Research paper

Behind Closed Doors: Examining the Stock of Clothing in Individuals' Wardrobes.

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Handling Editor: Julian Kirchherr

Received:08.09.2024 / Accepted: 22.11.2024

Abstract

Increasing the use intensity of individual garments is crucial in reducing the total environmental impact of clothing consumption. Implementing circular economy strategies, such as reuse, can intensify the use of garments. However, a deeper understanding of the current fulfilment of the need for clothing is essential for the effective implementation of circular economy strategies. To this end, we conducted an extensive wardrobe study on 156 adults living in Flanders (Belgium) in 2024. The study finds that participants had, on average, 198 garments in their wardrobe, of which only 2% was pre-owned and 22% was dormant (not used in the last 12 months). Further, 75% of dormant clothes are in good enough condition for reuse. This shows the considerable untapped potential to intensify the use of garments currently trapped in wardrobes. However, the results suggest that the potential to reactivate dormant garments is limited for two reasons: First, participants are unwilling to part with over half of their dormant garments, primarily because they believe they will prove useful in the future. Second, the observed scarcity of pre-owned garments in wardrobes suggests a low demand for reusable garments. The findings in this study provide essential groundwork for developing more effective policies to promote the full utilisation of garments in the transition to a CE for consumer clothing.

Keywords: Wardrobe Study · Circular Economy · Urban Stocks · Reactivation · Reuse · Consumer Behaviour

1. INTRODUCTION

Lifecycle thinking (LCT), which considers all stages from material sourcing to production, use, and end-of-life management of products, is crucial in the transition to a sustainable society. This is certainly true for consumer textiles, which is facing increasing scrutiny over its high environmental impact (Niinimäki et al., 2020). The European Environment Agency (EEA) (2022) found that the European consumption of textiles significantly contributes to climate change, water-, and land use. To address the adverse impacts of the current system, transitioning to a circular economy (CE) is proposed. For instance, the European Union (EU) has included consumer textiles as a key product value chain in their new Circular Economy Action Plan (European Commission, 2020, 2022). CE embraces LCT, with as core principle value retention: keeping materials in use for as long as possible in the highest possible application to avoid the environmental burdens associated with production and waste treatment processes (European Commission, 2014). However, the current operationalisation of CE has been criticised for failing to give proper attention to the use phase of products, neglecting sustainable consumption (Reich et al., 2023). The focus of the literature has been on mapping material flows (Reich et al., 2023), or environmental gains from efficiency improvements at the product level (Laitala & Klepp, 2020; Maldini, 2021). This has resulted in policies focusing on technological solutions, such as design measures (eco-design) or waste management solutions (recycling).

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Waste prevention, through slowing and changing consumption patterns, should receive more attention. Understanding the function of products in urban stocks is vital to elongate and intensify the use phase of products (Laitala & Klepp, 2020; Moraga et al., 2019, 2021; Pauliuk, 2018). Variations in the use phase can have a significant effect on the final environmental impact of products (Polizzi di Sorrentino et al., 2016). Research has demonstrated the potential environmental benefits of increasing the use of each garment (Laitala et al., 2018; Niinimäki et al., 2020; Roos et al., 2016). Top-down approaches, using material flows from trade statistics, lack insights into key aspects of the stocks, such as the extent to which garments are fully utilised by individuals or to what extent individuals participate in CE strategies, such as (informal) reuse or rental. Hence, there is a need for empirical evidence regarding the current urban stock and use of clothing at the individual level. A review by Laitala (2014) found that two-thirds of garments are discarded before being worn out due to various factors, such as changing body types or preferences. This is confirmed by the presence of reusable garments in the residual household waste stream (OVAM, 2022; Rijkswaterstaat, 2019). Further, research has shown that about one-fourth of garments in wardrobes are dormant, not being discarded, but also not being used (de Wagenaar et al., 2022; Maldini et al., 2017; WRAP, 2022). This demonstrates the potential of increasing the utilisation of garments in the use phase. A deeper understanding of individual behaviour regarding the (dis)use of garments is required to realise this potential successfully. This information is crucial to create meaningful policy interventions towards a circular future. Hence, this study aims to contribute to a better understanding of consumer wardrobes in relation to intensifying and extending the use phase of garments.

2. LITERATURE REVIEW

To transition to a CE, vast changes in our current way of producing and consuming are required. CE is implemented through a set of strategies, often presented as a hierarchical list, from most to least preferred, including reduce, reuse and recycle (Kirchherr et al., 2017). To move to a CE for clothing a mix of reactive (e.g. reuse) and proactive (e.g. reduce) strategies should be used to extend and intensify the utilisation of clothing (Niinimäki et al., 2020). The most straightforward approach to achieving the full potential of garments would be for individuals to use them for their entire lifespan. Here, technical aspects such as garment quality, proper care and maintenance practices, or repairability play a vital role in elongating the lifetime of individual garments (Maguire & Fahy, 2023). Yet, as stated in the introduction, individuals often do not use garments for their entire lifespan. When an individual is unable or unwilling to use a garment fully, it is possible to prolong the use phase beyond the individual. The most well-known CE strategy to extend the use phase is reuse, which involves transferring the use of the garment to a new owner through the donation, resale, or gifting of garments (Fortuna & Diyamandoglu, 2017; Sandin & Peters, 2018). The environmental benefits from the reuse of a garment arise mainly from the avoided production of new products (Sandin & Peters, 2018). The benefit of reuse is conditional on the assumption that the reuse of a product (partly) offsets the demand for a new product (Fortuna & Diyamandoglu, 2017; Sandin & Peters, 2018). Hence, for reuse to succeed, individuals must be willing to part with reusable items and show interest in acquiring and using pre-owned items (Turunen, 2023). Another way to intensify garment use is through collaborative consumption, such as ‘product-as-a-service’ systems or sharing platforms. This allows individuals access to a wide variety of products with fewer products in total (Armstrong et al., 2016; Belk, 2014). Lastly, proactive strategies question how the need for clothing is currently fulfilled. Current consumption patterns in the global North are often considered excessive, beyond what is required to live a good life. Concepts such as ‘consumption corridors’ or ‘Doughnut Economics’ seek to set lower and upper bounds to consumption (Fuchs et al., 2021; Raworth, 2017). This is also reflected in a sufficiency-based approach, which seeks to encourage conscious consumption by avoiding consumption beyond the actual need (Bocken et al., 2022).

A deeper understanding of current consumer behaviour is required to promote those CE strategies that will effect the most beneficial behaviour change (Piontek et al., 2019; Polizzi di Sorrentino et al., 2016). For instance, how many garments are needed to fulfil the need for clothing, how intensely garments are used, and to what extent (groups of) individuals are already using CE strategies, such as reuse or rental. The answers to these questions can be found in individuals’ wardrobes. There is a lack of systematic, empirical research on quantifying and understanding the size and composition of the clothing stock with users, and how, when or why clothes enter and leave wardrobes (Maldini et al., 2023). The research available on this primarily uses variations in wardrobe studies. In its broadest sense, wardrobe studies use quantitive or qualitative methods to systematically analyse the content of individuals' wardrobes (Maldini et al., 2023). Wardrobe studies can be used to delve into habits and offer insights into consumer behaviour, which can underpin potential interventions to foster a more sustainable and circular clothing system. Fletcher & Klepp (2017) provide an overview of 50

different wardrobe study methods, illustrating the wide variety of uses. Wardrobe studies have been primarily used to gain qualitative insight into specific practices (such as care and maintenance) or specific garments (e.g. favourite items) in particular groups (e.g. female students). Sample sizes are typically small (less than 50), and female participants are overrepresented in most studies. There is a lack of wardrobe studies that take a more comprehensive approach by fully quantifying the wardrobes of a representative sample. Maldini et al. (2023) point out that more such studies are required to gain the necessary insights into consumer behaviour regarding clothing. Only three notable wardrobe studies were found with this focus: WRAP (2022), de Wagenaar et al. (2022) and Maldini et al. (2017). They report an average wardrobe size of respectively, 118, 132 and 130 items. A direct comparison between the findings of these three studies is not possible as they include/exclude different garment categories (e.g. underwear or shoes). However, all three found a significant stock of dormant garments in wardrobes (about one-fourth) and a limited share of pre-owned garments. This indicates that there is room to intensify the use of garments by reactivating dormant garments either by the current or a new owner. Another recurring finding in the three studies is that women have more extensive wardrobes than men. This demonstrates the existence of different groups within society, which may require different policy interventions to achieve sustainable clothing consumption. However, each of the three studies falls short on one or more aspects to provide reliable numbers, i.a. small sample size (Maldini et al., 2017), non-representative and biased sample (de Wagenaar et al., 2022), and reliance on participants self-reported estimates (WRAP, 2022).

Hence, this study aims to build on the best practices from previous wardrobe studies, while mitigating their shortcomings, by answering the following research questions: “How do individuals currently fulfil the need for clothing?” and “What is the potential of CE strategies to intensify the use of clothing to fulfil this need more sustainably?”. Regional data is crucial to implementing proper interventions as climatic, societal, and economic aspects influence clothing practices. This study focuses specifically on the region of Flanders in Belgium. A comprehensive wardrobe study, facilitated by a researcher, was done at the participant’s home. The audit included a full count of garments, noting per garment (1) the garment category, (2) the acquisition method (‘first-owner’ or ‘pre-owned’), and (3) whether it was used in the last 12 months (‘active’ vs ‘dormant’). Additionally, for dormant items critical factors for garment reactivation were noted, i.e. garment quality, reasons for disuse, and reason for retention. Further, we examine to what extent self-reported estimates are a good proxy for the actual wardrobe size. To summarise, we provide a much-needed baseline assessment of how the need for clothing is fulfilled by individuals at a regional level. This can then serve as a starting point for targeted, evidence-based policymaking to achieve a more sustainable fulfilment of the need for clothing. The paper is organised as follows: Chapter 3 outlines the different steps for data collection and analysis. Chapter 4 reports the obtained results with regard to (1) wardrobe size and composition, (2) the reactivation potential of dormant garments, and (3) the relationship between actual and estimated wardrobe size. Lastly, chapter 5 discusses (1) how our results relate to those of previous (volumetric) wardrobe studies, (2) looks at the implications for the implementation of CE strategies, and (3) reflects on the data collection protocol.

3. METHODS

3.1 Sample Selection

Potential participants were identified through an online survey consisting of three parts: (1) collection of demographic data to allow for a stratified sample selection, (2) general questions on spending habits (time, money, and sustainability) on electronics, clothing, and food, to check any bias within the sample toward clothing and sustainability, and (3) after receiving more specific information about the research set-up, asked if they would be willing to have one of the researchers visit them at home. The survey received more than 400 responses, of which 208 willing participants emerged. The list of potential participants was stratified according to age and gender to ensure a wide variety of participants. The three age categories are based on the study by Maldini et al. (2017). Within each stratum, participants were selected based on convenience sampling. For example, as the wardrobe audits had to happen at participants' homes, participants were selected so that researchers could reach multiple participants within the same day. The final sample contained 156 participants. Table 1 shows how the final sample relates to the population in Flanders in 2024. The final sample has an equal division between male and female participants, which aligns with the population distribution. The youngest age group is overrepresented, while the oldest is underrepresented. Due to this, weights were calculated to match the population distribution for age and gender in the analysis.

Table 1.Distribution of Population, Sample (n = 156), and Resulting Weights

demographic variable	population, %	sample, % (n)	weight
Men (all)	49%	50% (78)	
16-34	14%	25% (39)	0.56
35-54	15%	12% (18)	1.25
55+	20%	13% (21)	1.54
Women (all)	51%	50% (78)	
16-34	14%	25% (39)	0.56
35-54	15%	14% (22)	1.07
55+	22%	11% (17)	2.00

3.2 Data Collection Protocol

Five researchers collected the data between January and March 2024 as part of their master's project. Each researcher audited at least 30 wardrobes together with the individual in control of the wardrobe. All participants lived during the survey in either Flanders, the northern region of Belgium, or the capital region of Brussels. A detailed protocol was created for the wardrobe audit to ensure that every researcher followed the same approach. The protocol was trial run by each researcher to resolve any ambiguity or issues. The final protocol comprised three subsequent stages: (1) a preface, (2) a quantitative wardrobe audit, and (3) a qualitative investigation of the reactivation potential of dormant clothing. The entire data collection protocol was formalised in an Excel workbook with standardised tables.

The preface started by reviewing and confirming the participant's demographic data, after which an anonymizing number was assigned. Secondly, participants indicated where they stored clothing, with common locations pre-listed to aid recall. Lastly, participants were asked to estimate the total number of garments they owned and the number of dormant garments to assess the reliability of participants' estimates, as previous wardrobe studies have depended on this.

Following the preface, a wardrobe audit was conducted in each location where participants indicated that they store clothing. Wardrobe studies can vary in form, meaning no standardised methodology exists (Maldini et al., 2023). In this study, when we refer to the wardrobe audit, we mean that all the garments within the scope of the study were systematically counted at the participant's home with a researcher present to guide the process. For each garment, three attributes were noted: (1) the garment category, (2) if the current owner of the garment was its first owner or not (labelled "first-owner" vs "pre-owned"), and (3) if the garment had been worn in the last 12 months (labelled "active" vs "dormant"). In practice, this was achieved through a 'piling exercise': per garment category four piles were created by the participant: (1) active/first-owner garments, (2) active/pre-owned garments, (3) dormant/first-owner garments, and (4) dormant/pre-owned garments. To determine which clothing categories to use, an initial list was taken from Maldini et al. (2017) but narrowed to focus only on clothing types with the most potential for higher R-strategies, such as renting, reuse, and repair. Hence, underwear and swimwear were excluded. Accessories such as gloves, scarves, hats, bags, and shoes are outside the scope of this study. The final list (see Table 4) comprised twelve pre-defined clothing categories plus an open 'other' category.

Following the wardrobe audit, additional questions about the dormant garments were asked to shed light on the potential for reactivation. Reactivation is defined as either reestablishing an active relationship with the garment or parting with it. Firstly, participants were asked to judge the quality of the dormant clothing, as good quality items can be reactivated through reuse, while poor quality items should be recycled. The second question asked why the item had not been used. Insight into this is required to design interventions which prevent clothing from becoming dormant in the first place. Next, participants were asked if they would be willing to part with the dormant garment. If the answer to the question was 'yes', it can be inferred that the reasons for retaining the dormant garment are practical, e.g. enough storage space, so no need to clear out, or no access to convenient collection channels. However, if the answer is 'no', then a more individual barrier must be overcome to reactivate the item. Hence, in the final question, respondents could state why they kept dormant garments to gain insight into these barriers.

3.3 Data Analysis

The data from each visit was double-checked for accuracy. For 23 participants not all the dormant garments had been correctly logged in the follow-up questions. Hence, the data on the dormant garments was analysed for a smaller sub-sample of 133 out of the initial 156. Additionally, there was confusion between the reasons for not using garments (e.g. poor fit) and the reasons for retaining dormant garments (e.g. emotional attachment). The answers were examined and reclassified to resolve this. The final datasets are analysed using descriptive and inference statistics. Statistical tests are used to ascertain how total wardrobe size relates to gender, age, the number of dormant items, and the number of pre-owned items. The type of statistical test depends on various data characteristics, such as the variable type (quantitative vs categorical) or the distribution of the observations (e.g., normal). A Shapiro-Wilk test was used to evaluate if the data significantly deviated from a normal distribution at a significance of 0.05. When the data was normally distributed, a parametric statistical test was used: a t-test if one variable is categorical, and a Pearson correlation if both variables are continuous. If the data was not normally distributed, the non-parametric equivalent test was used: a Mann-Whitney U test if one variable was categorical and a Spearman correlation for two continuous variables. Details on the outcome of all statistical tests are given in the supplementary information (SI_S2). Finally, we ran a multiple regression to build a model to predict the actual wardrobe size based on a participant's estimate and demographic characteristics.

4. RESULTS

4.1 Analysis of Wardrobe Size and Composition

Table 2 summarises the results of the wardrobe audit. A total of 30,056 individual garments were registered among 156 respondents, averaging 193 garments per person. Wardrobe size ranged from 44 to 434. On average, 46 pieces per person, or 24% of the wardrobe, were dormant in the last 12 months.-Again a wide range is observed, from only 2 dormant items to 241. A significant positive correlation was found between total wardrobe size and the number of dormant items ($r = 0.62$, $p = 9.8*10^{-18}$). On average 5 pieces per person, or just 2.6% of the wardrobe, were pre-owned. Notably, 60% of wardrobes had no pre-owned garments at all. Those with at least one pre-owned item had, on average, 13 pieces or 6.4% of their wardrobe. No significant correlation was found between total wardrobe size and the number of pre-owned items ($r = 0.08$, $p = 3.28*10^{-1}$). Further, no significant difference in the total wardrobe size of participants with and without pre-owned items was found ($p = 4.88*10^{-1}$). Lastly, no significant correlation was found between the number of pre-owned items and the number of dormant items ($r = 0.15$, $p = 5.89*10^{-2}$).

Next, differences between gender and age were investigated. Women were found to have significantly larger wardrobes than men ($p = 1.42*10^{-7}$). Further, women owned significantly more pre-owned clothing than men, both in absolute ($p = 1.85*10^{-2}$) and relative amounts ($p = 3.76*10^{-2}$). No significant differences in the absolute amount or relative share of dormant clothing were found (resp. $p = 1.10*10^{-1}$ and $2.58*10^{-1}$). Regarding age, there is a significant positive relation with wardrobe size ($r = 0.21$, $p = 8.41*10^{-3}$), and a significant negative relation between the number of pre-owned items and age ($r = -0.51$, $p = 1.75*10^{-11}$). No significant relationship between age and the number of dormant items was found ($r = -0.03$, $p= 7.13*10^{-1}$). More details of the statistical tests are given in the supplementary information (SI_S2).

To check the influence of the oversampling of younger participants (under 35 years old) and the undersampling of older participants (above 54 years old) the weights given in Table 1 were used to recalculate the means of Table 2. This results in a slightly higher total wardrobe size of 198 pieces due to younger participants having marginally less clothing on average than the older participants. Notably, the weighted average for pre-owened garments is, on average, only 3 pieces per wardrobe. This is due to a correction for the fact that younger participants have more pre-owned items on average. Due to the recalculation, the share of pre-owned garments in an average wardrobe decreases to 1.9%.

Table 2. Summary Results of the Wardrobe Audit

			number of garments	mean	SD	%	min	median	max	weighted mean	%
	all	total	30 056	192.8	77.3		44	181	434	198	
	(n=156)	dormant	7 225	46.3	38.8	24%	2	39	241	44.5	22%
		pre-owned	780	5.0	12.6	2.6%	0	0	81	2.8	1.9%
gender	women	total	17 534	224.8	79.4		73	220	434	227	
	(n=78)	dormant	3 971	50.9	41.1	23%	2	41	241	47.0	21%
		pre-owned	566	7.3	16.2	3.2%	0	0	81	4.3	1.9%
	men	total	12 522	160.5	60.3		44	150	392	169	
	(n=78)	dormant	3 254	41.7	35.9	26%	2	37	191	41.9	25%
		pre-owned	214	2.7	6.9	1.7%	0	0	41	1.4	0.8%
age	16-34	total	13 908	178.3	78.5		44	160	392	177	
	(n=78)	dormant	3 555	45.6	38.3	26%	2	39	241	45.1	25%
		pre-owned	714	9.2	16.7	5.2%	0	2	81	8.3	4.7%
	35-54	total	8 262	206.6	78.6		98	194	434	201	
	(n=40)	dormant	2063	51.6	37.5	26%	4	45	160	50.6	25%
		pre-owned	57	1.4	3.5	0.7%	0	0	15	1.5	0.7%
	55+	total	7886	207.5	69.7		99	201	427	211	
	(n=38)	dormant	1607	42.3	41.2	20%	2	31	191	39.5	19%
		pre-owned	9	0.2	0.8	0.1%	0	0	4	0.2	0.1%

(SD = standard deviation, min = minimum, max = maximum)

Figure 1 shows the average wardrobe disaggregated by aggregated garment category and gender. A table with all 12 garment categories is provided in the supplementary information (SI_S1). Women possess more garments on average for each of the aggregated clothing categories. Tops are the most frequent garment category for both women and men. The most notable difference between the genders is in the category 'one-piece', which encompasses dresses, jumpsuits, and overalls. For both genders, a positive significant correlation was observed between total wardrobe size and each of the aggregated clothing categories, except for 'one-piece' for male participants. All correlation coefficients and p-values are given in the supplementary information (SI_S2). The fraction of pre-owned garments is small (<5%) across all garment categories. 'nightwear' has the lowest fraction of dormant garments for both genders.

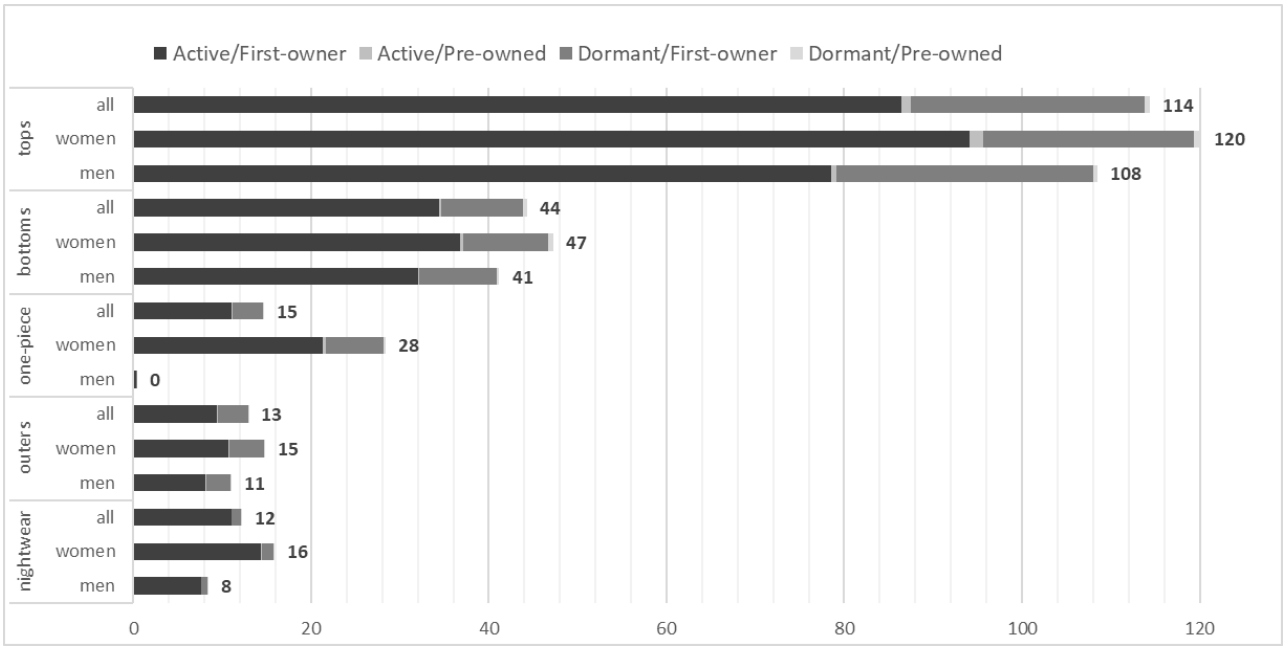

Figure 1. Average Wardrobe Disaggregated by Garment Category and Gender (Weighted Averages)

4.2 Reactivation Potential of Dormant Clothing

From 133 participants additional information was gathered about their dormant garments. Table 3 reveals that 75% of dormant garments are in good condition, indicating that they have not yet been used fully. When prompted, participants were willing to part with only 43% of dormant garments. Table 3 further shows that for a dormant item in good condition, the probability that the owner was willing to part with it was only 36% (27/75), while this was 64% (16/25) for an item in poor condition. This suggests that people are more likely to retain clothing in good condition, hindering the potential reuse of the garments. Table 3 also shows the top reasons for not using a garment split over garment quality. Garments that participants are willing to part with are not being used due to style issues or are uncomfortable to wear (eg. an unpleasant fabric or poor fit), while those that are kept are garments not being worn due to a lack of specific occasions, or those held in reserve.

Table 3 . Reactivation Potential of Dormant Garments By' Perceived Quality' and 'Reason for Disuse' (n = 5 816)

			willing to part with	
		All	Yes	No
	All dormant garments	**100%**	**43%**	**57%**
Perceived quality	**Good condition**	**75%**	**27%**	**48%**
Reason for disuse	not my current style	20%	12%	8%
(Perceived quality=good)	uncomfortable to wear	19%	12%	8%
	no occasion	16%	1%	15%
	not a priority (reserve)	14%	1%	13%
	other	6%	1%	4%
Perceived quality	**Poor condition**	**25%**	**16%**	**9%**
Reason for disuse	not my current style	5%	4%	1%
(Perceived quality = poor)	uncomfortable to wear	4%	3%	1%
	no occasion	3%	1%	3%
	not a priority (reserve)	4%	1%	3%
	worn-out/defect	6%	6%	0%
	other	3%	1%	1%

(Some percentages do not add up precisely due to rounding.)

Looking further into the 57% of garments participants are unwilling to part with, the most common reason for wanting to retain the garment was, by far, 'the intention to use it in the future' (70%). The specific future intention varies, with the main subcategories given being garments saved for particular occasions (20%), garments in reserve while more preferred items are currently in use (15%), and garments kept because they

might still be useful someday (15%). 'Emotional value' was also a notable reason for keeping dormant garments (12%). For the remaining garments, the reason was either unclear (15%) or uncommon (<5%).

4.3 Estimated vs Actual Wardrobe Size

Using a participant's guess to estimate the total wardrobe size would be an advantage, as it would be less resource-intensive than conducting an actual count. Hence, this section investigates to what extent a participant's estimate is a good proxy for the actual wardrobe size. An initial estimate of wardrobe size was collected for 148 participants. On average, participants over- or underestimated their wardrobe size by 32%. Figure 2a shows that most participants (75%) underestimated their wardrobe size with, on average, 39 pieces. Figure 2b shows a simple linear regression model. The coefficient of estimated wardrobe size is highly significant ($p < 0.001$), while the R^2 shows that the model can explain 39% of the variation in the total wardrobe size. Including additional explanatory variables, which can be collected via surveys, such as the participant's age and gender, can increase the model's predictive power. Additional models, using multiple linear regression, are provided in the supplementary information (SI_S3).

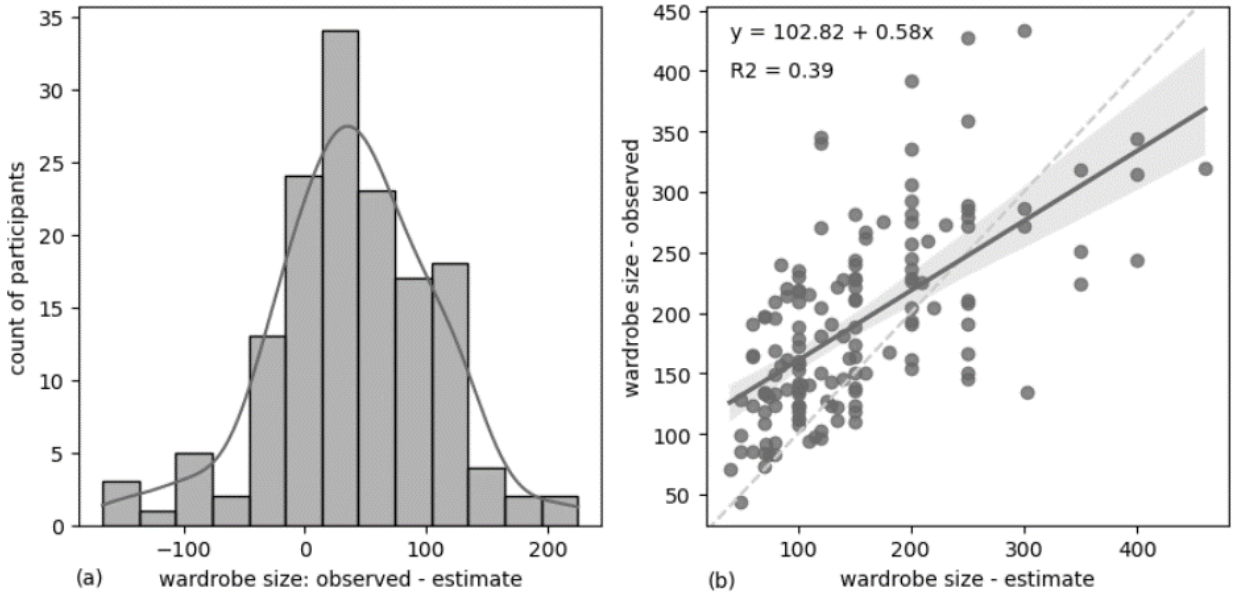

Figure 2. (a) Difference Between Observed and Estimated Wardrobe Size, and (b) Simple Linear Regression of Estimated vs Observed Wardrobe Size (The Dashed Line Represents a Perfect Estimate).

5. DISCUSSION

This section discusses the implications of our finding that the need for clothing in the region of Flanders (Belgium) is fulfilled by on average 198 garments, of which 22% is dormant and 2% is pre-owned. First, the results of our wardrobe audit are compared to those of previous quantitative wardrobe studies. Next, the results are used to understand the potential of CE strategies to intensify the use of garments in society. Lastly, we reflect on the strengths and weaknesses of the audit protocol, and future research pathways.

5.1 Audit Results in Relation to Previous Studies

Table 4 gives an overview of the study design and findings of this study next to the three previous quantitative wardrobe studies discussed in the introduction (WRAP (2022), de Wagenaar et al. (2022), and Maldini et al. (2017)). The number of garments is presented in a way that aligns as closely as possible with the garment categories used in this study to allow for a comparison of the results. From Table 4 it becomes clear that the average wardrobe size in this study is notably higher than previously reported. Variations between countries are expected due to climate, culture, or economic prosperity differences. However, a more likely factor contributing to the variation is methodological differences. WRAP (2022) relied on the best estimate of participants; however section 4.3 shows that this is likely to lead to an underestimate of wardrobe size. de Wagenaar et al. (2022) ask participants to count by themselves; risking varying interpretations of the scope and method, as well as response fatigue. After a while, participants may stop counting altogether, as was found to have happened by Rhee & Johnson (2019). Maldini et al. (2017) used a method similar to this study: quota sampling and audit with the participant at their home. Further, Flanders and the Netherlands are neighbouring regions with a similar climate,

culture, and economic prosperity. This makes the difference in, for example, the number of ‘sweaters’ hard to explain. Maldini et al. (2017) did have a smaller sample size (n=50). Further research would be required to draw any conclusions. Although the totals differ between the studies, ‘T-shirts, short sleeve’, ‘sweater’ and ‘pants, long’ are the most common types of garments found in all studies. Upper-wear garments (tops) are the most common item in every study, occupying from 41% in WRAP (2022) to 64% in Maldini et al. (2017) of wardrobes.

Table 4. Comparison Between Results of Wardrobe Studies

	this study	WRAP (2022)	de Wagenaar et al. (2022)	Maldini et al. (2017)
audit type	audit with researcher	self-audit, estimate	self-audit, count	audit with researcher
document type	academic publication	report	academic publication	report
sampling method	quota for age and gender	quota for age and gender	self-selection	qouta for age, gender, urbanization
recruitment	snowballing/convenience	market research pannel	online MOOC	snowballing
representative sample	weighted results	yes	no	no
number of participants	156	6,000	520	50
gender balance	matched to population (about 50/50)	matched to population (about 50/50)	16% men/78% women/ 5% none	50% men/50% women
age range	16 to 51+	matched to UK adult population	18 to 51+	18 to 51+
geographical scope	Flanders (BE)	UK	global	NL
year	2024 - Q1	2021 - Q4	2020 - Q1	not explicitly stated, around 2016

	total	%D	%PO	total	%D	%PO	total	%D	%PO	total	%D	%PO
total	**198**	**22%**	**1.4%**	**78**	**29%**	*na*	**96**	**23%**	**18%**	**102**	**27%**	**5.4%**
men	169	25%	0.8%	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
women	227	21%	1.9%	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*
tops	**114**	**24%**	**1.4%**	**32**	**26%**	na	**50**	**22%**	**17%**	**65**	**27%**	**5.3%**
shirts, short sleeve	40	25%	1.5%	12	24%	*na*	19	23%	15%	26	28%	6.0%
shirts, long sleeve	7	15%	2.6%				8	20%	16%	12	32%	2.0%
blouses or dress shirts	24	23%	1.1%	9	30%	*na*	10	22%	19%	12	26%	6.0%
blazer or suit vest	6	34%	1.9%				2	25%	15%	1	30%	4.0%
sweater	38	22%	1.2%	11	25%	*na*	11	22%	20%	14	22%	7.0%
bottoms	**44**	**22%**	**1.5%**	**26**	**30%**	*na*	**25**	**24%**	**16%**	**26**	**28%**	**5.2%**
pants, short	12	21%	1.9%	22	27%	*na*	6	22%	12%	5	29%	3.0%
pants, long	29	21%	1.3%				14	24%	16%	18	26%	5.3%
skirts	4	30%	16.7%	4	45%	*na*	5	27%	22%	3	36%	7.0%
one-piece	**15**	**24%**	**1.7%**	**7**	**43%**	*na*	**11**	**27%**	**18%**	**5**	**37%**	**7.9%**
dress	13	24%	1.7%	7	43%	*na*	10	28%	18%	4	36%	9.0%
one-piece, not dress	1	24%	1.5%	na	na	*na*	1.6	22%	15%	1	43%	4.0%
outers	**13**	**26%**	**1.6%**	**8**	**29%**	*na*	**10**	**24%**	**23%**	**6**	**19%**	**6.0%**
nightwear	**12**	**9%**	**1.1%**	**4**	**23%**	*na*	na	na	na	na	na	na

(D = dormant, PO = pre-owned, na = not availible)

This study found that, on average, 22% of the total wardrobe was dormant. This percentage is in line with previous research. Also, similar to de Wagenaar et al. (2022) and Maldini et al. (2017), a positive correlation was observed between the total number of garments and the number of dormant garments. When examining specific garment types, differences emerge. For instance, in this study, the category 'blazers or suit vests' has the highest percentage of dormant items, a finding not observed in other studies. When it comes to the reasons behind the disuse, WRAP (2022) reports similar reasons: (1) ‘for occasions only’, (2) ‘poor fit’, and (3)‘not a priority’. None of the previous wardrobe studies considered whether or not participants would be willing to part with their dormant garments. Hence, the finding that participants are willing to part with only 43% of dormant garments provides a valuable new insight for policymakers or companies looking to reactivate dormant clothing.

Our findings on the presence of pre-owned garments (1.9%) diverge strongly from de Wagenaar et al. (2022) (18%), while it is closer to Maldini et al. (2017) (5.4%). WRAP (2022) mentions finding that 10% of wardrobes are pre-owned, but since this data is not disaggregated by garment category, no recalculation to the scope of this study was possible. The notably higher share of de Wagenaar et al. (2022) could be due to a selection bias, i.e. an MOOC on sustainable fashion likely attracts people more inclined to own pre-owned garments. On the other hand, in our research and Maldini et al. (2017) participants could have been unwilling to disclose that garments were pre-owned, fearing social stigma. Further research could investigate participants' perceptions of owning pre-owned clothing to shed light on this. The finding that 60% of participants possessed no pre-owned items is

consistent with Takens et al. (2023), who did an online consumer survey on sustainable fashion in Flanders (n=1 774).

With regard to demographics, no direct comparison is possible, as gender- or age-disaggregated results could not be recalculated to the scope of our study. We would encourage further research to include disaggregated results to make comparisons between groups possible. Only de Wagenaar et al. (2022) partly did this, but not in a way that allowed for a recalculation to the scope of this study. Looking at the general findings, we can observe that all studies find that women own more garments on average than men. The findings on age and total wardrobe size are inconsistent between studies, with de Wagenaar et al. (2022) finding that the oldest age bracket (55+) had more clothing, while Maldini et al. (2017) found that the youngest age bracket (18-30) possessed the most. We found a weak positive relation between the total number of garments and the participants' age. This could indicate that clothing accumulates over time. Our results show that younger individuals have more pre-owned garments. Maldini et al. (2017) also observed this, while de Wagenaar et al. (2022) did not. Further research and more detailed data reporting could help investigate the findings on gender and age more deeply. Due to the variations between demographic groups, a broad sample is essential in regional wardrobe studies to prevent skewed results.

To summarise, the differences in the findings highlight the need for and relevance of quantitative regional wardrobe studies to gain a deeper understanding of the actual stock of consumer clothing and its usage. Here, it can be noted that so far wardrobe studies have been mainly conducted in affluent economies. Additional studies in developing or emerging economies would provide a more complete picture. While more detailed data reporting is needed to compare between studies and specific population groups.

5.2 Implications for CE and Higher R-Strategies

This study found that in Flanders, an average adult fulfils his need for clothing with 198 garments. This need is fulfilled inefficiently, with 22% of items in wardrobes not being used in the last 12 months, even though 75% are in good enough condition to be used at the product level. This is further confirmed by the finding that most dormant garments are kept because the owner may want to use them in the future. The dormant garments in our wardrobes represent a significant resource that could reduce the need for new clothing if reactivated. Further, the prevalence of dormant garments indicates excess consumption. To move to a circular economy for clothing a mix of reactive (e.g. reuse) and proactive (e.g. reduce) strategies should be used to extend and intensify the utilisation of clothing (Niinimäki et al., 2020).

Reactive strategies focus on intensifying the use of existing garments, either through the current owners' efforts or by transferring ownership to someone else. A first reason for dormant garments could be a technical defect requiring repair. However, within our dataset, it appears that the disuse of garments is not due to technical issues, as very few defective dormant garments were encountered. This indicates that defective garments are either still in use, have been repaired or have been disposed of. It seems plausible that favourite or expensive items would be mended, while non-favourite or cheap items would be disposed of, as found by Laitala et al., (2021) and Poikolainen et al. (2023). Our results indicate that 75% of dormant garments are still of good quality, meaning they can be reused. Keeping these garments in wardrobes risks them becoming outdated, while their future use remains uncertain. Hence, it would be better to find new users for the items through donation, gifting or resale, where they could replace the purchase of new clothing. For reuse to succeed, supply must match demand. On the supply side, the reuse potential of dormant clothing depends on consumer’s willingness to part with garments in good physical condition (Turunen, 2023). We found that participants are readily willing to part with 43% of their dormant garments. Two-thirds of these garments are in good condition and can be reused at the product level. The remaining one-third, which is in poor condition, should go to recycling. Individuals are known to hold onto products they wish to part with (Nilsson et al., 2023), with typically practical constraints (e.g. time, knowledge) preventing them from conducting the actual act of disposal. These are garments with low pragmatic and hedonic value to the current owner (Nilsson et al., 2023). Hence, soft policy interventions that lower disposal barriers can reactivate these garments or materials, such as information campaigns or convenient collection services. This leaves the 57% dormant garments participants were unwilling to part with. These garments are kept because they still hold significant pragmatic or hedonic value to the current owner (Nilsson et al., 2023). Indeed, when participants were asked why they wanted to keep dormant garments, the two main reasons were ‘future use’ (70%, pragmatic value) and ‘emotional value’ (12%, hedonic value). Yet, 84% of these garments are of good quality and could be reused by others. To reactivate these garments, a more complex disinvestment process is required. For garments with a high emotional value the potential for reuse is low. These garments are considered irreplaceable due to the memories of experiences or people they hold to the owner

(Mugge et al., 2005). Their function in the wardrobe has gone beyond merely their use as garments. One possible pathway for reactivation could be informal reuse by close family and friends (Nilsson et al., 2023). Garments kept for their pragmatic value have a higher reuse potential as they could be presently useful to others, if the current owner can be convinced of parting with the garment. Our findings on participants' willingness to part with dormant garments reveal the complexity behind successful garment reactivation. Different policy strategies are required to reactivate the different types of dormant garments. On the demand side, we found few participants with a significant share of pre-owned clothing in their wardrobe (on average 1.9%), demonstrating a limited inclination towards owning preowned clothing. Slight differences between groups were found, with younger or female individuals more likely to possess pre-owned garments. Further research should investigate the barriers to owning pre-owned garments. To maximise environmental gains the acquisition of pre-owned garments should replace the acquisition of new garments instead of being an addition to the wardrobe. Previous research found that acquiring a pre-owned garment typically only replaces the acquisition of one in four new garments (Delanoeije & Bachus, 2022). The present study found no significant difference in the wardrobe size of participants with and without pre-owned items. Hence, people with pre-owned garments do not accumulate more clothing. However, this initial finding requires more investigation, as our finding, for example, does not eliminate the possibility of a higher turnover of garments.

While, in general, reactivation of dormant garments presents a promising pathway to increase the use of individual garments, the reactivation may be hindered if the dormant garment currently fulfils a function to the owner by simply being available (Klepp et al., 2020). Therefore, proactive interventions which examine how we fulfil our need for clothing are essential. One way to do this would be to reduce the absolute amount of clothing we need to meet our needs. A sufficiency-based approach seeks to encourage conscious consumption choices by avoiding consumption beyond the actual need (Bocken et al., 2022). For clothing this is reflected in the concept of 'the capsule wardrobe', which aims at reducing the wardrobe size to only the very essentials, while focusing on quality, longevity and timeless design (Bardey et al., 2022). Further research could examine to which extent the current wardrobe size could be shrinked to an 'essential wardrobe' for different individuals. Another pathway to smaller individual wardrobes is through collaborative consumption, such as clothing swaps or product-service systems. Future use at specific occasions, such as weddings, formal parties or funerals, was the main reason given for wishing to retain dormant garments by participants. Through collaborative consumption, individuals could access a wide variety of garments for specific occasions without individual ownership (Armstrong et al., 2016). This strongly incentivises selecting products designed for longevity, repairability, and recyclability, as the function becomes the product. The intensive use would enable the garments to keep up with trends. Currently, such strategies are not default options for consumers, so interventions to improve awareness and social acceptance are essential for these strategies to reach their potential (de Wagenaar et al., 2022; Polizzi di Sorrentino et al., 2016).

To summarise, this section gives insight into how CE strategies could be used to fulfil our need for clothing differently: by using fewer products in total and by intensifying the use of individual products. To achieve this, different groups need to be approached with other interventions and different garment types with different strategies. High-quality, timeless garments which are properly maintained should be the focus for everyday wear, Reusing or collaborative consumption can provide more intense use of garments for occasional wear that will not be worn intensively by a single individual. Our findings highlight the need for policy initiatives to go beyond product design (eco-design) and waste management (recycling), as the additional resources invested to achieve longer-lived recyclable products will be wasted without complementary initiatives to promote the full use of products.

5.3 Limitations of the Study and Recomendations

During this study, the audit protocol was thoroughly tested. Standardising the method allowed different researchers to collect data, building a large sample of in-person audits. The same quantitative audit protocol can be used in future research projects with the same or different qualitative questions. This allows for building a more extensive quantitative dataset while investigating specific questions. However, for the current protocol, some limitations can be noted: Firstly, the total number of garments can be objectively counted; however, it may still be a slight underestimate, as it is likely that some garments stored away in unusual spots were missed. Secondly, we relied on the participants' judgment to determine if a garment was dormant or pre-owned. These are subjective statements, sensitive to recall bias or socially desirable answers. For example, recall bias was observed as participants sometimes found it difficult to recall whether a garment was used in the last 12 months. The extent to which participants gave socially desirable answers is more challenging to ascertain. Finally, this

wardrobe study took a single measurement in time to gain insight into the composition of wardrobes. Hence, there is no information on the inflow or outflow over time. However, the acquisition of a garment is often not combined with the disposal of another garment (Maldini, 2021). Therefore, the in- and outflows have consequences for the growth or shrinkage of wardrobes, and hence, the total wardrobe size over time. Wardrobes can be more fully understood through a stock-flow model. However, to achieve this, all the in and out flows would need to be known over time, or if wardrobes are in steady state, the average residence time of garments. Collection of this data without recall or observation bias is not evident.

6. CONCLUSION

This study conducted an extensive wardrobe audit among 156 adults to provide a baseline assessment of how the need for clothing is fulfilled in the region of Flanders, Belgium. We find that, on average, people have 198 garments in their wardrobe, of which 22% are dormant. This shows a considerable untapped potential of products and materials trapped in wardrobes. Further, 75% of dormant clothes are still in good condition, highlighting the need to move beyond initiatives on waste management to waste prevention. However, the results suggest that the potential to reactivate dormant clothing is limited for two reasons: First, participants are unwilling to part with over half of the dormant garments, mainly because they believe they will use them in the future. Second, the observed scarcity of pre-owned garments in wardrobes (2%) suggests a low demand for reactivated clothing. The findings in this study provide essential groundwork for developing more effective policies to promote the full utilisation of garments in the transition to a CE for consumer clothing.

SUPPLEMENTARY INFORMATION

The supplementary information for this article is available online; SI_S1 to SI_S3 are bundled together. Click here, or copy the full URL:
http://circulareconomyjournal.org/wp-content/uploads/2025/02/Appendix_Vermeyen_et_al_Behind-Closed-Doors-Examining-the-Stock-of-Clothing-in-Individuals-Wardrobes.pdf

ACKNOWLEDGEMENTS

The work presented in this paper is part of a joint PhD project between the KU Leuven in Belgium and the University of Utrecht in the Netherlands. The project is funded by the KU Leuven (project number: 3E211210).

AUTHOR CONTRIBUTIONS

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Luc Alaerts: Writing - Review & Editing.
Ernst Worrell: Writing - Review & Editing, Supervision.
Karel Van Acker: Writing - Review & Editing, Supervision.
Filip Germeys: Conceptualization, Methodology, Writing - Review & Editing, Supervision.

DECLARATIONS

Competing interests: the authors declare no competing interests.

Declaration of generative AI and AI-assisted technologies in the writing process: during the preparation of this work the author(s) used ChatGPT-3.5 in order to improve the language and readability. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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