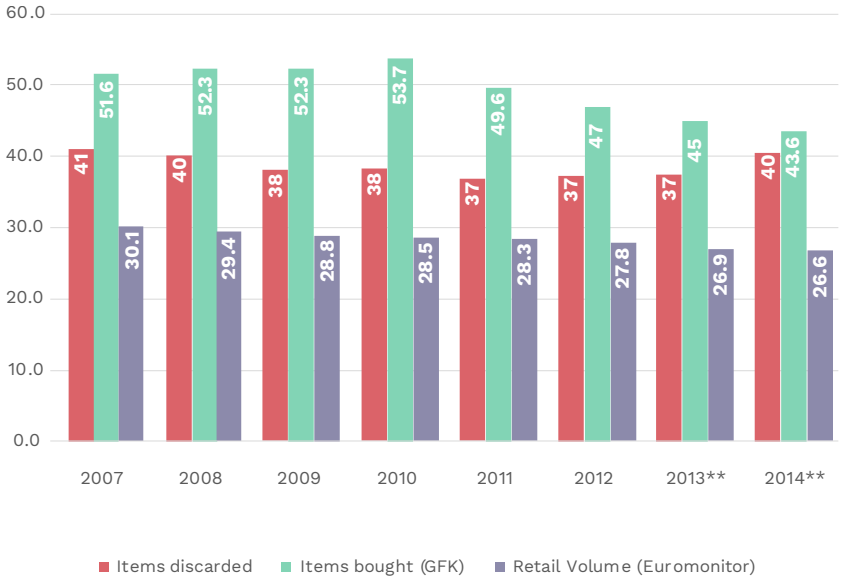


Figure 3.3: Average number of clothing items purchased and discarded per capita. Source: CBS, Rijkswaterstaat, container analysis, Euromonitor, GFK

3.2.3 Post-consumer clothing and footwear waste

On the basis of our interviews with sorting actors and previous studies of textiles included in general household waste by Eureco and Rijkswateerstaat, we estimate that around 80% of all post consumer textiles are clothing and footwear, 20% accounting for home textiles and other materials. Using the average weight per item from our container analysis (see section 3.4), we calculate items of clothing and footwear in textile waste. This is a rough estimation since post-consumer textiles may vary greatly according to

seasons and region, among other factors. The resulting estimated figures are roughly comparable with items reported by Euromonitor and GFK (retail volume and consumer purchases respectively) in terms of product types included.

Figure 3.3 shows the average number of items purchased and discarded (annually per capita), we find GfK's data more consistent with waste volumes than Euromonitor's. The higher numbers for purchases in relation to waste are in line with other European studies (see section 3.5.), which award it to items stored at home ("national wardrobe").

3.3 TEXTILE WASTE DESTINATIONS

This section discusses the destiny of Dutch textile waste. Most of the data is based on 2012 figures (Ffact, 2014, see fig 3.4 for an overview). However, the kind of waste collected and its use can vary to a great extent over time based on changes on regulation, consumer awareness, second-hand or recycled material demand for specific products, and other factors. Our interviews with Dutch collectors and sorters aimed at estimating updated figures. Unfortunately, and despite the endorsement received from the branch organization VHT, we could not gather enough information to update these figures. Some collecting and sorting actors did not react to our interview invitation and others could not provide accurate information.

3.3.1 Textile volume incinerated

Disposal of waste via landfill is banned in the Netherlands. Therefore all textile waste that cannot be sorted to other destinations is incinerated for energy recovery. The total amount of textile waste incinerated includes material disposed via household waste and what is collected separately but considered not suitable for reuse or recycling. Ffact estimated that in 2012 145kton of textiles were found in regular household waste and thus incinerated (FFact 2014, p.8). The same report indicates that in 2012, about 7% of sorted textiles could not be re-used or recycled and was therefore incinerated (FFact 2014, p.14). During our interviews, higher figures were

mentioned (e.g. 10% for 2015). Therefore, we estimate that the total volume of textiles currently incinerated is slightly higher than that of textiles disposed in general waste (see fig 3.4 for estimates in 2012).

Figure 3.4: Destiny of textile waste in 2012 according to Ffact, 2014 (Kton).

From a household waste analysis carried out in 2009, Eureco (2010) found that 65% of the textile found in regular waste was suitable for reuse or recycling. If disposed properly, these textiles could have been sorted as follows: 35% clothing re-use, 10% linen reuse, 20% recycling and 36% not suitable for product reuse or recycling. Applying these percentages to 2009 Rijkswaterstaat's volumes, we conclude that collecting all 2009 post-consumer waste separately would have prevented the incineration of 95kton of textiles suita-

ble for reuse and recycling that year. Moreover, 50kton could have been used for clothing reuse, 14kton for linen reuse and 28kton for recycling.

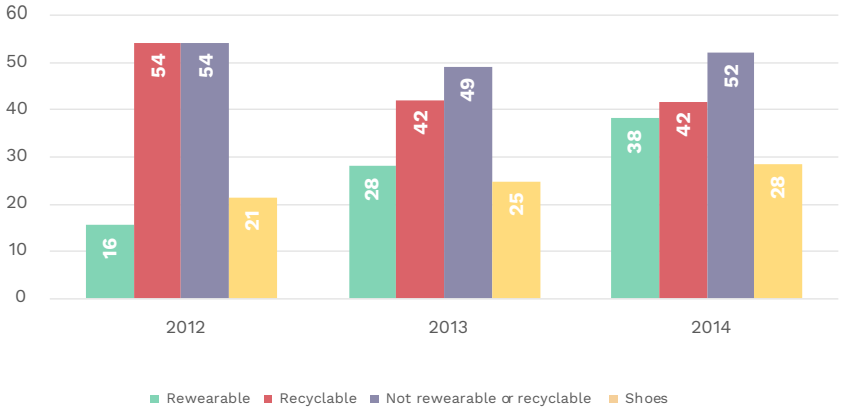


Figure 3.5: Potential destination of textiles found in household waste in kton (currently incinerated). Source: Rijkswaterstaat.

From 2012 onwards, the annual household waste component study assigned to Eureco by Rijkswaterstaat included subcomponents to the textile category. These subcomponents are not as specific as their 2010 report, but they give a more recent impression of the developments in household waste content. See fig 3.5 for the volumes during 2012-2014 calculated on the basis of Rijkswaterstaat/ Eureco percentages. These textiles are currently incinerated, but they could follow the destinations suggested in the figure if they were separately disposed of and collected.

3.3.2 Textile sorted

Textile sorted in the Netherlands includes material collected locally and textile imports (see fig. 3.6). According to sorting actors, this is because Dutch post-consumer textiles are in high international demand, but used clothing of good quality is often cheaper when imported, including transport costs. Local collectors need to pay municipalities and maintain the infrastructure and human resourc-

es needed for their activity, and this may result in higher costs than buying foreign textiles already collected and sorted elsewhere (see section 3.2.2). Moreover, not all textile collected in the Netherlands is sorted locally; some sorting actors have foreign clients that buy 'original' (unsorted or roughly sorted post-consumer textiles, in which any non-textile items have been removed). This may be more convenient for them, since manual labour is costly in the Netherlands.

Figure 3.6: Collection, import and processing of post-consumer textiles (kton) in 2012. Source: (FFact 2014)

According to Ffact (2014), 23kton were exported 'original' in 2012. From the remaining 67kton collected, 5.2kton were non-textile materials and the other 61.6kton were sorted into the reuse, recycling and incineration grades (see fig. 3.4).

3.3.3 Textile reused locally

Post-consumer clothing suitable for reuse was 56% of the textiles sorted in the Netherlands in 2012 (34.9/61.6kton). 6.6kton of these were sent to Dutch second hand shops (10.6 % of the locally-sorted volume). The rest, 28.3kton, was exported for reuse in different quality categories (Ffact 2014).

The percentage of collected textiles reused differs per sorter, as they serve different clients. Actors sort per product category, which may vary over time as their clients or demand changes. In the Netherlands, there is one textile sorter that owns its own second-hand shops, this actor has a higher percentage of their sorted product going into re-use locally; approximately 30%. For most of the sorters this in not a profitable pathway, and therefore the amounts locally reused are smaller. Note that we are not including clothing reuse directly exchanged from one consumer to another or via collection at second-hand shops in this report.

3.3.4 Textile recycled locally

37% of the sorted textiles in the Netherlands (22.6kton) were recycled in 2012. 12.8kton of these were processed locally to become either cleaning cloth (9.9kton) or recycled fibres (2.9kton) (FFact 2014). The rest were exported for recycling abroad. Sorters sell their products to each other for further sorting and selling, fitting to their clientele or expertise.

3.3.5 Textile volume exported

The total amount of exported post-consumer textiles in 2012 was 109kton; however, this includes post-consumer textiles that were previously imported for sorting purposes.

From the 90kton textiles collected in the Netherlands in 2012, 23kton (25.5%) was exported after a first sorting round, to be processed by foreign sorters. During a more selective sorting process, more material was selected for export: 41.6kton, adding up to a total of 64.6kton (71.6%) exported (FFact 2014).

Based on consultation with actors in the sorting chain, Ffact calculates the following export volumes and categories after selective sorting: 28.3kton rewearable (68%); 3.3kton recyclable for e.g. cleaning cloth (7,9%) and 9.8kton other recyclable grades (23,7%).

3.4 TEXTILE CONTAINER ANALYSIS

The issue of growing textile waste has received a lot of attention in recent years. However, to our knowledge the actual composition of the post-consumer textile mountain in the Netherlands has not been analysed in detail yet. This information is particularly relevant to develop strategies to improve waste streams and enable realistic solutions to promote reuse and recycling. With this aim in mind, we analysed the content of textile waste containers in detail, the results of this analysis are presented below. Although this data cannot be considered representative of the whole Dutch textile waste, it does offer a first indication of its composition. We encourage other actors to reproduce this analysis using similar methods to enlarge the sample. Finally, we note that this analysis does not include those textiles being disposed of by other means such as household waste, bulky waste and second-hand shops.

3.4.1 Methodology and general results

The textile container analysis took place on the 12th of April 2017 at one of the sorting plants of the charity organization Sympany. A number of 13 volunteering sorters (mostly fashion and textiles students) processed 200kg of collected textiles in street containers from the Veluwe area in 5 hours. The results were processed by Gunilla Piltz, a fashion and textiles student at Saxion, as part of her graduation project.

Since 2009, textile collectors are required to receive all kinds of textiles by municipalities including broken garments, shoes, soft toys, accessories and household textiles such as towels. 9kg (37 items) including soft toys, belts, bags and shoes, were not sorted in detail. Each pair of gloves, socks and shoes was considered a single item. The sorters executed the analysis by working in pairs, one member specifying the type of product and the other one filling in the prepared excel sheets according to the variables discussed in this section.

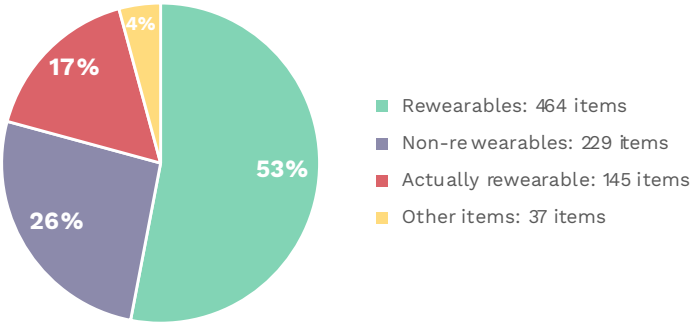


Figure 3.8: Outcomes of the container analysis in Items

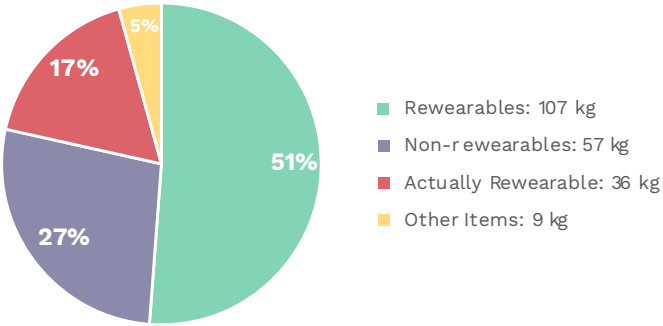


Figure 3.9: Outcomes of the container analysis in volume

Firstly, textiles are divided into two categories: re-wearable and non-rewearable. The division is based on the sorter's criteria (see fig. 3.7). Volunteers are trained by an experienced employee, who points out overall sorting principles such as: paying attention to areas were garments may be worn out (e.g. collar, arm pits and crotch). Underwear, non-garment textiles and socks are considered non-rewearable. Children's clothes deserve special treatment as the second-hand market is larger and sorters can be more flexible with the condition of garments.

The 200 kilograms sorted are 838 items, resulting in an average weight of approximately 240 grams per item. 107kg of these (464 items) are rewearable. This accounts for 55.4% of the total number

of items sorted. The other 93kg (374 items) are non-rewearable; accounting for 44.6% of the items. From those items considered non-rewearable by the sorter (usually sold for recycling), volunteers identify that 145 items are re-wearable according to their own criteria. These criteria are based on the personal perception of the item being sellable in a second hand shop or in condition to be bought by volunteers. As a result, 17.3% of the total items are considered “actually rewearable” (see Figures 3.8-3.9). Moreover 11 new items (including packaging and/or with the label attached) were found.

3.4.2 Product types

The first grade of the sorting process is garment group, with the following results:

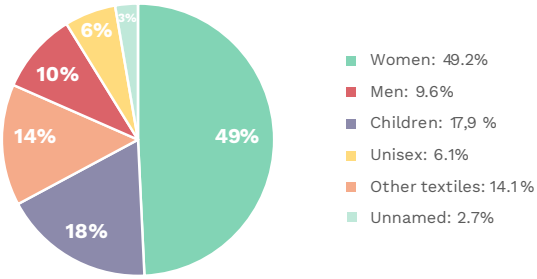


Figure 3.10: Garment groups in non-rewearables

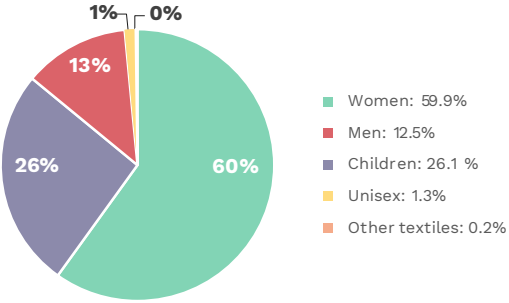


Figure 3.11: Garment groups in rewearables

Figures 3.10 and 3.11 display the percentages of garment types in non-rewearables and rewearables. When the total volume of sorted textiles is considered, the results are the following: Womenswear 55.1%, Childrenswear 22.1%, Menswear 11.2%, other textiles 6.6%, unisex clothing 3.5%, unnamed 1.2%.

Moreover, the type of garment is registered, sorted according to the categories in fig. 3.12. The following percentages and numbers of rewearable/non-rewearable items are found: 24.5% (62 non-rewearable/143 rewearable) T-Shirts/Tank Tops, 18.5% trousers (58 non-rewearable/97 rewearable), 13% underwear including socks (75 non-rewearable/34 rewearable), 12.8% (57 non-rewearable/50 rewearable) sweater/cardigans, 30% other.

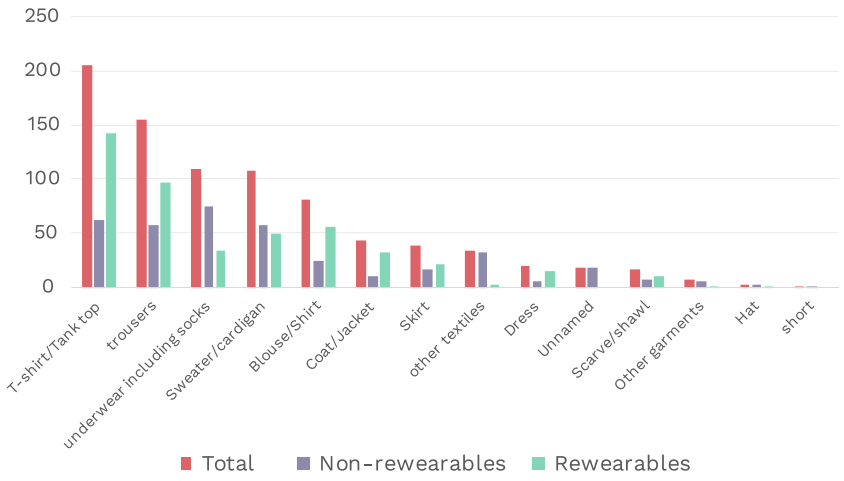


Figure 3.12: Garment types in Items

3.4.3 Materials

Items are also analysed in terms of material in order to provide relevant insights for recycling processes. 21.2% of the items are made of more than one material, regardless of the fibre composition. This category includes items such as jackets with lining, trousers with patches, etc. which would need to be taken apart for recy-

cling. Moreover, around half of the items include hardware such as buckles, zippers and buttons. 56.3% of the items have no hardware, 35.9% have light hardware, and 6.3% heavy hardware.

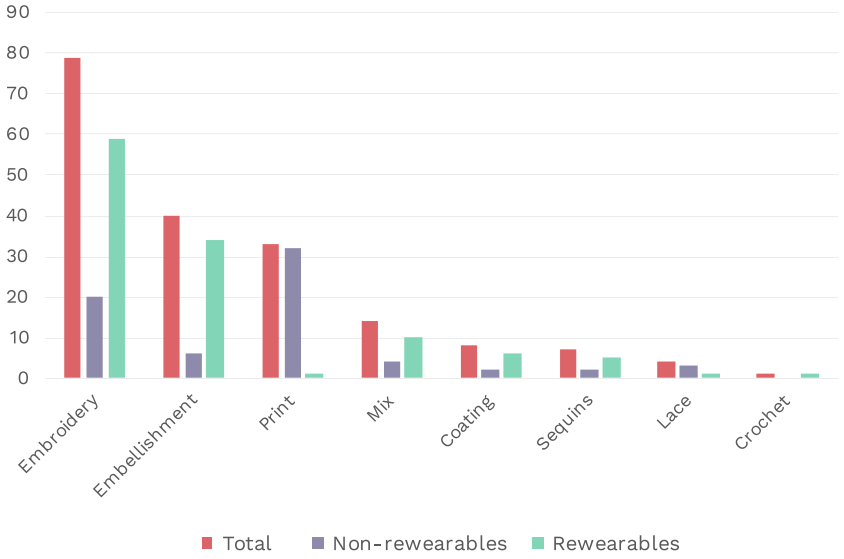


Figure 3.13: Finishing in Items

Finishing is also accounted for (see Figure 3.13). 77.9% of the total items (653 items) does not include specific finishing. The most common finishes are embroidery (9.4%, with 20 items non-rewearable and 59 rewearables), embellishment (4.8%, including 6 non-rewearable items and 34 rewearable) and prints (3.9%, 32 items non-rewearable and 1 rewearable).

The kind of textiles used in the products includes knitted (58.1%), woven (35.1%) and non-woven (0.4%) materials; 6.4% of the items were a combination of these materials. 22% of the items are multi-coloured, followed by 15.6% blue, 13.6% black and 11.8% white items (see figure 3.14).

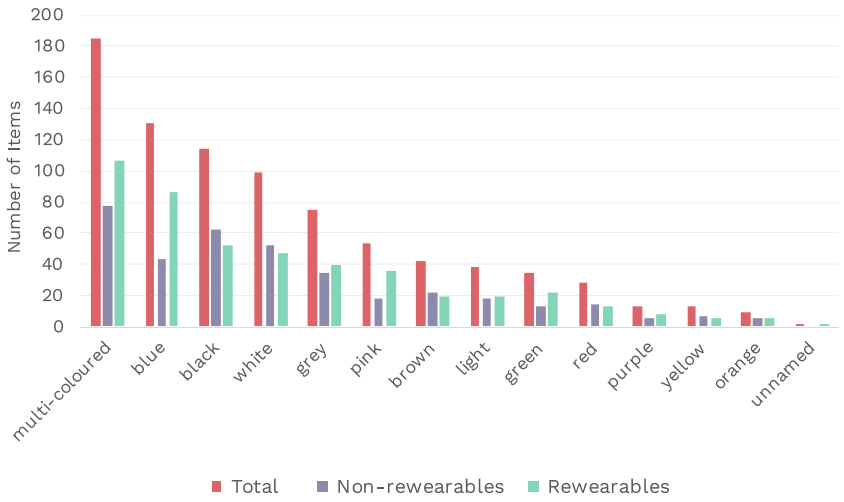


Figure 3.14: Colours in Items

3.4.4 Fibre composition

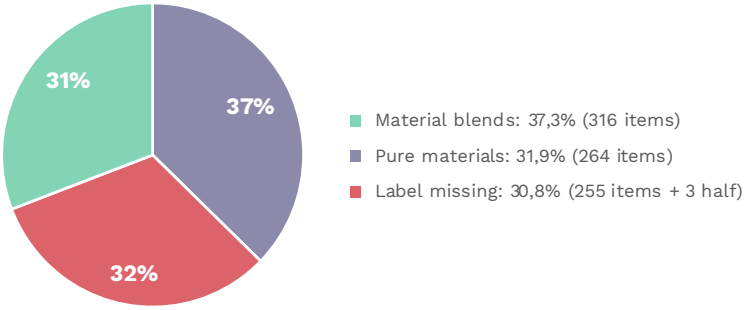


Figure 3.15: Materials

As part of the sorting process, items are classified according to their fibre composition. 30.4% of the items (255) miss the label and therefore cannot be classified. 264 items (31.9%) are made from pure materials and 312 items (37.3%) from material blends (see fig. 3.15). Cotton is the most common fibre for pure materials (46.3% of the labelled items = 78 non-rewearables and 114 rewearables).

Polyester is in the second place, with 5.6% of the labelled garments (20 non-rewearables and 27 rewearables). Other pure materials are Viscose, Wool, Acrylic, Nylon and Linen with small percentages (Figure 3.16).

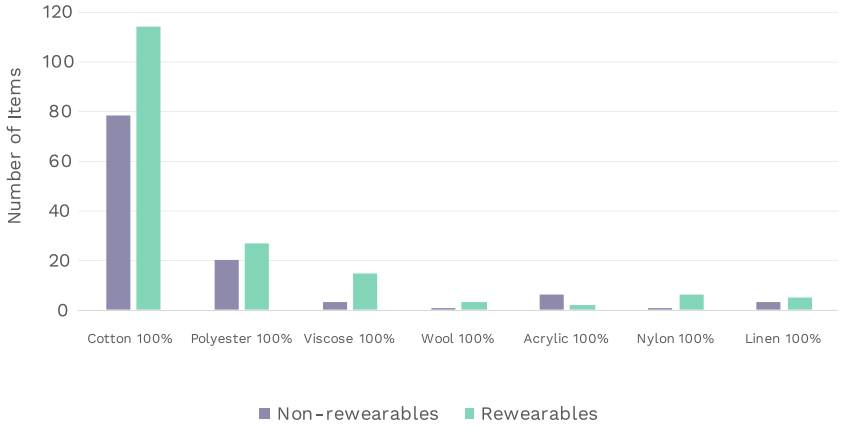


Figure 3.16: Pure Materials

Over 100 different blends are found among the 838 items sorted. The most common blends are:

- Cotton 95% / 5% Spandex (39= 18 non-rewearables + 21 rewearables)
- Cotton 98% / Spandex 2% (23= 6 non-rewearables + 17 rewearables)
- Cotton 97% / Spandex 3% (10= 3 non-rewearables + 7 rewearables)
- Cotton 80% / Nylon 15%/ Spandex 5% (5 non-rewearables)
- Polyester 65% / Cotton 35% (11= 5 non-rewearables + 6 rewearables)
- Viscose 95% / Spandex 5% (12= 7 non-rewearables + 5 rewearables)
- 20.5% of the total labelled items are made of blends with a percentage over 80% Cotton and only 1.5% is 95% (or more) Polyester.

3.4.5 Conclusions

Based on the sorting criteria of Sympany, which is influenced by the international second hand market, we found that around half of the sorted items were of rewearable quality. This coincides with general Sympany averages. However, the volunteers found these criteria too strict, and therefore the category “actually rewearable” was introduced within initially non-rewearable items. The garments in this category (which accounted for 17% of the total items and volume) were considered suitable for reuse by volunteers, meaning that they would sell them or buy them in the local second hand market. Sympany’s approach to children’s clothes was more flexible, given that this grade is in higher international demand. From these observations and considering that sorters grade the collected items on the basis of demand, we conclude that there are opportunities for more clothing reuse. There are enough clothes collected that are still in good enough condition to be worn again; however, the demand for second-hand items is lower than the offer. In line with our conclusions from the wardrobe study (see Chapter 2), we identify opportunities to encourage clothing reuse, in this case applying for both the national and the international context.

More than half of the items sorted were women clothes, with men garments, unisex garments, children garments, and other textiles accounting for the other half. This is in line with our wardrobe study, which pointed out that women’s wardrobes were 60% bigger than men’s in the sample group. The fact that the percentage of women’s clothes was even higher among rewearables may indicate that they dispose of their items more easily than men. Moreover, they may be more inclined to dispose of their used items though separate collection than men.

The material analysis in this study points out that extensive processes are needed before post-consumer textiles can be recycled. 21.2% of the items sorted were made of more than one material (such as jackets with lining, trousers with patches, etc.). Moreover, around half of the items included hardware such as buckles, zippers and buttons. Finally, 22.1% included finishings such as embroidery or heavy printing, which could contaminate recyclable material if not taken apart. This implies that intense manpower is

needed to process post-consumer textiles before recycling. Designing clothes with recycling processes in mind (e.g. design for disassembly) would reduce human resources costs and result in more material suitable for recovery. Moreover, the development of technologies to assist the disassembly process could reduce costs as well.

Blue, black, and white are common colours and therefore more suitable for mechanical recycling with no dying. However, multi-coloured items accounted for 22% of the total, challenging the practice of fibre-to-fibre recycling with no chemical treatment. Pure cotton textiles accounted for 46.3% of the labelled items, while 20.5% were blends with a percentage over 80% cotton. This fibre is the most common; therefore actions to recycle this material may result in more post-consumer textiles recovered. In any case, these conclusions are based on the characteristics of the sample analyzed. Studies of other (bigger) samples are needed in order to consider findings representative.

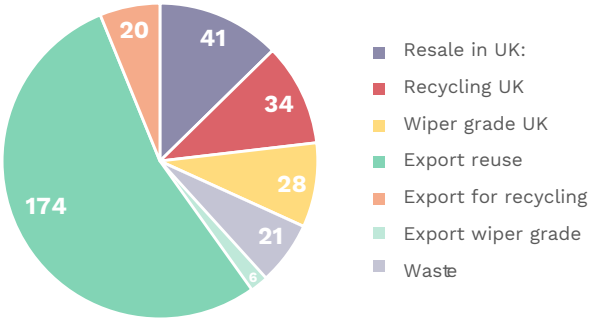
3.5 INTERNATIONAL COMPARISON OF POST-CONSUMER TEXTILE VOLUMES AND MANAGEMENT

International comparisons of waste volumes are complex, since the available information is scattered and based on disparate data sources and methodologies, while language barriers play a negative role in the circulation of publications. However, in this section we intend a simple comparison of previously published estimates in the region. Figure 3.17 shows textile waste volumes per capita, including clothing, accessories and home textiles, calculated on the basis of previously published data. Dutch figures are provided by CBS and Rijkswaterstaat. For a more detailed description of Dutch waste volumes and destinations, see sections 3.2 and 3.3. The other countries are discussed briefly below.

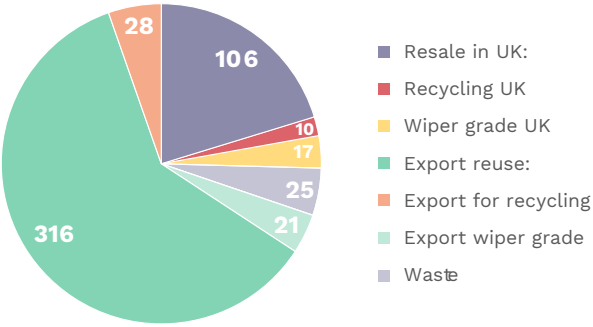
Figure 3.17: International comparison of textile waste volumes (kg per capita) Sources: NL (Rijkswaterstaat n.d.; CBS n.d.), UK (Morley et al. 2009; Morley et al. 2006), DK (Palm et al. 2014), DE (BVSE 2015), FR (EcoTLC 2012).

We note that Dutch volumes of separately collected textiles in the figure (estimated by CBS) should be higher during the last years. Ffact (2014) estimated 90kton (5.4kg per capita) for 2012 and we estimate 96kton (5.7kg per capita) for 2014 (see section 3.2.2). The total volume should be higher as well, since household waste is accounted for separately. In any case, the Netherlands is collecting less than half of all post-consumer textiles produced. That is a reality for all the other countries illustrated in the figure with the exception of Germany. However, estimations of the total volume vary per country and publication. The Netherlands and UK include accounts of textiles in household waste while Germany, France, and Denmark estimate general volumes on the basis of sales using different methods. This fact impedes comparisons in the percentage of textiles collected. Lastly, while volume of post-consumer textiles discarded per capita should correspond to some extent to retail volume per capita reported by Euromonitor in these countries (see fig 1.2), this is not always the case. In sum, a lot more research is needed, not only in the Netherlands but also in the other countries in the region, in order to provide accurate and comparable information.

3.5.1 United Kingdom



Figures 3.18: Destination of collected textile in the UK, **2005** (kton) Source: (Morley et al. 2006; Morley et al. 2009).



Figures 3.19: Destination of collected textile in the UK, **2008** (kton) Source: (Morley et al. 2006; Morley et al. 2009).

Textile waste seems a dramatic problem in the UK, the country showing the highest rates in the region. Maybe for that reason, the issue has been covered in more detail than in other countries, and more data and literature are available. Studies done by DEFRA (Department for Environment, Food and Rural Affairs), include textile volumes found within municipal solid waste for the years 2003, 2007, 2008 and 2009. The UK data in figure 3.17 is based on these publications (Morley et al. 2006; Morley et al. 2009). During that period, the total volumes of discarded textiles grew by 13%. The amount of separately collected textiles increased by 39%, while

the volumes found in municipal solid waste decreased. When compared to the other countries, the total volume of post-consumer textiles in the UK is much higher; however, retail volume differences illustrated in fig 1.2 are not as dramatic.

According to Morley et al. (2009), UK collected textiles are mostly exported for reuse (see figs. 3.18-3.19). This sector grew between 2005 and 2008 as did resale within the UK, while the volume of textiles recycled locally decreased during that period.

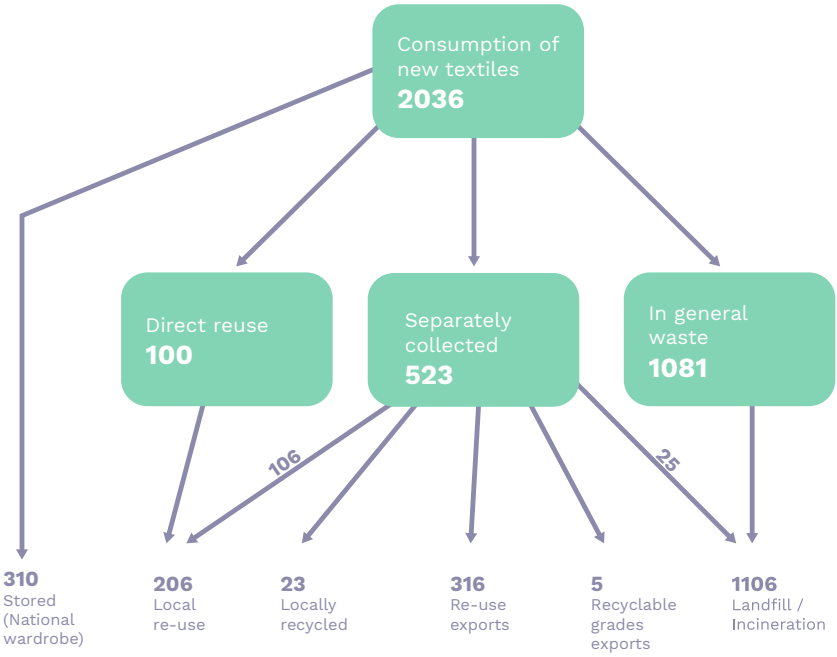


Figure 3.20: Destination of post-consumer textiles in the UK in 2007 (kton). Source:(Morley et al. 2009)

More recent information is provided by WRAP (the local Waste and Resources Action Programme), estimating that approximately 70kg of textiles per UK household were discarded in 2012 (WRAP 2012). These approximately 30kg per person are in line with the growing amounts of new clothing items per capita in the country.

Figure 3.20 gives an overview of textile pathways and volumes in the UK in 2007. We note that the figure explains a difference in textile volumes consumed and discarded by 310kton stored at home and not in use ("national wardrobe").

3.5.2 Denmark

Palm et al. (2014) present a figure (fig 3.21) summarizing the flow and destination of textiles in 2010 based on updated numbers from Tojo et al. (2012) and Watson et al. (2014). When comparing Dutch and Danish total volumes of post-consumer textiles per capita for that year, we note that they correspond to differences in retail volume accounted by Euromonitor (figure 1.2).

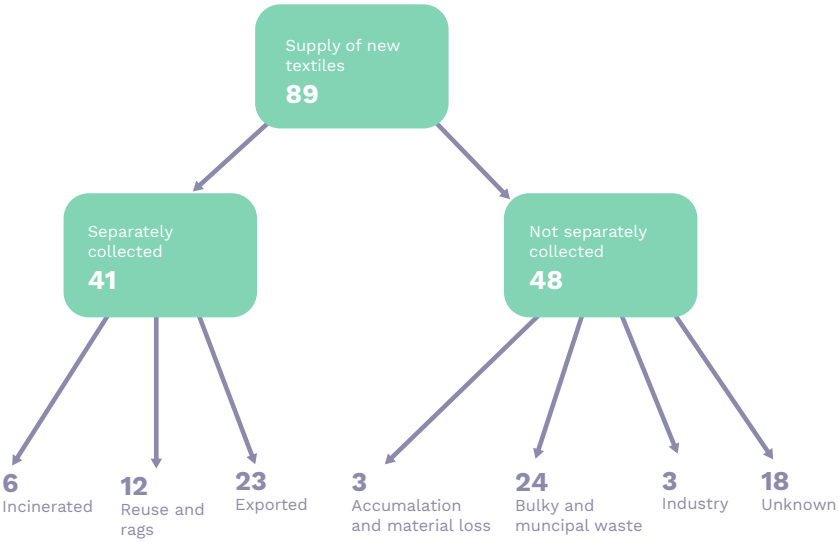


Figure 3.21: Destination of post-consumer textiles in Denmark in 2010 (kton). Source (Palm et al. 2014). See original source for similar analysis in other Nordic countries.

3.5.3 Germany

According to the German *Bundesverband Sekundärrohstoffe und Entsorgung* (BVSE 2015), Germany produced 1.126kton of textile waste in 2007, of which 750kton were collected for reuse and re-

cycling. The total volume per capita was around 13kg, similar to the Dutch volume. In 2013, the total volume escalated to 1.347kton, of which 1.011kton were collected for reuse and recycling. Therefore the collection of textile waste improved, growing from 60% to 74% of the total.

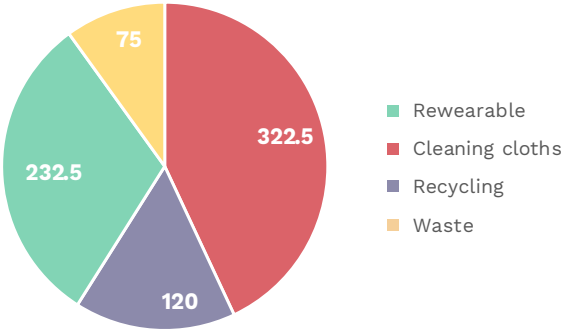


Figure 3.22: Destination of separately collected textiles in Germany **2007** (kton). Source: (BVSE 2015)

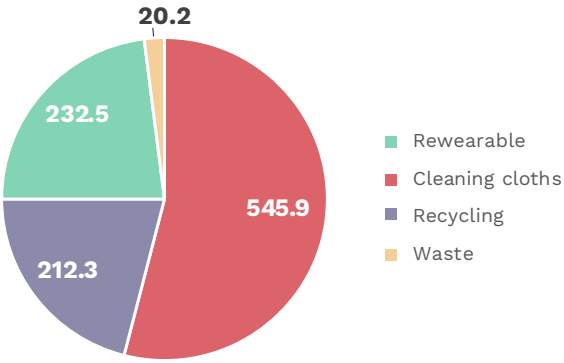


Figure 3.23: Destination of separately collected textiles in Germany **2013** (kton). Source: (BVSE 2015)

The destinations of German textile waste for the years 2007 and 2013 are presented in figures 3.22 and 3.23. The volume of textiles sold for reuse grew to a great extent (around 70%) as did textiles

sold for cleaning cloth, while the volume of waste resulting from the sorting process diminished.

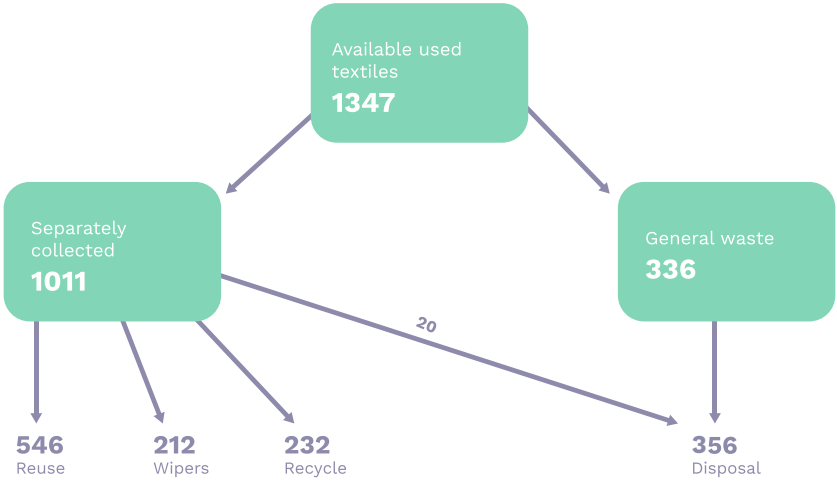


Figure 3.24: Destination of post-consumer textiles in Germany 2013 (kton). Source: (BVSE 2015)

3.5.4 France

An Extended Producer's Responsibility (EPR) legislation was implemented in 2006 in France for clothing, linen and footwear (CLF) (EcoTLC 2016). The legislation was ratified in 2008, aiming at 100% reuse and recycling of used CLF. In 2016, Eco TLC represented more than 94% of the industry. In 2009 the organization collected 1.9 kg of used CLF per French inhabitant, in 2013 this volume had grown to 2.4 kg and in 2016 reached 3.2 kg. The goal is to reach 4.6 kg per person by 2019 to be reused, recycled or used for energy recovery.

Textiles collected by this programme in 2016 were reused (59.4%), recycled (31.8% including 22% unravelling and 9.5% cleaning cloth) or used for energy recovery (8.5%), with a small portion that could not be recovered (0.3%). They included linen (6.9%), footwear (10.8%) and clothing (82.3%). EcoTLC estimates the current annual French volume of used TLC at 639.000 tones, or 9.2 kg per capita

(EcoTLC 2012b). However, these estimations are based on retail volume during 2011, rather than current accounts of post-consumer waste.

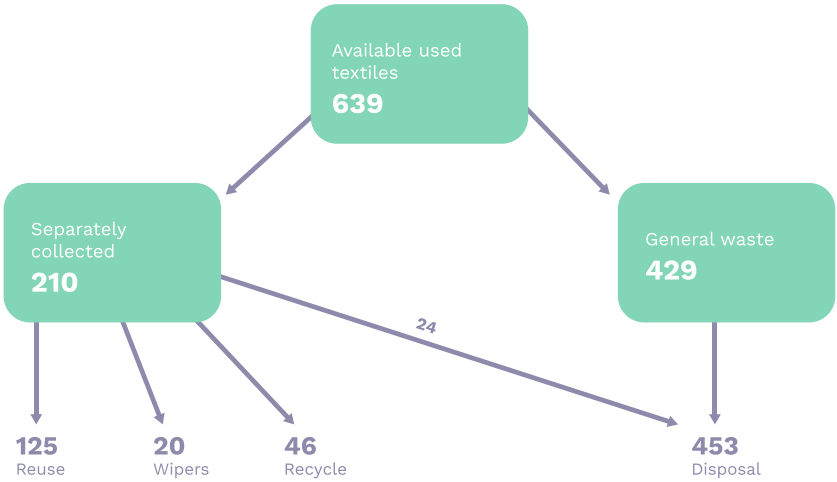


Figure 3.25: Destination of post-consumer textiles in France 2016 (kton). Source: (EcoTLC 2016).

3.5.6 Conclusions

Judging by the international publications reviewed in this section, growing post-consumer textile volumes seem to be problematic in all countries in the region. They are all implementing programmes to collect more textiles separately and make the best use of them. Available historical data within countries indicates that the results of these programmes have been positive and collected volumes have increased through time. However, more research is needed to understand the effect of different systems across countries and the final destinations of separately collected textiles.

For example, in this report we could not compare the percentage collected across countries because the total volume of post-consumer textile in some of them is uncertain. In those cases, the volume of separately collected textiles may have increased side

by side with total textile volumes. In sum, similar research methods should be used across nations in order to understand the advantages and disadvantages of different collection methods, programmes, and policies. This knowledge would enable useful international comparisons so that we can learn from each other and reach common goals.

Moreover, the effect of post-consumer textiles in their different destinations is yet to be determined. It is still unknown how much of the textiles exported for reuse are actually reused, and what is their effect in the country receiving them. The environmental impacts of different downcycling, recycling and upcycling practices should also be analysed in more detail. One recommendation is to assess the comparative environmental advantages of these practices in relation to traditional resource use (employing tools such as life-cycle analysis) while developing recycling solutions.

CHAPTER 4: CONCLUSIONS

4.1 SUMMARY OF THE RESEARCH FINDINGS FOR THE GENERAL PUBLIC

During this project we measured the size of the Dutch clothing mountain. We are all aware that more and more clothing and textiles are circulating in the Netherlands. We buy more clothes, keep more clothes at home, and throw away more clothes. However, it was not easy to find accurate information about this issue before we started this project.

In this research we discovered a Dutch consumer buys approximately 46 new clothes items annually. The average price of each item is around 16 euro. In any case, we buy less than consumers in other countries in the region such as Germany, Denmark and the United Kingdom. We keep approximately 173 pieces of clothing in our personal wardrobe, of which 50 have not been worn in the last year and 7 are second-hand. Women, young adults and people living in bigger cities have more clothes than men, older adults and people living in towns and villages. 3 garments per person are discarded in the supply chain (before arriving to consumers) annually. Each Dutch inhabitant throws away approximately 40 clothes per year, 24 of these clothes are thrown away in general household waste and they are therefore incinerated. 5 are collected separately but they are not suitable for reuse, so they can be recycled, 2 are rewearable according to consumers, but not by international second-hand standards; finally, 9 of these garments are suitable for the international second-hand market.

Based on these and other facts, we provide recommendations to reduce the size of the Dutch clothing mountain for consumers,

companies, designers, fashion schools, textile collectors and sorters, municipalities, and public policy. Moreover, we propose directions for further research.

Nederlands samenvatting

In dit onderzoeksproject hebben we het volume van de Nederlandse kledingberg gemeten. De bewustwording dat meer en meer kleding en textiel gebruikt wordt in Nederland groeit. We kopen meer kleding, bewaren meer kleding in huis en gooien meer kleding weg. Ondanks deze bewustwording was het niet makkelijk om informatie te vinden voor aanvang van deze studie.

Uit dit onderzoek is gekomen dat de Nederlandse consument gemiddeld 46 nieuwe kledingstukken per jaar koopt. De gemiddelde prijs van een kledingstuk is 16 euro. Nederlanders consumeren minder kleding vergeleken met consumenten uit omringende Europese landen, zoals Duitsland, Denemarken en Engeland. Onze garderobe bestaat gemiddeld uit 173 kledingstukken, waarvan we er ongeveer 50 niet gedragen hebben in het afgelopen jaar, en gemiddeld zeven items zijn tweedehands. Vrouwen, jongvolwassenen en mensen uit de grote steden hebben meer kleding dan mannen, ouderen en mensen uit dorpen. 3 kledingstukken per jaar worden afgeschreven voor het de consument bereikt. Elke Nederlander gooit jaarlijks 40 kledingstukken weg. 24 stuks gaan bij het huishoudelijk afval en worden daarmee verbrand. De overige 16 stuks worden ingezameld, waarvan 5 stuks niet geschikt zijn vor hergebruik, deze worden gerecycled. 2 stuks zijn herdraagbaar volgens de consument maar voldoen niet aan de internationale tweedehands standaarden; en tot slot zijn 9 van deze kledingstukken geschikt voor hergebruik.

Op basis van deze en andere feiten doen wij aanbevelingen hoe de grootte van de Nederlandse kledingberg te verminderen. Deze zijn gericht op consumenten, bedrijven, ontwerpers, modeopleidingen, textielinzamelaars en sorteerders, gemeenten en overheidsbeleid. Bovendien geven we veelbelovende richtingen aan voor nader onderzoek.

4.2 RECOMMENDATIONS TO REDUCE DUTCH TEXTILE WASTE

One of the aims of this project is to highlight the importance of growing clothing volumes. Much of the research and many of the actions in sustainable fashion and textiles have focused exclusively on reducing environmental impact per product, for example by promoting the use of organic or recycled materials. Although this line of action is certainly valuable and needed, it should be complemented with solutions to maintain or reduce the quantity of clothing made and discarded. Producing a garment with zero environmental impact seems impossible; therefore, **clothing volumes matter.** We recommend consumers, companies, researchers and policy makers alike to take this into account.

Another objective is to contribute to an increasing awareness of the clothing volumes in circulation and the effect this may have on the environment. During this research we perceived that although all actors seem sensitive to this issue, it is uncommon to place it at the core of daily decisions. Despite the fact that popular environmental frameworks nowadays integrate environmental and economic aspects as equally important, these tend to conflict in daily practice, economic issues taking the upper hand. Examples include consumers that do not want to miss the opportunity to buy a lot of clothes at sales; retailers pushing for lower costs from their suppliers with no interest in environmental or social implications; municipalities charging charities per kilo of separately collected textiles; and post-consumer textile sorters selling at the best price possible, with no interest in the impact of their grades at the final destination. Therefore, a straightforward and general recommendation for those willing to make a change is to **place environmental issues at the core of daily decisions** in order to counterbalance economic aspects.

Below we make **recommendations to the different actors involved:**

On the basis of our wardrobe studies, we recommend **consumers** to visualize their wardrobe as a system that needs management and maintenance. Many of our respondents were not aware of what they had, and therefore did not buy new clothes with that in mind. Managing the content of the wardrobe more efficiently may contribute to making the best out of what is already there. For instance, trying out unexpected combinations can promote outfit variety and understanding patterns of use may help in buying clothes that are actually going to be used. Being aware that one third of the wardrobe content is not in active use may question the need to buy so many new clothes every year. Moreover, unused volumes that are in good condition should be seen as a resource for exchange and reuse in order to have variety over time with no environmental impact.

If used textiles cannot be exchanged within the close network, they should always be allocated to separate collection, no matter the kind of textile or its condition. More than half of household textiles possibly suitable for reuse or recycling are still disposed of via general waste and are therefore incinerated. Collectors recommend placing textiles in closed plastic bags to avoid contamination by other materials often found in textile containers. Moreover, product labels should remain attached so that the material composition of post-consumer textiles remains clear.

In the same line, we see business opportunities for **companies** wanting to make a change in the sector. Offering wardrobe apps or other wardrobe managing tools may enable consumers to experience a more structured, time saving, cost saving and satisfying handling of clothes and it may prevent overconsumption. These systems could also suggest opportunities for clothing exchange via social networks, for example. Curated second-hand boutiques and specialized laundry services may contribute to reducing reluctance to reuse. Fashion retailers may incorporate take-back systems and second-hand sections within their stores. This may benefit the image of their brands in terms of durability, and awareness of the company buyers and designers on critical points to improve product quality. Moreover, offering reused products may provide an extra source of revenue and an additional group of potential clients arriving to shops.

Take-back systems may confront companies and **designers** with finding solutions to the end-of-life of their own products, and therefore promote a more responsible product design practice. Our container analysis pointed out that a lot of work is needed in the removal of buttons, zippers, linings etc. to prepare garments for recycling. Awareness of the process of disassembly may contribute to better product design. Additionally, complex multi-fibre blends are a barrier for many existing and upcoming recycling technologies. Designing with end-of-life in mind should prioritise recyclable fabrics and fibres. Moreover, there are promising lines of intervention at a material level, for example in the development of self-healing textiles or recycled textiles and the technologies needed to produce them. While research in self-healing materials is still in its infancy, textile recycling is at a more advanced level and has tangible opportunities to scale up. In any case, creative research on new recycled materials or new recycling processes is needed to help overcome challenges such as feedstock quality and assurance (in terms of consistency in fibre and colour). The development of recycled fibres and fabrics with increased quality, hand feel, and technical capacity is another promising line of action. Designers wanting to enable clothing reuse may offer versatile garments suitable for different body types, using durable materials. Lastly, we highlight the importance of grounding creative projects for a better apparel sector on actual facts. Much of the creative design work in sustainable fashion is based on assumptions of what may be the central problem and effective solution. Analysing reliable information and testing creative solutions in order to observe their effects in practice can result in more realistic actions with a positive effect.

Fashion design education aimed at enabling a positive change can train students on problem solving. The focus of design education on the aesthetic performance of products inspired in fashion trends and lifestyle does not help to find innovative solutions to the growing clothing mountain. Educators must teach the next generation of makers to think systemically, considering and facilitating a product's end-of-life and viewing garments also in terms of materials, not only trend items. Using common design practices in other sectors such as involving potential users in the process of

design, prototype testing, and incremental innovation could lead to more meaningful and long-lasting products. Moreover, encouraging fashion designers to use their problem-solving skills to find better ways of designing, producing, selling, using, maintaining, and disposing of clothing would empower the sector to find alternatives.

The collection of post-consumer textiles in the Netherlands can be improved by clearer and more efficient communication to the public. We found that consumers are generally not informed about the destiny of textiles placed in the container. Communication programmes such as the 'plastic hero' campaign may contribute to bigger separately collected volumes. Moreover, **textile collectors and sorters** willing to commit to the development of the sector can keep better track of their activity in terms of volumes and prices, and share them accordingly. Transparency and collaboration between these actors would enable technical assessments of the sector's activity. This information is central in order to find the best destination for post-consumer textiles in environmental terms. Moreover, they can contribute to more local reuse and recycling by partnering with other organizations such as second-hand stores, platforms and street markets, recycling initiatives, etc. Additionally, developing more and stronger end markets for non-rewearable textiles is key. With separately collected post-consumer textile volumes hopefully growing in the future, the sector will need innovative solutions to transform a growing fraction of non-rewearable textiles into new materials.

In our interviews with post-consumer textile collectors and sorters, we identified some challenges for efficient collection that could be improved with the collaboration of **municipalities**. Above the ground containers result in a better quality of the textiles sorted. Textile containers placed next to general waste containers with restricted access (e.g. requiring a card) contribute to textile contamination. More importantly, we recommend a general evaluation of the current collection system and assessment of its long-term sustainability. According to our interviews, a declining quality in the textiles collected and the lack of end markets for low-value post-consumer textiles are challenging the economic sustainability of collectors and sorters. Moreover, more than half of all post-consumer textiles are still disposed of via general household waste. In

sum, current systems may need to be redesigned in order to find the best destination for all Dutch post-consumer textiles.

In fact, public policy aimed at reducing the total clothing volumes could help to balance tensions between economic and environmental issues, as stressed at the start of this section. Subsidies and other economic incentives supporting local reuse and recycling such as tax benefits for second-hand stores may increase the volume of post-consumer textiles reused locally and maintain or reduce resource use. Public advertising campaigns such as anti-tobacco communication programmes may balance the effect of fashion advertisement. In sum, systems based solely on economic gains have proven to bring some challenges along. Public policy may help to counterbalance and compensate environmental issues in order to promote a prosperous apparel sector in a wider sense.

4.3 RECOMMENDATIONS FOR FURTHER RESEARCH

One aspect of the Dutch clothing mountain that we have not covered in this report is the trade of second-hand clothing. To our knowledge, the **volumes of clothing reuse** exchanged locally via online platforms, charity shops, and markets have not been investigated yet. Acceptance of second-hand clothing across different sectors of the population is another promising field of research, as are the pricing criteria of consumers and intermediaries, and the kind of garments more frequently exchanged.

Another important issue uncovered in this report is the **volume and destiny of product returns**, online purchases play a central role here. Moreover, we have not been able to trace the **evolution in Dutch post consumer textiles destinations during the last five years**, due to limited data shared by local collectors and sorters. The cooperation of these actors in future research is central. Moreover, their responses would enable historical analysis in the **average price of post consumer grades sold** in order to assess the economic sustainability of the sector.

Assessments of textile volumes discarded and separately collected using the same research methods for all countries in the region are very much needed. The results of such a study would enable analyses of the advantages and disadvantages of different collection methods, programmes, and policies so that we can learn from each other and reach common goals.

Moreover, the effect of post consumer textiles in their different destinations is yet to be determined. It is still unknown how much of the textiles exported for reuse are actually reused, and what is their effect in the country receiving them. The **environmental impacts of different downcycling, recycling and upcycling practices** should also be analyzed in more detail. One recommendation is to assess the comparative environmental advantages of these practices in relation to traditional resource use (employing tools such as life-cycle analysis) while developing recycling solutions. As mentioned in the previous section, the development of new recycled textile materials and the technologies needed to produce them is essential. However, this creative and technical research should always keep a critical eye on its own environmental implications. Finally, the extent to which **reuse actually substitutes the production of new clothes** is another promising field of research in the apparel sector. Previous research has pointed out that replacement of new items is never on a one-to-one basis and that replacement rates differ across nations.

For our **wardrobe studies and container analysis** we developed research tools that should be employed to enlarge the samples so that the findings are representative. These tools are available for anyone interested to repeat the study in the Netherlands enabling historical perspectives or to perform similar studies abroad.

Lastly, **more research is needed connecting clothing purchase, usage, and discarding behavior**. These longitudinal studies are certainly complex, but it is only by understanding what lies behind daily practices that we can propose constructive solutions to maintain or reduce the volume of the Dutch clothing mountain.

GLOSSARY

TEXTILES	Textile-based products and materials including all clothing, accesories and home textiles.
HOME TEXTILES	Towels, sheets, curtains and other non-wearable textile products.
CLOTHING	Wearable products including those made out of textiles (e.g. shirts, trousers, etc.) and other materials (e.g. shoes, belts, bags, etc.).
ITEM/GARMENT	Piece or clothing. Sometimes items include more than one garment, such as in packaging including several pairs of socks, and sets of underwear.
RETAIL VOLUME	Volume of sales to consumers, measured in items, including both offline and online purchases and excluding second-hand products (reused).
RETAIL VALUE	Value of the retail volume at the point of sale, measured in Euros or Pounds.
WARDROBE	Set of clothing owned by a single person including items kept in storage spaces, laundry area, and those separated for exchange or charity.

UNUSED ITEM	Item that has not been worn in the last year or not worn at all.
SECOND-HAND ITEM	Item that was owned and used by another person before, including garments bought in second-hand shops or markets, items given or exchanged.
REUSE	Textile products are used again, with no alteration to the original item.
RECYCLING	Recycling is the process of breaking down textiles into raw materials which are then used to make new products.
DOWNCYCLING	Using a mechanical process, discarded textiles are turned into new products, usually with a lower value and industrial application. Textiles are cut into cleaning cloth, shredded to create insulation/fill and/or fibers are bonded in composite materials.
HIGH-VALUE RECYCLING	Using a mechanical or chemical process, discarded textiles are regenerated into new products, usually with a higher value application such as yarns, fabrics and garments.
POST-INDUSTRIAL TEXTILES	Textile by-product from the manufacturing stage (eg. clipping waste, offcuts, roll ends and remnants).
PRE-CONSUMER TEXTILES	Finished textile products which are unfit for sale (e.g. manufacturing rejects, and deadstock).

POST-CONSUMER TEXTILES	Used textiles products that have been collected from the consumer (eg. used clothing, footwear, accessories, linens, and other household soft goods disposed within general household waste or separately collected via clothing banks, donation points, in-store collection schemes, or waste management companies).
REWEARABLE TEXTILES	Used textile products that are categorized as suitable for rewear or reuse at the sorting facility. This fraction will be sold or donated, to either domestic or international markets.
NON-REWEARABLE TEXTILES	Used textiles that are categorized as unsuitable for rewear or reuse at the sorting facility, due to damage, substantial wear and tear or style obsolescence. This fraction will be sent towards incineration, downcycling or high-value recycling solutions, depending on the product specifications, quality and available end markets.
'ORIGINALS'	Unsorted post-consumer textiles or roughly sorted post-consumer textiles, in which any non-textiles items have been removed.
GRADING	The practice of separating post-consumer textile products according to quality specifications or end market specifications.

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