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Environmental impacts of the market for second-hand clothes

Does buying second-hand clothes on Vinted in Belgium generates environmental benefits?

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Academic year 2022-2023
Master's thesis with the view of getting the degrees:
CEMS + Master's in Management / Master's in Business Engineering, professional focus
Daytime schedule

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to the individuals who have made this thesis possible.

Foremost, we extend our heartfelt thanks to Professor Paul Belleflamme, our promoter, for his valuable guidance and support throughout the thesis. His advice and feedback were indispensable, and his availability has been instrumental in shaping our work.

We would also like to acknowledge the contributions of Professor Contino and his PhD candidates, Marie-Charlotte Sparenberg and Diederik Coppiters, for their expert advice on the life cycle assessment method.

We are deeply appreciative of all the participants who took the time to complete our questionnaire. Their valuable insights enabled us to answer our research question.

Finally, we would like to express our sincere appreciation to our families for their steadfast support, encouragement, and feedback throughout this academic journey. Without their unwavering commitment and the time they dedicated to reviewing this work, we could not have achieved this milestone.

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GLOSSARY

CO_2e	**CO_2 equivalent**
FF	**Fast fashion**
GHG	**Greenhouse gases**
GWP	**Global Warming Potential**
LCA	**Life Cycle Assessment**
LCI	**Life Cycle Inventory**
SHC	**Second-hand clothes**

INTRODUCTION

The fashion industry is one of the world's biggest polluters, contributing to 10% of global greenhouse gas emissions, almost 20% of wastewater (The World Bank, 2019) and generating 92 million tonnes of waste each year (Ramos, 2022).

The consumption of textiles and the quantities of textile waste generated are constantly increasing, meaning that nowadays, the standard clothing item is worn seven times before it is discarded (Thomas, 2020) and that a truckload of clothes is burned or thrown into landfills every second (Ellen MacArthur Foundation, n.d.). This increase in consumerism can be explained by the rise of fast fashion (Dahlbo et al., 2016). Fast fashion is a sector of the fashion industry that can no longer be ignored for its environmental impact. It is a clothing supply chain model that is intended to respond quickly to the latest fashion trends by frequently updating the clothing products available in stores. This model results in a significant amount of energy and water consumption and generates enormous amounts of waste (Zamani et al., 2017). The environmental impact of fast fashion has been well documented, and it is increasingly clear that a more sustainable approach is needed.

However, the growing second-hand clothing market is gaining attention as a more sustainable option for fashion lovers. More and more people are becoming aware of the negative impact of the fashion industry on the environment and are taking steps to reduce their ecological footprint. Second-hand clothing is seen as one alternative to fast fashion that can potentially reduce the environmental impacts, by prolonging the practical service life of clothes (Zamani et al., 2017) and diverting textile waste from landfills. In fact, the global second-hand clothing market is expected to grow by 127% by 2026 (thredUP, 2022).

Second-hand clothes have become a trend, especially with the emergence of online platforms such as *Vinted*. On *Vinted*, users can buy and sell second-hand clothes, making it easier than ever to participate in the second-hand clothing market. However, while buying second-hand clothes is generally seen as an eco-friendly option, one question remains: how can we be sure that buying second-hand clothes on *Vinted* is better for the environment? Is this common belief supported by scientific evidence?

This master thesis aims to investigate the environmental impacts of the second-hand clothing market, focusing on the purchase of second-hand clothing on *Vinted* in Belgium. The research question guiding this work is: *"Does the purchase of second-hand clothing on Vinted in Belgium generate environmental benefits?*". While more and more research is being conducted on the environmental impact of the fashion industry, there is still a lack of research on the specific impact of buying second-hand clothes on the *Vinted* platform in Belgium. By exploring this topic, we will be able to better understand the environmental benefits of second-hand clothing in terms of global warming potential and water consumption and whether *Vinted* is a sustainable alternative to traditional shopping methods. Furthermore, this topic is of personal and professional importance, as sustainable fashion is a topic of interest in our personal and future professional life.

To address our research question on the sustainability of second-hand clothing, we will conduct a comprehensive study that involves analysing the environmental impacts of the entire life cycle of three selected second-hand garments: a pair of jeans, a cotton T-shirt, and a wool sweater. We will measure the environmental impacts, specifically the Global Warming Potential (GWP) and water consumption, using the Life Cycle Assessment (LCA) methodology, from the first life of the garment to its second life. To provide a better understanding of the environmental benefits of second-hand clothing, we will compare the environmental impacts of purchasing second-hand clothes on *Vinted* with those of buying new clothes in traditional stores. This comparison will contribute to the ongoing debate on sustainable fashion. Our study aims to offer a more nuanced understanding of the environmental benefits of second-hand clothing, and the results can be used to guide consumers and policymakers towards more sustainable fashion choices.

Overall, this thesis aims to make a scientific, managerial, and societal contribution by providing an independent and critical study of the environmental impacts of the second-hand clothing market. It will provide an analysis of the problem and propose recommendations for sustainable fashion practices. Furthermore, this thesis wants to reflect on the societal impact of second-hand clothing and its potential to contribute to a more sustainable fashion industry.

To best address this subject, we have structured the thesis into several sections, each with a specific objective and purpose.

Chapter one presents a comprehensive literature review in which we cover all relevant aspects of our topic that have already been researched. Hence, we will guide you through the discovery of the fashion industry, how it has evolved, and the arrival of a disruptor: the fast fashion. Afterwards, we will move on to an explanation of the circular economy and explain this business model and how it applies to the fashion industry thanks to the concept of circular fashion. Subsequently, we will deep dive into the second-hand market, and identify the characteristics of the consumers participating in this market. The next step is the analysis of digital platforms, as well as a focus on the most important player *Vinted*. Following that, we will summarise the current legislation targeting the textile and clothing industry with a focus on the EU and the US. The next section is an important explanation of the environmental impact of the textile industry: it will explain the Life Cycle Assessment tool method that we will use to conduct our analysis. Finally, we will close the literature review with a focus on the environmental impact of the second-hand industry specifically and discuss relevant concepts such as the replacement rate, the life span left, as well as the rebound effect.

Chapter 2 explores the global environmental impact of the second-hand market and narrows down the subject to a specific research question. It utilises quantitative research methods to address and answer this question. Hence, thanks to the previous literature review, we have been able to define a research question, as well as several hypotheses to answer them. Thereafter, we will expose our two-pronged methodology, where we define the goal and scope of the Life Cycle Assessment, describe the inventory analysis and data collection for secondary research with existent sources but also primary one through a survey we led among the Belgian population. The third section of this chapter exposes the results. In this section, you will find a social and demographic analysis of the respondents of our survey, but also the results of the LCA we have run, validations or rejections of the hypotheses, and finally a scenario analysis.

To close this thesis, Chapter 3 provides an in-depth interpretation and analysis of the results of the LCA. The result analysis provides an interpretation of the findings, with an examination of variables such as the life span left, the replacement rate, the types of clothing, the avoided impacts of second-hand clothes and investigation of *Vinted'*s market. Based on these findings, practical recommendations are presented for *Vinted,* the Belgian government, and

consumers. Additionally, this chapter proposes one broader recommendation for the global fashion industry.

Finally, the conclusion section summarises the research findings, limitations of the study and proposed interesting leads for further research. Overall, the thesis aims to provide an independent and critical investigation that proposes an identifiable contribution to current knowledge, useful for managerial decision-making and societal impact.

CHAPTER ONE: LITERATURE REVIEW

I. STUDY OF THE FASHION INDUSTRY

To kick off this thesis, it is important to apprehend the fashion industry scene. To do so, we will discuss the **traditional apparel industry**, the **evolution of this industry** through time and the textile supply chain on which this industry relies. Next, we will describe the **current state of the apparel industry** by considering the number of external variables that influence it. Finally, we will discuss the **major disruptor of this industry** called fast fashion and its drifts. The objective of this section is to establish the most complete picture of the fashion industry.

A. The Fashion Scene

The traditional clothing industry

The term "**fashion**" appeared in the **14th century** at the aristocratic court and was then the mirror of the social condition (Portail de la Mode, 2019). This passion for clothing further developed with the first fashion show in the 19th century, and a craze to create new trends throughout the 20th century's events. This industry has grown at such a fast pace that it is today the 4th largest in the world, worth **$1.5 trillion** (Smith, 2023) , which represents 1,55% of global GDP in 2021, and is expected to reach an annual value of production of three trillion $ by 2030 (Drew et al., 2021; Smith, 2023).

An industry that keeps on growing

Still nowadays, the clothing industry concerns every person in the world. Over the past 20 years, the rag trade has significantly changed due to **economic development and growing purchasing power**. The industry includes everything from textile and apparel brands to wholesalers, importers, and retailers. According to the *Joint Economic Committee* of the US, it employs over 1.8 million people in the US (Maloney, 2019) and produces today 80 billion pieces of clothing per year (Tabishat, 2022). Naturally, these factors have significantly increased the clothing production and consumption, especially in emerging markets in Western, Asian and European regions (Statista & McKinsey & Company, 2022).

Studies from *McKinsey* (Remy et al., 2016), and the *World Resources Institute* (Drew et al., 2021) state that clothing production has doubled between 2000 and 2015, and that even **more demand** for apparel is anticipated by 2050, as the global GDP is projected to grow by about two percent annually until 2060 (OECD, n.d.). Moreover, Drew et al. (2021) have observed a 36% drop in the number of times a garment was worn before being thrown away. Which is translated by having consumers buying 60% more clothing than in 2000, but who keep each piece for half the period compared to before (Reichart & Drew, 2019).

But, how does it work?

A brief overview of the textile supply chain: a historic linear Business Model

When fashion was born, it directly adopted a linear production system. This **traditional linear model** is based on a three-step approach: taking (the gathering of raw materials), creating/transforming (the making of clothing), and wasting (the wearing and eventual discarding of clothing) (Ellen MacArthur Foundation, 2017).

Figure 1:Textile product life cycle based on a linear Business Model

Note. Clotuche, L., Hanon, C. (2023). Based on *Assessing the Environmental Impact of Textiles and the Clothing Supply Chain,* by S.S. Muthu, 2020, p. 4. Copyright 2020.

The fashion industry has seen a significant **transition** during the past 30 years (Brydges, 2021). This transition results of a combination of several phenomena such as lean retail (Abernathy et al., 1999) ; global supply chain innovation (Tokatli, 2008) ; digitisation (Crewe, 2017), etc. However, despite innovation, the traditional garment industry continues to mainly follow a traditional linear model approach.

To understand the fashion industry and its business model better, it is relevant to look at the **textile supply chain**. While the supply chain process may vary for different types of garments, examining a generalised supply chain can provide valuable insights. This generalised supply chain model consists of nine distinct steps in the life cycle of textile products such as clothes. As you can see on Figure 1, this supply chain is complex. This is due to the numerous segments it covers and the decentralisation of the workforce, which we will develop further in this literature review (cf. infra Fast fashion: the birth of a disruptor p.8).

The supply chain management (SCM) starts with the extraction and preparation of raw material to transform it into fibre production, which later turns into yarn and then a fabric ready to end in the apparel manufacturing process to be sold to a client (Muthu, 2020). However, several techniques exist to produce clothes and different production lines and processes can be used for the same type of garment. Doctor Muthu (2020) mentions that due to this complex supply chain, it can be complicated to study the environmental impacts of a garment. However, we are ready to take up this challenge on our own scale!

B. The Apparel Industry in 2023

Impacts of Covid & the War on the apparel industry

An e-commerce boom due to Covid

The Covid outbreak has caused significant disruptions to supply chains around the world in recent years (Davies & Stevenson, 2022). But this pandemic also had a positive effect on the fashion sector, by boosting e-commerce sales in 2020 (Swatski, 2021).

COVID-19 has revealed how some of the major brands (i.e. Nike, H&M, Zara, etc.) and merchants are vulnerable to having a **supply chain** that is dispersed and lacks transparency (Lin, 2021). Indeed, major fashion shops have felt the strain of lockdowns, logistical challenges, and changing consumer behaviour (Magyar, 2021).

However, in the meantime, digital transformation has leapt in all sectors and fashion **e-commerce** has exploded. The industry is predicted to rise at a compound annual growth rate of 21.6%, from US$550 billion in 2020 to approximately US$668 billion this year (Lin, 2021).

Supply Chain disruption due to the War in Ukraine

The garment industry has been impacted globally by Russia's invasion of Ukraine, especially its supply chain. Energy prices skyrocketed after the initial shock, and the acute scarcity of raw materials and staple commodities are raising consumer prices across the board and hastening the inflationary effects of the global supply chain problem. This, of course, leads products shipped overseas to be less price competitive (Abiteks, 2022).

Three key trends have been identified: the first is in **transportation**, where shipping companies are ceasing to dock in Russian and Ukrainian ports, and the second is in **regulation**, where sanctions, boycotts, and payment systems are having an impact on the apparel industry. Finally, the third is regarding **raw materials**, where staple crop production, rare gas supply disruption, and wood exports (GlobalData, 2022).

Digital clothing

Many people who consume fashion or work in the sector still find it challenging to comprehend digital fashion. Still in 2023, although the topic of digital fashion is developing fast, it is still unclear exactly what it entails and how it should be described. According to Baek et al. (2022), digital fashion could be defined as "*the virtual creation, production, and representation of one's identity* via *computer-generated design*". It can be declined into various dimensions such as virtual reality, metaverse and NFTs. *DressX* is today the leading fashion multi-brand marketplace featuring digital collections from the most renowned brands and 3D designers (DRESSX, 2023). In its last sustainability report, *DressX* (2022) declared that when compared to the creation of physical clothes, digital clothing generates **97% less CO_2** and conserves **3,300 litres of water** every item (DressX, 2022). Therefore, switching from physical to digital samples while in the design and development stages can lower a brand's carbon footprint by up to 30% (The Fabricant, 2021). Hence, digital fashion will certainly be a hot topic to follow in the coming months for the fashion industry and its environmental impact.

C. Fast fashion: the birth of a disruptor

In the early 2000s, fast fashion has emerged as a major industry disruptor, which experienced an explosive growth of the consumption of clothes.

What is fast in fashion?

Fast fashion (FF) is a system of production and consumption, a model characterised by a **rapid turnaround of new products at low prices**, which allows firms to quickly respond to the latest trends and deliver copies to the consumers thanks to their rapid production (Brewer, 2019). Actually, FF is the result of Fordism and the traditional linear economic model that took hold

at the end of the 1960s: the idea of the serialisation of products, of numerous products in large series, with a form of standardisation of production and work organisation. All this with the aim of creating economies of scale (Cohen et al., 2022a).

Thus, fast fashion companies offer very low selling prices. This makes it possible to distribute many products to as many consumers as possible, creating a **consumerism society**. From the 1980s onwards, there was a certain acceleration in this logic, to which was added the globalisation of sales and a concentration of brands in large international groups. This led to progressive relocation of production.

With this system, based on productivism and consumerism, **large groups** such as *H&M* or *Inditex* (which owns *Zara*) have appeared. These large groups have several brand portfolios and apply the same recipe to all their brands. The system they invented in terms of production is based on the two following axes.

The first axis is **cost control**. They massified the volumes of textiles and optimised the product by proposing more attractive designs, copying the great fashion houses (which will give rise to many lawsuits), but also: by degrading its quality (lower cotton weight, jeans that do not hold up in the wash, etc.). All this, while having deplorable working conditions (cf. infra Social externalities p.11) (Thomas, 2020).

The second axis of strength of fast fashion is the control of management and logistics: **supply chain management**. The large fashion groups have optimised their logistics chains to such an extent that they have become much more efficient. This has allowed them to serve increasingly dense and connected store networks, and therefore a much faster rate of arrival of products in stores. This is what makes up the primary characteristic of FF: **the acceleration of the arrival of new products in stores & high responsiveness** level to customers' demand (Thomas, 2020).

Accustomed to four seasons and therefore four collections per year, fast fashion will increase this number from four to ten. Today, at *Zara*, there are **24 collections per year**, sometimes even 36. And all of this is possible thanks to the high responsiveness, rapid prototyping, small production runs and efficient delivery processes that the big players (i.e. *H&M, Inditex, Mango, C&A*, etc.) have been able to implement (Kaikobad et al., 2015). This has been

successful thanks to worldwide communication campaigns with celebrities and the exponential multiplication of stores. Moreover, what has led to a normalisation/democratisation of fast fashion is the fact that it has managed to reach all social classes - from the little jobber student to celebrities' looks. Fast fashion has become normalised on the whole social pyramid (Cohen et al., 2022a).

As a consequence, FF structures all the modes of textile consumption and tends to standardise the tastes. Consumers have been used to buying more and more often for less and less money. Nowadays, every three weeks, customers search for new trendy, cheap and distinctive clothes (Kaikobad et al., 2015). The same product will be found all over the world in a few weeks and will quickly accumulate and then be replaced. In parallel, the consumer will wear less, and FF will become synonymous with disposable fashion.

A small sister of fast fashion: the ultra-fast fashion

This fast fashion industry is already being challenged/overtaken by another model which is very strongly inspired by its own, but which goes further into the extremes by breaking prices even more and increasing the pace: **the ultra-fast fashion!**

The latter is very popular, especially among young people. It is led by *Shein*, but also by other smaller players such as *Pretty Little Things,* for example. These actors are pure players present only online, and what makes them different from FF is their systematic effect of **copying fashion trends**. They have a very detailed analysis of trends and therefore hold a lot of data. In addition, they have a speed of production which is even tenser. The ultra-fast fashion works in a logic of permanent renewal which is achieved by releasing new items online every day thanks to production times that vary between three to five days maximum. This allows players to control their production line and inventory by manufacturing very **small volumes quickly in networked workshops**. In terms of communication, they use micro-influencers to reach the younger generation (Shadel, 2022). Concerning the prices, ultra-fast fashion represents an extreme of fast fashion with average product costs of seven euros and cost prices of between 0.10 and 0.20€ (Cohen et al., 2022a).

The drifts of fast fashion

Between 2002 and 2017, global clothing production doubled, and this trend is expected to continue as global clothing consumption is expected to **increase by a further 64.5%,** from 62M tonnes in 2017 to 102M tonnes by 2030 (Global Fashion Agenda & Boston Consulting Group, 2017). This model generates many negative externalities developed hereunder.

Environmental issues

One of the main drifts of fast fashion is its environmental impact. Since this is a major consideration in our thesis, we have dedicated a full detailed section to it below (cf. infra Environmental Impact Textile Industry p.34).

Social externalities

Unfortunately, most of the fashion industry nowadays is also about the **exploitation of workers and opacity**. Since the fashion industry is in constant need of urgency and always looking for the country with the lowest production costs, Asia has quickly become the place of choice for clothing production. The textile industry employs 75 million people worldwide, 65 million of whom are in the Asia-Pacific region, particularly in China. But Chinese wage costs have increased. This has led to a relocation to other Asian countries, such as Thailand, Indonesia, Malaysia, Cambodia, Vietnam, Laos and the most known for having particularly opaque, even dangerous working conditions, especially for child labour: Bangladesh (Cohen et al., 2022a).

In Bangladesh, about 15% of children aged six to fourteen from the slums of Dhaka work full-time in the textile industry. After the age of fourteen, we are talking about one child out of two (Quattri & Watkins, 2016). Moreover, since there are many subcontractors, there is no traceability of production conditions. In parallel of **child labour, forced labour** is also a common practice in the fashion industry. Notably, the case of Uyghurs in China, for whom it is said that almost one in five garments produced in China has been subject to forced labour by Uyghurs and more than 500,000 Uyghurs produce 20% of the world's cotton (End Uyghur Forced Labour, 2023).

However, it is not only on the other side of the world that dark parts of the textile supply chain are hidden. In **Los Angeles**, the largest clothing manufacturing centre in the US, there are also hidden sweatshops (Thomas, 2020). In fact, half of the workers in California sweatshops are undocumented, receive poor wages, and work in unsafe conditions (Morrison, 2019).

Societal problems

Since fast fashion accelerates the acquisition of products, it has created several issues, including the phenomenon of **addiction**. Consumers have become incapable of reasoning about purchasing textile fashion products, and constantly want to buy the latest trends to satisfy this need. Added to this, is the issue of **inclusivity,** which wants to move away from the model of the skinny white woman to allow all types of consumers to dress as they wish. Following this logic, more and more regulations are being put in place by politicians and brands towards these issues, which led in 2019 to the creation of a global coalition of fashion and textile companies, the ***Fashion Pact*** (Cohen et al., 2022a).

II. A conscious shift to a new business model: Circular economy

After observing the threats posed by the linear economic model of fashion to our planet and people, the circular economy has begun to emerge as a new financial and environmental opportunity. This chapter aims to detail what is behind this recent shift in consciousness. To do so, we will first address the emergence of slow fashion and the paradox of fashion. Then, we will clarify the general concept of circular economy. Finally, we will detail how the circular economy applies to the fashion industry.

A. Slow Fashion

After realising all the drawbacks of fast fashion (cf. supra The drifts of fast fashion p.11), society is starting to realise that it is probably time to review the production and consumption rhythm and welcome a new model: slow fashion.

Fifteen years ago, this new alternative and minority market in textiles began to develop. Slow fashion arrived to **denounce the main evils** of its industry: its speed, its search for efficiency and optimisation, its excessive growth and globalisation and its spin-offs (Cohen et al., 2022a). However, the term "slow" does not refer to a slowdown. According to Kate Fletcher (2007), *"slow fashion is about designing, producing, consuming and living better. Slow fashion is not time-based but quality-based (which has some time components). Slow is not the opposite of fast – there is no dualism – but a different approach in which designers, buyers, retailers and consumers are more aware of the impacts of products on workers, communities and ecosystems"*.

Subsequently, Clark (2008) defined three components of slow fashion: 1. **local** anchoring and valuing of local resources; 2. **transparency** of the value chain and disintermediation between the manufacturer and the consumer; 3. extension of **the life span** of products. Today, these three elements are widely found among responsible fashion entrepreneurs, who associate them with relocation and assimilate it into an alternative and responsible fashion policy. It is therefore also called responsible fashion, ethical fashion, sustainable fashion.

B. The Fashion Paradox

As you can see on Figure 2, this industry quickly faced tensions between the ambition of growth and the commitment to reduce the environmental impact (Gray et al., 2022). This situation is named after the **fashion paradox**, which represents the contradiction between the desire of companies to meet the absolute desire of consumers to be fashionable and follow the latest trend and meet environmental targets (Brewer, 2019).

Figure 2: The Fashion Paradox

Note. Clotuche, L. Hanon, C. (2023). Based on Slow Fashion in a Fast Fashion World: Promoting sustainability and Responsibility, by M. Brewer, 2019. Copyright 2020.

As the market constantly adapts to meet consumer demand, alternatives have been found for the fashion industry to satisfy consumer demand while limiting their fashion consumption and environmental impact. These alternatives are opposed to the **traditional linear economic model** and are part of a **circular economic model** (Gray et al., 2022).

Moreover, after slowing down consumption, a new model has emerged that aimed to go one step further by repurposing what has already been used: the circular economy.

C. Circular Economy

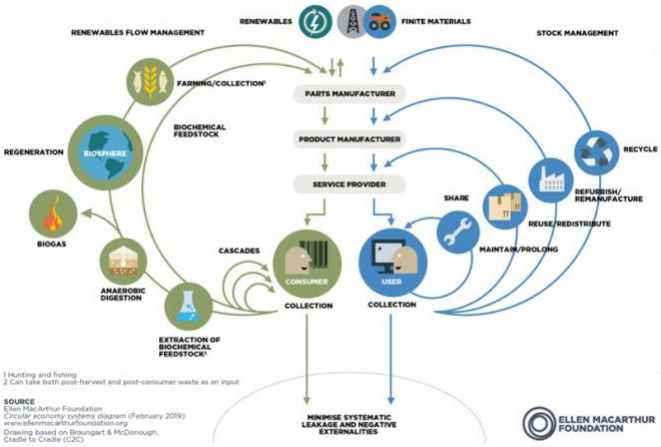
Circular economy is nowadays presented as “THE” solution, but what is it exactly? It is above all a big umbrella concept that is mobilised to encompass somewhat different phenomena.

The term circular economy appeared in the 1960s, referring to a “closed loop” (Cohen et al., 2022b). This concept contrasted with the cowboy economy, an economy where consumption and production are the drivers and output maximisation is the goal (Tóta, 2015). This idea has evolved up to the introduction of the concept of "**cradle to cradle**", which is the belief that we must close the loops and therefore minimise energy and material inputs (EPEA, 2023), as you can see on Figure 3.

The *Ellen MacArthur Foundation* (2020) defines it as*: "a restorative or regenerative economy through the design, maximum use and recovery of products, components and materials*

throughout the value chain, distinguishing between technical and biological cycles". To improve this definition, the *ADEME* (Agence de la transition écologique) (2014) also added the social dimension by insisting on the fact that this economy wants to preserve the planet, but also develop the well-being of individuals.

Figure 3 - Circular Economy systems diagram



Note. Adapted from *Ellen Mac Arthur Foundation*, by E. Mac Arthur. https://ellenmacarthurfoundation.org. Copyright 2019. By Ellen Mac Arthur Foundation. Adapted with permission.

The theory of R's

The basis of circular economic models is the theory of R's, which is a theory that focuses on the hierarchy of waste. In 2017, Kirchherr defined a model mobilising ten Rs which are (Venturini, 2021) (Cohen et al., 2022b):

- **R0. Refuse:** to ask the question of need, check that this product is not superfluous, is it functional? Is it not redundant? Is it even harmful?;
- **R1. Rethink**: action to have an in-depth reflection, to make the use of the product more intensive and to change our relationship to the object by not transferring the property rights to the consumers but by integrating systems such as collaborative consumption, mutualisation, etc.
- **R2. Reduce**: action to increase the efficiency of manufacturing and product use by consuming less energy and natural resources.
- **R3. Reuse - Re-employ:** echoes second-hand.
- **R4. Repair:** the logic of slowing down the loops and increasing the life of the product.

- **R5. Refurbish:** to refurbish an old product or update it.
- **R6. Remanufacture**: the same logic but at a more industrial level.
- **R7. Repurpose:** to give a new function to a product to give it more added value.
- **R8. Recycle:** to convert waste into reusable material.
- **R9. Recover:** refers to energy, incineration, etc. linked to linear economy.

3 Pillars

These R's are grouped into three main pillars which are: 1. reduce the loops; 2. slow down the loops, and 3. close the loops.

The **reduce pillar**, mainly concerns lean production, industry 4.0 (the field's digital transition and real-time decision-making, increased productivity, flexibility, and agility (IBM, n.d.)), the reduction of waste, clean technologies, as well as everything that is linked to the control of pollution and prevention. But it also affects activities further upstream in the value chain, i.e. the development of products and services on demand, ordering with 3D printing, and ideas that will be closer to local business models (Cohen et al., 2022b).

The second block "**slow down**", focuses on how to make consumers appreciate the garment more. It tackles the notion of inter-temporality and revisits price, quality, and the creation of modular pieces (i.e. clothing that evolves with the age of the child). In addition, in this pillar, we try to educate the consumer on sobriety and make them think about whether they really need new clothes (i.e. *Patagonia*). Finally, brands also try to develop an emotional bond with their customers by developing an ethical or fair-trade concept (Cohen et al., 2022b).

Finally, the "**close**" pillar is directly linked to renting, recycling upcycling, and second-hand in order to extend the life of the garment by increasing its number of users (Cohen et al., 2022b).

D. Circular Fashion

The circular economy has also established itself in the fashion industry. In this section, you will learn about how the textile and clothing players are integrating sustainability and circularity through a variety of business models.

What is **circular fashion** in concrete terms? According to *Tex&Care*, the academic chair of Université de Lille, it is a type of fashion that aims to drastically reduce all of its environmental externalities by relying on life cycle thinking, and whose ultimate objective is to re-evaluate the values of fashion and to create an extended value, with and for all stakeholders (Cohen et al., 2022a). This definition is based on the theory of the R's (cf. supra The theory of R's p.15).

As shown in Figure 4, circular fashion economy follows a very different model than linear fashion economy. Indeed, as explained before, the linear model describes the process of extracting raw materials, then designing and producing the garment, which is worn and finally ends up being discarded to end up in landfills. In short, linear fashion is *"take-make-waste"* (Drew et al., 2021) (cf. supra A brief overview of the textile supply chain: a historic linear Business Model p.6). In contrast, circular fashion breaks the linear process by reusing or recycling clothes to prevent them from becoming waste. The gray loop in Figure 4 describes the situation in which clothing is reused by the community. The garment being in good condition will simply be repaired and/or redesigned, then reused through resale or rental. The loop can be repeated as many times as the garment is still usable. Otherwise, it will be recycled, which is described in the black loop in Figure 4. Recycling will retain material value to create renewable materials that will be used as raw materials for new garments (Drew et al., 2021).

Figure 4 - Linear & Circular Economies Graphs

Note. Adapted from *The Sustainable Fashion Forum*, by The Sustainable Fashion Forum. https://www.thesustainablefashionforum.com Copyright 2020. Adapted with permission.

III. A New Industry: The Second-hand Market

Now that we have covered the broad outlines of the fashion industry and its circular alternatives, let's dive into our main topic: the second-hand market. The second-hand market is an integral part of the slow fashion model and more specifically the reuse economic model (Gray et al., 2022).

A. Overview of the second-hand market

Second-hand clothes are used fashion products that were previously owned by another person exchanged between consumers acting as buyers and sellers. During the past years, second-hand clothes have become more popular due to the following elements: the increasing interest in eco-friendly fashion, the attractive costs of second-hand clothing and the penetration of online shopping platforms (Future Market Insights, 2022), which we will develop further (cf. infra Digital platforms p.25).

In terms of numbers, by 2021, the **second-hand clothing market** was estimated to be worth $96 billion. In comparison, the **fast fashion market** was estimated to be worth $210.2 billion (Yahoo!finance, 2022). To benchmark this data, the global apparel market was worth $1.55 trillion in the same year (Smith, 2023). Therefore, we can see that the market share of thrift stores (6.4%) was worth about half the one of fast fashion (14%) in 2021. In addition, only slightly more than half (57%) of US adults resold used clothing in 2021. These numbers show that second-hand clothing is still far from being a mainstream phenomenon (thredUP, 2022).

However, second-hand is a market that has completely exploded in the last ten years and that translated into a **very strong economic activity**. Between 2012 and 2021, the second-hand global market grew by 215%, while the conventional market grew by 24%. And, according to ThredUp's 2022 resale report, in the following five years, the second-hand market in the US is expected to more than double and reach $82 billion. Moreover, it is expected to grow three times faster overall than the global apparel market. More specifically, eight times faster in North America, two times faster in Europe, four times faster in Africa and South America and three times faster in Asia and Australia. These figures show the strong development expected in the global second-hand clothing market in the future (thredUP, 2022).

Three main phenomena explain why the second-hand market has developed so much:

1. The first phenomenon is the very steady **increase in online sales of clothing** over the past ten years. According to *Fevad*, in 2020, one out of two products purchased online were from the fashion sector (Laine-Devroede, 2021) ;
2. The second phenomenon is the arrival of the Lithuanian application ***Vinted***, which arrived in Belgium in 2018 and has completely restructured the way people sell and buy clothes. In the United States, it is *ThredUP* that has had this catalytic effect by centralising second-hand products and reselling them, this has made traditional thrift stores more accessible and has therefore also participated in democratisation (Cohen et al., 2022c) ;
3. The last interesting element is the great trend of **vintage** fashion that has been democratised. Society has experienced a trickle-down effect of this as it starts from the world of luxury, and has therefore brought about a kind of social and cultural diffusion (Cohen et al., 2022c).

Finally, it is important to explain the **relationship** between second-hand clothing and **fast fashion**. Indeed, as fast fashion evolves rapidly, consumers are constantly getting rid of clothes that are no longer in fashion in order to buy new ones. This leads to huge dumps of clothes, which are the products of the second-hand market. It can therefore be said that the disposable nature of fast fashion allows the second-hand to exist because it represents the preconditions for the second-hand supply systems (Kaikobad et al., 2015; Tóta, 2015).

Business models of the second-hand market

Let's now deep dive into five business models specific to the second-hand fashion market :

1. **Solidarity-based second-hand**: actors such as *Oxfam, Emmaus, Red Cross*, have a business model based on the management of clothing donations articulated around sorting skills by volunteers. These social and solidarity actors claim more responsible consumption, fighting against waste, and want to help people to dress in dignity. Three major elements are currently affecting these historical business models: 1. the decrease in the quality of donated products; 2. an increase in the overall volume of clothing; 3. the decline in the

attractiveness of the traditional solidarity store due to the appearance of online sales (Cohen et al., 2022c; Paz, 2022).

2. **Sales depots and shared stores.** The 18-35 age group has shown a real revival of interest in thrift stores, particularly in city centres. These stores have a focus on commercial animation: merchandising, atmosphere, commercial advice, etc. It is in some ways the replica of what you can find in new clothes (Sorensen & Johnson Jorgensen, 2019).
3. **Online second-hand**: is the most disruptive business model of the last decade (ex : *Vinted, Vestiaire Collective*,etc.). There are three types of platforms: C2C intermediation, C2B2C centralisation, and finally B2B2C, which brings together thrift stores. This business model being at the heart of our work, we will develop it in more detail further in this work (cf. infra Digital platforms p.25) (Cohen et al., 2022c).
4. **Conventional brands**. Since conventional brands have seen a drastic change in consumer behaviour, and a drop in store traffic, they have reacted by proposing a new second-hand offer (corners in stores and sections on websites). The *Chaire Tex&Care* conducted a study revealing that almost all brands are now committed and that 68% of them opt for a voucher system that allows both collecting products and selling products in return (Cohen et al., 2022c).
5. **The integrated B2B solution**: players such as *Patatam/Rediv* or *Recycle Veepee* have identified a lack of specific skills that retailers and distributors do not have to sell second-hand clothes. They therefore propose a turnkey integration, offering technical and technological mastery of sorting a large volume of clothing (Rediv, 2023).

Limitations of the second-hand market

Following the business models, we can name five limitations of the second-hand market (Cohen et al., 2022c) :

1. The disruptive business model of **platforms will generate a turbo consumption**, a hyper-consumption. Therefore, second-hand clothing purchases will be much more numerous than when buying new products and will not allow consumers to question the volume and sobriety of their consumption. Society remains in the optics of purchasing “more for less” instead of rationalising itself and seeking a “less is more” mentality (Bick et al., 2018) (cf. infra Rebound Effect p.50).

2. Another massive drift is the **use of vouchers** by conventional brands. Hence, consumers drop off a second-hand product, only to get a discount to buy a new garment. This represents an ecological dissonance (Crête & Preyat, 2021).
3. The question of **reterritorialization** should be asked about purchases on platforms that come from very distant countries. This applies to both sites and vintage stores, which buy cargo from the US, New Zealand, Philippines, etc. (Eviota, 2022).
4. The **cancellation of the "donation" effect**, since the consumer has understood that their clothes can now be a financial resource (Paz, 2022).
5. The **AGEC law** prohibits in France the destruction of unsold clothes and pushes to transfer these clothes to the second-hand excessive (LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire (1), 2020). This law will be further discussed (cf. infra Laws in France and Belgium p.30).

B. Consumer Behaviour

In their article "*The Global Glut of Clothing Is an Environmental Crisis*", Dottle & Gu (2022), announce that there has **never been a greater interest in sustainability** among consumers. Théot (2020) states that 60% of the European respondents to an EU survey from April 2019, believe that climate change is among the most serious issues nowadays. According to a recent study led on 10,000 Gen Z and millennial consumers worldwide, at least 65% of them are concerned about the environment and over 80% plan to purchase solely sustainable items, or as much as they can. Moreover, more than 40% of those polled stated they thought the fashion business was unsustainable (Javaid, 2022). Now that they have realised that they can be actors in this climate change crisis, consumers start to pay attention to their environmental impact (Théot, 2020).

Who is the second-hand consumer?

A survey conducted by the *Chaire Tex&Care* has revealed valuable information about the behaviour of second-hand consumers in France (Cohen et al., 2022c) :

Firstly, second-hand purchases are becoming more and more common because they are **regular purchases**. French people usually buy new pieces of clothing once a month, which means they buy at least twelve pieces a year. Concerning the second-hand segment, one out

of three people also buys at least once a month. This trend is rather recent as one out of four French people started buying second-hand between the last two and five years, and 70% of the buyers started buying second-hand in the last ten years. The clothing category represents 60% of all second-hand purchases (Cohen et al., 2022c).

Second-hand has become part of the **clothing supply habits**. According to this survey led by the *Chaire Tex&Care (Cohen et al., 2022c)*, 70% of the respondents said that it has become an easy way to buy clothes and half said that it could replace a new purchase.

In terms of business model preferences, **platforms** attract the most consumers, with *Vinted* in the top-of-mind at 60%. In the second place, it is the second-hand market and C2C events, which are favoured by 25% of consumers in this market dynamic (Cohen et al., 2022c).

In terms of age, **25-34-year-olds** represent the majority of buyers, as they are the ones who buy on *Vinted* and at flea markets. They are followed by the 16-17-year-olds who go to the thrift store a lot, which is a model that has been abandoned by the 30-year-olds (Shearsmith, 2020).

Trends

In the context of the second-hand market, it is important to understand the different dimensions influencing consumer clothing consumption and behaviour. However, please note that each consumer is different and that each dimension is considered independently of the others.

To start with, for some consumers, the search for second-hand products can be compared to a **treasure hunt**. They are looking for clothing that is not widely available on the market. The simple fact of finding the item or garment gives them emotions of gratification and pleasure. This treasure hunt phenomenon is particularly widespread in China (Wang et al., 2022).

In addition to that, fashion plays an important role in the **personal image, social image** and **acceptance** in a social group. Clothes are used to communicate taste and lifestyle of a person (Čiarnienė & Vienažindienė, 2014). Second-hand clothing responds globally to a psychological demand from consumers, seeking construction of identity around clothing, a need to be unique that corresponds well to contemporary consumers (Cohen et al., 2022c). Hence,

second-hand garments can be a facilitator of acceptance and image. Furthermore, clothes are now subject to society's approval. In fact, it enables people to affirm, feel good, express and love themselves (Machado et al., 2019). But it may also not be a facilitator, as the social image of second-hand clothing may be perceived by some people as low class and low social status (Hur, 2020; Machado et al., 2019).

Lastly, second-hand fashion is motivated by **ethical and environmental clothing consumption**. In fact, an increasing number of consumers are willing to reduce their footprint and the use of resources (Hur, 2020). This is due to a growing concern about the negative's externalities of industrial production on the environment (Jalil et al., 2019). Consumers are concerned about the impact of their own fashion consumption and tend to change it by reusing clothes and fashion items.

Overconsumption

However, the ethical consumption is not verified in all cases. Indeed, despite the willingness of second-hand shoppers to be more sustainable, the way they consume second-hand is beginning to be as harmful as fast fashion. It appears that some consumers who are environmentally conscious, give priority to their personal fashion needs (Vehmas et al., 2018). Articles are beginning to question whether reselling might not also lead to **overconsumption** (Kent, 2022a). Second-hand seems to have become a common practice in order to justify any purchase, even if it is not necessary. Consumers who wish to buy second-hand, believing that they are no longer playing a role in the unethical side of the fashion industry, no longer think about the utility of their purchase, but rather allow themselves to buy a lot, even in mass. In today's second-hand consumers' mind, buying second-hand is good for the planet as well as being good for their wallet. Consumers think they have found a loophole in the system that allows them to consume without feeling guilty (Kibel, 2020). Unfortunately, this way of thinking and over-consuming risks making second-hand clothing lose all its eco-responsible meaning.

Finances

The purchase of second-hand clothing is influenced by **financial reasons**, and more particularly the income and the cost. Indeed, second-hand clothes allow consumers to go shopping with restricted resources (Baker, 2011). They have the possibility to find deals and therefore buy a piece of clothes for a lower price or a fair price. According to an *eBay UK* poll, the top three motivations for buying used goods are to "*get a better deal or discover a bargain"* (32%), *"cut back on spending"*, and *"the rise of the cost of living"* (both 31%) (Dennis, 2022b). Therefore, the price advantage incentivises consumers to buy second-hand clothes (Tóta, 2015).

What we have been able to understand about consumer behaviour is that second-hand constantly plays a **traditional role as a financial variable/adjustment**. Since it is cheaper, consumers buy. And since they understand that it can become a new financial source, they sell. Hence, consumers today see clothing as an investment resource. The mechanism of the C2C market is therefore well established, and this mechanism seems to have arrived to last, especially on the platforms (Cohen et al., 2022c)

Obstacles

A survey led by *eBay UK* discovered that there are **still challenges to the widespread use** of second-hand goods. The top reasons for avoiding used products are worries about sanitation (51%), the safety of second-hand products (35%), quality difficulties (28%) and fraudulent or inauthentic goods (27%) (Dennis, 2022b).

Another obstacle to second-hand clothing on platforms is **fitting**. The industry is therefore developing more and more techniques to counter this, particularly through the measurement of clothes and very precise descriptions of the pieces on the platforms (e.g. *Sizekick*). This could lead to a renewed interest in social shops and thrift shops (Cohen et al., 2022c).

The last obstacle in the appropriation of second-hand by consumers remains the deep reflection of the **relationship of consumers to their clothes**, which, according to the survey of the *Chaire Tex&Care*, describes that 38% of French people would rather choose a new branded garment well discounted in an outlet, than a second-hand piece (Cohen et al., 2022c).

IV. Digital platforms: Disruptors for the booming economy of second-hand

Digital platforms and technology are two major contributors to **the exponential growth** of the second-hand market. Numbers state that 70% of US consumers believe that second-hand shopping is more accessible due to technology and digital platforms (thredUP, 2022).

The trend of second-hand shopping is global and is forecasted to continue as 95% of sales are expected to be online by 2030 in developed markets. The entire fashion sector is impacted by online sales, which often have a critical and dominant size (Cohen et al., 2022c).

A. Three types of platforms

We distinguish three types of platforms for second-hand online sales (Cohen et al., 2022c).

Firstly, the **C2C intermediation.** This consists of putting consumers in contact with each other, by offering services that are increasingly developed around this intermediation. A key element is the security of payments, communication tools, merchandising tools, etc. Well-known players of this type are *Vinted, Facebook Marketplace*, or *Vestiaire Collective* which will be developed further down (cf. infra Smaller Relevant Players p.28).

The second model is **C2B2C centralisation**. It is a model inspired by *ThredUP* in the US, where clothes are collected from individuals, sorted and resold.

Finally, **B2B2C solution platforms**, bring together independent second-hand stores and offer them visibility to a community of potential shoppers. This concerns not only second-hand but also upcycling and other services.

One observation can be made about these online business models: their strength lies essentially in services and in the provision of technological services. Their business is not directly related to fashion, but is to work on promotional tools, advice, online products, etc. (Cohen et al., 2022c).

B. Focus on the Most Important Player: Vinted

Vinted is a C2C e-commerce network where people can buy, sell, or trade previously used, pre-loved clothing and other accessories for fashion. It seeks to hasten the shift from the take-make-waste fashion economy to one that is circular (Dwivedi, 2022).

History of *Vinted*

Vinted is a Lithuanian company founded in **2008** by Milda Mitkute and Justas Janauskas, with the aim of developing a website where people could sell clothes they no longer wanted to other people (Théot, 2020) !

The website was originally made available **in Lithuania**, then quickly reached Germany and the Czech Republic. Mantas Mikuckas, a business angel who invested in *Vinted* in 2011 and is currently the COO, later discovered the company. From that point forward, *Vinted* hired staff and worked on their social media and marketing tactics. The business raised €5.2 million in 2013 and expanded into new areas (Théot, 2020). Between 2013 and 2018, the company raised a total of $100 million from investors, demonstrating the interest of investors in this novel sort of business strategy (Vinted, 2023b). The business has offices in Berlin, Warsaw, and Prague in addition to its headquarters in Vilnius. Since *Vinted* was founded, the company's purpose has never changed : *"Sell what you don't wear or hunt for unusual items"* (Vinted, 2023a).

Vinted's Success

In less than ten years, *Vinted* has taken an almost hegemonic place in the second-hand fashion market. This phenomenon can be explained by the fact that there was a presence of consumers who were eager to buy and resell clothes among themselves, and they found the opportunity to do so easily through *Vinted* (Cohen et al., 2022c).

Vinted is now present in 16 countries, has a community of 75,000,000 members, and a **business volume of 1.3 billion euros**. France alone accounts for half of *Vinted*'s global activity. *Accel, Insight Partners, Burda Principal Investments, Sprints Capital, Lightspeed Venture Partners,* and *EQT* are the company's principal investors. It has raised $562.3M in six fundraising rounds (Dwivedi, 2022). By putting consumers in touch with each other, putting

their products into circulation, and offering secure transaction options, second-hand clothing has become central to the consumption of clothing by individuals in a way that is both lucrative and fun (Cohen et al., 2022c).

Vinted's Business Model

Vinted's business model depends on two elements to be successful: the platform's **mass clothing alternatives** and its capacity for **safe and quick transactions**.

Vinted's business model is based on a **circular economy**. This business model is undoubtedly one of the key factors of its success since before the adoption of this model in 2016 this company was not even profitable. In 2017, Thomas Plantenga became a consultant for the business before taking over as CEO. He looked at the costs of the company, closed several offices, reduced the workforce from 250 to 150, and looked at the marketing plan with a concentration on television and social media (Théot, 2020).

However, the game-changing development occurred when *Vinted* decided to stop charging sellers a **commission** so they could use their platform for free. Buyers are still required to pay a €0.70 "*Buyer Protection Service Fee*" and a five percent commission on the purchase price in the interim. *Vinted*'s second major source of income is from sellers who pay to have their closets advertised (Tsagliotis, 2019).

By making *Vinted* free to use, the new business model made it easier to draw in **new merchants.** For a variety of reasons, it's crucial to draw in new merchants. The size of the garment assortment increases with the number of sellers *Vinted* has. A wide range of products make it easier to draw in and keep customers. The second advantage of having a large seller base is that when they have sold their own clothing, they are more likely to purchase clothing on *Vinted.* Thirdly, *Vinted* will encourage its vendors to sign up for premium options (i.e. wardrobe spotlight, item bumps, ads) as it expands to a large number of merchants who may offer the same type of clothing (Théot, 2020).

Vinted's prospects for the future are **promising**. In 2020, the company purchased *United Wardrobe*, the largest second-hand market in the Netherlands, and in 2019, *Chicfy. Vinted* has expanded into international markets through *United Wardrobe*, and by acquiring *Chicfy,*

Vinted has lessened competition in Spain. *Vinted* will soon start providing services like buying and selling for selected charity. *Vinted* is poised to have a greater and more positive influence because to the investors' strong support, the company's engaged leadership, and customers' growing awareness of sustainability and affordability (Dwivedi, 2022).

C. Smaller Relevant Players

Vinted is far from being the only actor on the C2C e-commerce second-hand market. Load of other players exist, such as:

- ***Realreal*** **:** a US e-commerce company that promotes a circular economy by selling pre-owned premium fashion products, including clothing, jewellery, watches, furniture, and art. The platform aspires to be carbon neutral by 2021 (Lombard Odier, 2021).
- ***Vestiaire Collective*** **:** a fashion startup that has more than nine million members across dozens of nations, which offers an online marketplace for pre-owned clothing from high-end fashion labels in France. *Vestiaire Collective* goes further than the usual online marketplaces by adding to its business model a quality control and authentication tool for high-end/luxury items in order to avoid counterfeiting (Vestiaire Collective, n.d.).
- ***eBay*** **& its partners :** *eBay* was first introduced in 1995 as a marketplace for trading collectables and difficult-to-find goods. Today, *eBay* serves as a global marketplace where people and companies may buy and sell almost anything. *eBay* collaborates with several startups such as *Reskinned* and *ACS* to improve the fashion second-hand offer on its platform (Dennis, 2022a, 2022b; eBay, n.d.).

D. What can explain the disruption of platforms?

E-commerce & social media

Due to the **growth of social media and e-commerce** over the past ten years, the fashion industry has undergone significant upheaval. First of all, social media has become the primary platform for marketing and for cultivating client relationships. Besides, online shopping has made it possible for customers to order goods from about anywhere and have them delivered right to their door (Pun, 2022).

On top of that, **live shopping** has become a new trend. With this unique method of marketing, companies sell and advertise goods while simultaneously interacting live with customers. A standalone marketplace based on the idea of live shopping is being developed, and live shopping firms are enabling brands to fuel their live shopping platforms. Additionally, major tech firms like *YouTube, Facebook,* and *Google* are showing interest in live shopping (Pun, 2022).

V. Environmental Textile and Clothing Legislation

As mentioned earlier, the textile industry is known for its many negative externalities, which makes this industry a key area for a sustainable transition (European Commission, 2019). To operate this transition, **governance** is necessary. In the context of the textile industry, regulations are complex to implement because the textile supply chain typically involves different actors. Indeed, each stage of the garment supply chain may involve different actors from different countries (Cai, 2022). As a result, the governance landscape is complex given the different regulations in place in each country. Therefore, it is the role of the governments and regulators to create regulations which will generate the most widespread change, as it seems that self-regulation is not a possibility in this industry. Self-regulation is defined as *"a regulatory process by which an industry-level organisation, as opposed to a government or corporate-level organisation, establishes and enforces rules and standards for the conduct of business in the industry*" (Gupta & Lad, 1983). As a matter of fact, the pressure of climate-conscious consumption has already pushed some fashion brands to make some efforts for the environment (Regaudie, 2022). However, there is a risk that these players are greenwashing rather than making real efforts to significantly reduce their environmental impact (Kent, 2022b).

In short, regulations are needed to force large corporations to reduce their negative impact on the environment. These need to be cross-border regulations at the national and international level to combat conflict mechanisms between the different actors of the supply chain (Beyers et al., 2023). Few regulators have begun to intervene by publishing legislation such as the *AGEC law* or the *Fashion Act.* The purpose of this chapter is to explain the few existing climate regulations in the fashion industry.

A. Laws in France and Belgium

In our neighbouring country, France, two regulations will have an impact on the transition of companies in the textile industry in France.

The first is the introduction of the ***Duty of Vigilance*** which was adopted in 2017 in France and targets large companies to prevent environmental, social and governance risks in their

operations. This extends to the activities of their subsidiaries and business partners, subcontractors and suppliers. This means that any company that employs at least 5,000 people in France or more than 10,000 people in France with headquarters outside of France must publish a due diligence plan to prevent environmental, human rights and corruption risks (LOI n° 2017-399 du 27 mars 2017 relative au devoir de vigilance des sociétés mères et des entreprises donneuses d'ordre (1), 2017).

The second regulation is the ***AGEC law***, adopted in France since February 10, 2020, which aims to fight against waste. For the textile industry, it has three repercussions: firstly, the obligation to better inform the consumer about the ecological footprint of products. Secondly, a ban on landfilling and incineration of non-food products has been implemented, meaning that companies must now donate or recycle their unsold products. Finally, the third interesting point of the *AGEC law* is the transformation of the *"polluter-pays"* system. Before, manufacturers were obliged to finance the management of their waste through their contributions to an eco-organisation called "*FASHION*", but they had no objective of results. Today, these financial contributions will have to be modulated from 2023 with a bonus system depending on the environmental performance of the products (LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire (1), 2020).

Recently, Belgium passed a law that also has an impact on companies in the textile industry.

In fact, an ***Arrêté Royal*** was published recently in the Kingdom on single-use products and the promotion of reusable products. This law aims to prevent and reduce the impact of certain single-use products on the environment as well as to promote reusable products. In addition, it puts an emphasis on the transition to a circular economy with innovative and sustainable business models, products and materials (Service Public Fédéral Santé Publique, 2021). For example, in this *Arrêté*, there is a strong focus on creating a circular use of packaging in general and in particular, plastic bags (VBO FEB, 2022).

B. The Fashion Act: A Step in the Law in NYC

In the Big Apple, **a New York coalition's proposal for the *Fashion Act*** created a stir in January 2022. According to Cernansky (2022), *The Fashion Sustainability and Social Accountability Act* is the project of an innovative piece of legislation *"which aims to hold all major brands*

accountable for their environmental and social impacts". The Act aims to put a stop to fashion's harmful effects on the environment and global exploitation of garment factory employees by setting a standard for the industry's environmental and social policies. To ensure compliance with the *Fashion Sustainability* and *Social Accountability* Act (Wilson, 2022), fashion companies conducting business in New York and generating over $100 million in revenue must map at least 50% of their supply chains and disclose key metrics such as greenhouse gas emissions, water footprint, and chemical use. The measure does not specify which 50%, but it encourages brands to concentrate on the most dangerous social and environmental situations (Cernansky, 2022).

C. EU Regulations: Eco-design Rules

On our side of the world, things are progressing. The EU wrote the first draft of its ***"Circular Economy Action Plan"*** in 2015 with the intention of reducing Europe's ecological footprint on the world's natural resources (European Commission, 2020). Since then, development has occurred. According to Rankin (2022), the *European Commission* has declared a significant expansion of eco-design guidelines that may one day apply to all products, starting with textiles, and has called for the end of fast fashion by 2030. In the future, durability and recyclability will be covered by the EU eco-design regulations, which now specify energy efficiency standards for a variety of consumer items. Manufacturers, for instance, can be required to incorporate a specific percentage of recycled material into their products or limit the use of elements that make products difficult to recycle.

Furthermore, the EU executive wants big businesses to reveal how much **unsold inventory** they dump as part of a comprehensive campaign to combat a culture of waste. In the future, the commission might potentially outlaw the practice of disposing unsold goods in landfills (*AGEC law* in France), though representatives indicated they require more data on the issue.

In addition to this action plan, the EU has also started additional programs, like the **grant offered by the *European Innovation Council***, which firms like *Resortecs* are currently receiving (Ohr, 2022). Besides, the *"ERA Industrial Technology Roadmap for Circular Technologies and Business Models in the Textile, Construction, and Energy-Intensive Industries"* was released by the EU on January 23, 2023. It lists 92 circular technologies that cover every stage of a

material's and product's life cycle. It outlines the steps to take to create and use these technologies, which can lessen the negative effects that these industries have on the environment and the climate (Directorate-General for Research and Innovation (European Commission), 2023).

VI. Environmental Impact Textile Industry

The textile industry is known for its **huge environmental impact**: it exploits resources, pollutes the environment, and generates waste. This is the result of the large-scale production and overconsumption of this industry (Machado et al., 2019). In terms of number, the production of the global textile amounts to more than 150 billion items of clothing per year (Fashion United, 2023).

According to the *European Environment Agency* (2020) and *The Eco Experts*, the fashion industry is the fourth most environmentally damaging industry, and one of the seven most polluting ones (Howell, 2022). A 2018 study found that more than 3.3 billion tons of greenhouse gases are emitted across the value chain annually. To put this figure in perspective, we would have emitted 36.3 billion tons of CO_2 in 2021. This means that the global clothing and footwear industries accounted for between six and nine percent of greenhouse gas emissions (Quantis, 2018). Nowadays, fashion accounts for up to ten percent of global carbon dioxide emissions (Dottle & Gu, 2022). This is equivalent, according to the Ellen MacArthur Foundation (2017), to all international flights and shipping combined.

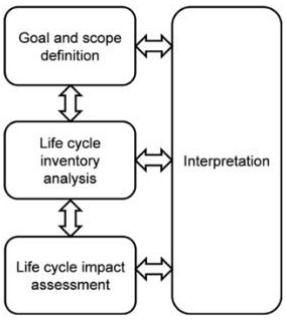
Luckily, collaborative consumption models such as **second-hand clothing** are seen as a solution to reduce the environmental impact of the textile industry (Roos et al., 2015). To understand better the avoided environmental impact of second-hand clothing, we will first outline in the following sections the methodology used to assess the environmental impact, the impact categories, and the environmental impact of a garment from cradle to grave without being reused. Then, the environmental benefits of second-hand will be explained.

A. Methodology

To accurately assess the environmental burden of clothing, most of the studies use the **Life Cycle Assessment (LCA) method** (Zamani et al., 2017). This commonly used methodology studies and quantifies a range of different environmental impacts of a product from a life cycle perspective. Basically, an LCA considers all the energy and material flows that impact the environment across the system boundaries, from manufacturing to use and disposal which is called from cradle to grave (Sandin et al., 2019). A characterisation method is used to assign

environmental impacts to each of these flows. LCA provides a holistic view of the product's environmental performance and identifies high environmental impact stages in the product's life cycle (Sandin et al., 2019). The range of impact categories assessed in the LCA differs from one study to another. The LCA process is divided in **four interdependent steps** that are detailed hereunder on Figure 5 (Sandin et al., 2019).

Figure 5: Illustration of the four steps of LCA



Note. Adapted from *Environmental assessment of Swedish clothing consumption – six garments, sustainable future*, by Sandin, G., Roos, S., Spak, B., Zamani, B., & Peters, G. (2019). https://doi.org/10.1016/j.jclepro.2018.02.266 Copyright 2019. Adapted with permission.

Defining the purpose and scope is the first step. It consists of defining the objective of the assessment, the functional unit, and the life cycle of the product. This also includes the boundaries of the product system and the environment. A product system can be defined as *" [the] collection of unit processes with elementary and product flows, performing one or more defined functions, and which models the life cycle of a product"* (Kuczenski et al., 2018). The functional unit can be defined as the quantitative unit representing the function of the product (Sandin et al., 2019). For example, a functional unit can be the average second-hand item of apparel (Babel et al., 2019).

The second step of the LCA is the **life cycle inventory (LCI) analysis.** In this step, all environmentally relevant materials and energy which flow between product system processes are detailed and quantified in terms of functional unit (Sandin et al., 2019).

Then the **life cycle impact assessment** takes place. Using impact methods, the LCI data is converted into potential environmental impact in the different impact categories (Sandin et al., 2019).

The final step is to **interpret the results** considering system limitations, data gaps and uncertainties and to make recommendations (Sandin et al., 2019).

B. Impact categories

To examine the environmental impacts of a process, there is a **wide range of environmental impact categories**. In the case of the apparel sector, some impact categories are more relevant than others (Roos et al., 2015; Zamani et al., 2017). The most relevant ones are elaborated in the following paragraphs, with particular emphasis on the first two, which are the most crucial.

First, **climate change** represents the increase in the temperature of the atmosphere and oceans due to emissions of greenhouse gases, methane, nitrous oxide, and chlorofluorocarbons (Bodin, 2016). These emissions are caused by humans burning fossil fuels or cutting down trees. To measure the climate change, various studies used the **Global Warming Potential** (GWP) with a perspective of 100 years which is measured in **kilograms of CO_2** equivalent (kg of CO_2e) (Sandin et al., 2019). The GWP describes the relative power of a greenhouse gas expressed on a molecule-by-molecule basis, taking into account the length of time it remains active in the atmosphere (Eurostat, 2014). The CO_2 equivalent (CO_2e) measure converts all greenhouse gases into an equivalent amount of carbon dioxide with the same global warming potential (Eurostat, 2017).

Second, the **water scarcity** impact category describes water consumption. Currently, water scarcity is a growing concern due to the extreme water consumption by human industries and agriculture in our world and especially in developing countries where most textile fibres are manufactured (Bodin, 2016). Indeed, these countries are already short of water and produce fibres like cotton which is a plant that requires huge amounts of water. This can have disastrous consequences on humans but also on ecosystems, forests, animals, and rivers. Water scarcity is measured in **kilograms of water** used (Sandin et al., 2019).

Third, **primary energy** is considered for **both renewable and non-renewable sources** to measure and gain insight into energy use and efficiency throughout the life of the garment (Bodin, 2016). This impact category allows us to assess the allocation of energy resources between current needs but also potentially identify parts of the value chain where greater

energy efficiency is needed (Sandin et al., 2019). Primary energy is measured in **Megajoules** (MJ) (Babel et al., 2019).

In addition, the **land occupation** measures the utilisation of the land. In the case of overuse, multiple consequences can happen such as biodiversity loss, water availability, erosion, or loss of fertile topsoil (Roos et al., 2015). To measure the land use, a soil quality index (SQI) is used. This index is based on the aggregation of four consequences of land use: the **biotic production loss** (measured in kilograms), **erosion potential** (measured in kilograms), **groundwater regeneration reduction** (measured in m^3), and **infiltration reduction** (measured in m^3) (Sandin et al., 2019).

The **toxicity** impact is the next category. It can be divided into **human toxicity and freshwater ecotoxicity**, describing the use and emissions of toxic chemicals. These can have a negative impact on human health, the air, and the water. Different methods exist to assess the toxicity of contaminated water (Roos et al., 2015). Currently, the method covering the most substances is named *UseTox* (Fantke et al., 2017; Rosenbaum et al., 2008). However, many textile chemicals and their breakdown products are still unresearched and missing in this method. The human toxicity is expressed in **comparative toxic units for humans** (CTUh) per kilograms of emissions and the freshwater ecotoxicity is expressed in **comparative toxic units for ecotoxicity** (CTUe) per kilograms of emissions (Golsteijn, 2014; Roos et al., 2015).

Finally, **freshwater eutrophication** and **acidification** are impact categories that are sometimes also used to assess environmental impact (Zamani et al., 2017). The freshwater eutrophication represents a phenomenon where the high concentration of phosphates and nitrates in the water causes the growth of algae consuming oxygen and affecting the biotopes. The freshwater eutrophication potential is expressed in **kilograms phosphorous equivalents** (Roos et al., 2015). The acidification is a process where acidic substances are delivered in the atmosphere and can be subject to chemical transformation, which can severely impact the ecosystem due to the changes in the chemical disposition of the environment (soil and/or water) (Bodin, 2016). This impact is measured by the **mole of hydrogen ions** (H+) (Roos et al., 2015) released in the environment. As acidification is well correlated to the climate change impact, some of the studies excluded it (Sandin et al., 2019).

C. Life cycle impact of clothes

Throughout its life cycle, the garment goes through different stages (cf. supra A brief overview of the textile supply chain: a historic linear Business Model p.6). It starts with the extraction of raw materials, then the product goes through other processes such as manufacturing, distribution, and use before ending its life at the disposal stage. **Each step** of the process has **impacts on the environment** (Muthu, 2020). According to Allwood et al. (2006), the main ones faced by the textile industry are greenhouse gas emissions, water use, toxic chemicals, and waste. These are going to be exposed in the following paragraphs.

Fibre's Production Impact

In the textile industry, mainly **two types of fibres** are produced to fabricate clothes. These can be either synthetic fibres such as polyester, polyamide, and elastane or natural fibres such as cotton, wool, linen, and hemp (Muthu, 2020; Sandin & Peters, 2018).

Around 63% of clothes are made of **synthetic fibres**. This type of fibre is obtained from petrochemicals, which are known to huge climate impact as it delivers **huge amount of CO_2** in the atmosphere (Sandin & Peters, 2018). Besides that, petrochemicals are also responsible for other **environmental hazards** (toxicity impact) such as water pollution, negative effect on humans' health, loss of biodiversity or destruction of ecosystems (Sharma et al., 2017).

The remaining (37%) clothes are composed mainly of **cotton** (Sandin & Peters, 2018). These plants are known to be very thirsty as an average of 3,644,000 kg of water is needed per ton of cotton produced (Aldaya et al., 2011). Therefore, cotton production generates **water scarcity** (Muthu, 2020). In addition, in 70% of cases, cotton is grown in areas where water is scarce, causing some populations to give up more than 50% of their available water to produce it (Loh & Wackernagel, n.d.). Last, cotton production requires an intensive use of pesticides and fertilisers, which deteriorate soil quality and therefore has a **land use impact** (Dahlbo et al., 2016). More than 1900 chemicals were identified to be utilised during the clothes production by the *Swedish Chemical Agency*. Among these, 165 are considered as **toxic** to health and environment (Dahlbo et al., 2016; Sandin & Peters, 2018).

Spinning, Weaving, and Knitting Impact

Further down in the production process, the **spinning of yarns and the weaving and knitting of fabrics** are most often occurring in the Asian countries and more particularly in China, India, and Bangladesh. These countries use **energy-intensive processes** which consume huge amounts of crude oil. As a result of this step of production, there are a **lot of particles and CO_2** emitted in the air (Cohen et al., 2022a).

Wet Processing Impact

Wet processing, i.e. **dyeing and finishing**, also has an important environmental burden. Indeed, for one kilogram of finished textiles, about one kilogram of **chemicals** and auxiliaries are used ; such as dioxins and heavy metals (which are carcinogenic) but also salts, detergents and organic acids (Muthu, 2020). In addition, these processes consume a **considerable amount of water**, which amounts to about 200 litres per kilogram of textile. After being used, the water turns into waste containing a range of chemicals (Parvathi et al., 2009). This leads to significant sources of **toxic emissions** and every year rivers and seas receive about 40-50,000 tons of dye. Therefore, it generates 20% of the water pollution in the world and this is very harmful to people and wildlife if the water is not properly treated before discharge (Igini, 2022; Mukherjee, 2015; Parvathi et al., 2009; Roos et al., 2015). Finally, these processes are responsible for three percent of global **CO_2 emissions** (Igini, 2022).

Use Impact

The use of clothing (**washing, drying**, etc.) also accounts for a large portion of **GHG emissions** (Cohen et al., 2022a). In addition, in recent years, we have seen the **release of microfibres** from clothing during washing, which pollutes both waterways and, of course, the various oceans (Thomas, 2020).

End-of-Life Impact

With the ever-changing trends in fast fashion, a lot of clothing is going into the **waste stream**. In fact, all the unsold pieces of fast fashion brands are thrown away in addition to all the clothing discarded by consumers to the waste pile (Jin Gam et al., 2011; Linden, 2016). According to the Guardian (2019), 87% of total discarded clothing is either **landfilled or**

incinerated (Moazzem et al., 2021). The remaining clothes are either **recycled** or **donated** to third-world countries (Farrant et al., 2010).

In the case of **landfilling**, clothing made from non-decomposable materials can remain in disposal areas for up to 200 years before disappearing (Brewer, 2019; Drew et al., 2021). This causes serious environmental and health problems as it generates emissions of contaminants to the air and groundwater (Sandin et al., 2019). As a result, microplastic and microtextile waste ends up in the oceans, while methane is generated by the landfill of natural fibres (Moazzem et al., 2021).

Incineration of clothing avoids the problems generated by landfilling. This technique (incineration) generates heat and electricity and therefore avoids the production of these by-products (heat and electricity). However, it also has drawbacks as it results in petrochemical CO_2 emissions (Roos et al., 2015). In addition to this, it also destroys many valuable materials and resources that could be recycled and would replace the production of raw materials (Sandin et al., 2019).

Textile recycling is a very complex and restrictive process, as only certain textiles are suitable for recycling. Currently, only one percent of clothing is recycled in a closed loop (Cohen et al., 2022a). More and more technologies are being developed by companies to improve the recycling of clothing (e.g. *Resortecs*). It is essentially the reprocessing of a used textile into a new product. In general, recycling is composed of mechanical, chemical, and thermal processes (Bodin, 2016). To separate the molecules and create new fibres, polyester textiles are depolymerised, and cotton is dissolved. All these processes require energy and resources and therefore have an environmental impact (Sandin & Peters, 2018).

Last, **third-world countries donations** are far from being a solution for our planet. Although citizens think they are doing a good deed by depositing unwanted clothes in the collection bins, the quality of these clothes has deteriorated to such an extent that even poor countries (especially Ghana) no longer want them and the clothes end up in open dumps and then in the oceans (Clément, 2023) .

Limitations

All impacts explained above are mitigated by the fact that the environmental impact varies for **each type of garment** along the value chain. It depends on the **mix and specifics of the fibres**, the associated production, use and disposal. Indeed, according to Van der Velden et al. (2014), the environmental burden of clothing does not only depend on the **base materials** (cotton, synthetic) but also on the **thickness of the yarn** and the **textile fabric**. In addition, the environmental impact depends on other elements than product characteristics. In fact, the **behaviour of the consumer** in both the acquisition and the disposal of the clothes is crucial and has an influence on the final environmental impact of the piece (Dahlbo et al., 2016; Laitala et al., 2015). Basically, the way a user is going to take care of his/her clothes (washing, drying, ironing) is a variable to take into account when assessing the environmental impact (Dahlbo et al., 2016; Fletcher, 2012).

VII. Environmental Impact of Second-hand Clothes

In the previous chapter, we have developed the second-hand clothing industry (cf. supra A New Industry: The Second-hand Market p.18), which is expected to bring some environmental benefit compared to the environmental impact of traditional fashion linear model (Farrant et al., 2010). To better understand this, we will first investigate the variables that influence the environmental benefits of second-hand clothing. Next, we will expose the results found in the literature regarding the environmental benefit of second-hand clothing (cf. infra Environmental benefits of second-hand clothes p.42).

A. Variables influencing the environmental benefit of second-hand clothes

Replacement rate

As explained before, second-hand clothes are seen as a means to reduce the production of virgin textile fibres and therefore, reduce the use of water, energy, and chemicals during the production chain (Dahlbo et al., 2016). However, **second-hand clothes differ from new clothes** in terms of characteristics (price, style, etc.) but also in the way consumers perceive them. Thus, one cannot consider that each purchase of second-hand clothes prevents the purchase of one's new clothes. Therefore, the **concept of replacement rate** had to be introduced. The **replacement rate** reflects the frequency with which new clothing is replaced by second-hand clothing (Nørup et al., 2019). This, therefore, determines to some extent the number of virgin materials and waste avoided through clothing reuse (Woolridge et al., 2006).

A **high replacement rate** reflects the situation when a buyer replaces a new item with a second-hand item. This buyer would have purchased a similar item new if he or she had not found it in second-hand.

On the opposite, a **low replacement rate** is attributed in the situations when a second-hand item does not replace a new item. For example, a situation when the buyer buys additional items in second-hand that he/she would not have bought new (Stevenson & Gmitrowicz, 2012).

As there is little data on the replacement rate of second-hand clothing, most authors **assume a one for one** replacement rate, which is not realistic (Sandin & Peters, 2018). Indeed, a replacement rate of one for one suggests that second-hand clothing will be reused by the new owner as many times as the owner would have used a new item (Sandin & Peters, 2018). Determining the exact replacement rate for an entire population is very complex as it depends on a multitude of factors such as the behaviour of individuals or their demand for second-hand textiles (Dahlbo et al., 2016; Nørup et al., 2019). Some authors such as Farrant et al. (2010) and Stevenson & Gmitrowicz (2012) have attempted to estimate the replacement rate through investigative studies (Nørup et al., 2019; Sandin & Peters, 2018).

On one hand, Farrant et al. (2010) investigated the replacement rate for textiles based on a questionnaire survey answered by 200 people in Sweden and Estonia and Africa. They developed an approach based on the profile of the different respondents to calculate a quantitative approximation of the replacement of new clothes allowed by the purchase of second-hand clothes. Based on that, they were able to conclude that the purchase of 100 second-hand clothes replaces the production of between 60 and 85 new items. This represents a **replacement rate of 60 to 85%** (Farrant et al., 2010).

On the other hand, Stevenson & Gmitrowicz (2012) estimated the replacement rate (not only for textiles but also for other types of materials such as furniture) by considering a wide range of variables. To determine the rate, they varied variables such as age, income, reason for purchase, or priority material flow. Overall, the average replacement rate for on-street venue purchase of clothing is **27%**, meaning that the purchase of 100 second-hand clothes replaces the productions of 27 new items. This figure is half of the replacement rate estimated by *WRAP*'s online survey for online purchasing channels (54%). However, it is important to keep in mind that these figures are not only for textile materials (Stevenson & Gmitrowicz, 2012).

To evaluate the environmental benefits of second-hand clothes, the replacement rate is an essential variable to include in the calculations (Nørup et al., 2019). Indeed, it has been shown that the choice of **replacement rate considerably influences** the resulting environmental impact (Sandin & Peters, 2018). In short, the newer clothes are replaced by pre-owned clothes, the higher the replacement rate and therefore the greater the environmental benefit (Nørup et al., 2019).

Several publications have evaluated the extent to which replacement rates with different values affect environmental impact. Indeed, Dahlbo et al. (2016) deducted that even replacement rates of 50% still induced environment benefit for textile reuse. Furthermore, Schmidt et al. (2016) concluded that it was still environmentally beneficial for replacement rates as low as 10% (Nørup et al., 2019; Sandin & Peters, 2018).

Furthermore, it has been shown that when the replacement rate is reduced from 100% to 50%, the **avoided impact** contributed by second-hand clothing is halved for climate change, slightly more than halved for energy, and halved for water consumption. Thus, halving the replacement rate can be said to also halve the avoided impact of second-hand clothing on average (Babel et al., 2019).

It should be noted that a **low replacement rate** for second-hand textiles may, under **certain conditions**, be **less beneficial** to the environment than recycling and incineration. This is because when replacement is too low, the prevented production of new products is small and thus too small to offset the negative impact generated by factors induced by the clothes reuse such as transportation (Fortuna & Diyamandoglu, 2017; Sandin & Peters, 2018) (cf. infra Rebound Effect p.50).

Overall, although the replacement rate estimated by Farrant et al. (2010) and Stevenson & Gmitrowicz (2012) seems to be the best option, Nørup et al. (2019) have shown in their studies that a real examination of the replacement rate is needed in countries where one is trying to understand the impact of second-hand textiles. This is because the replacement rate varies based on the characteristics of the population (Nørup et al., 2019). On top of that, the replacement rate seems to depend on the type of fibres, products, and materials. Deeper research and studies are needed to be able to assess more precisely the environmental impact of clothes reuse and recycling (Sandin & Peters, 2018).

Life Span Left

We mentioned above that extending the life of clothing through second-hand helps to mitigate environmental impact. However, it is **more complex** than that, as the mitigation of the avoided impact depends on the remaining life span of the reused clothing pieces. Hence,

the **life span is a crucial variable** to consider when assessing the **environmental impact** of second-hand clothing.

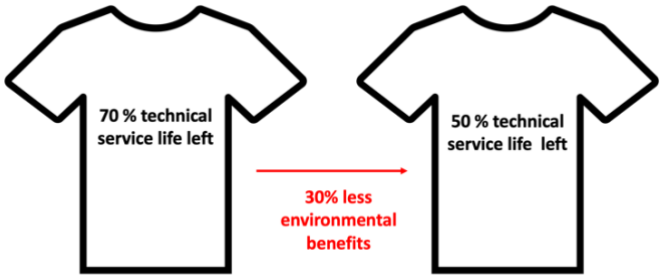
As a starting point, it is important to define the notion of clothing life span. It can be measured by the number of times a piece is worn (Klepp et al., 2020). More precisely, clothing life span can be divided into two categories: the **practical service life** and the **technical service life**. The **practical service life** describes the number of times clothes are worn/used by the user(s). The **technical service life** represents the amount of wear clothes functions, which means the number of times it can be worn before being damaged, having holes, etc. (Zamani et al., 2017).

Since the year 2000, the fashion industry has experienced an impressive growth in clothing sales but also a strong decline in the use of clothing (Mulhern, 2022). Currently, the practical life of clothing is shorter, falling well below its technical/service life. This is the result of the fast fashion, characterised by its rapidly changing trend. As a consequence, users increasingly find themselves no longer wearing their clothes due to their outdated fashion status (Klepp et al., 2020; Zamani et al., 2017).

When these garments are reworn by second users, the practical life and the way they were cared for by the first user influence how long the second user will be able to wear them, depending on the technical life of the garment (Zamani et al., 2017). Therefore, the **previous practical service life** and therefore the **technical service life left** of clothes have **an impact on the replacement rate** and thus on the **environmental benefit** generated by the reuse of clothing (Farrant et al., 2010; Klepp et al., 2020). In fact, Babel et al. (2019) evaluated to which extent the technical service life left of clothes being reused influences the avoided impact generated by second-hand clothing. Actually, they have shown that the avoided impact induced by second-hand clothing decreases significantly as the remaining technical service life decreases. Indeed, going from 70% of the remaining technical life to 50% reduces the avoided impact generated by a second-hand garment by one third for the global warming potential. For energy, it is also reduced by a third and for blue water, the avoided impact decreases by a little less than a third (Babel et al., 2019).

Therefore, the sale of second-hand clothes with 70% of their technical service life left induces an environmental benefit of about 30% more than second-hand clothes with 50% of their technical service life left (see Figure 6) (Babel et al., 2019).

Figure 6 - Reduction of Environmental Benefits



Note. Clotuche, L. Hanon, C. (2023). Based on *Comparative Life Cycle Assessment (LCA) of second-hand clothing vs new clothing,* by Babel, N., Toma, A. & Sivanandan, A. (2019). https://cf-assets-tup.thredup.com/about/pwa/thredUP-Clothing-Lifecycle-Study.pdf

Various factors influence the technical service life left of clothing after the first use, such as how the first user cared for the clothing. Washing-related problems, such as stains, odours, shrinkage, or colour changes reduce the practical life of clothing. It seems clear, therefore, that the remaining technical life when clothes are reused is different in each case, as it depends on the **consumer's behaviour** during the **use phase**. This aspect remains understudied. Authors usually make assumptions about the remaining technical life (Sohn et al., 2021). For example, when evaluating the environmental benefit of second-hand clothing, Babel et al. (2019) assumed a remaining technical life of 70%. This assumption agrees with Farrant et al. (2010) who claim that second-hand clothing generally still has a significant technical life. To extend the technical service lifetime of clothes, different options are possible such as increasing product quality but also communicating to consumers about the expected lifetime and ensuring higher product satisfaction (Laitala et al., 2015; Niinimäki & Hassi, 2011).

B. Environmental benefits of second-hand clothes

Different studies have examined the environmental impact generated by second-hand clothing. Among these Babel et al. (2019; Farrant et al. (2010) ; Gray et al. (2022); Klepp et al. (2020); Roos et al. (2015) and Woolridge et al. (2006) have quantified the environmental benefits of second-hand clothing. The following paragraphs detail the key findings and conclusions of their works.

According to Farrant et al. (2010), clothing reuse contributes significantly to **reducing the environmental burden** of clothing. This is because it diminishes the environmental impacts generated throughout the overall life cycle of the garment. Indeed, their study showed that the environmental impact generated by the collection, processing and transportation of second-hand clothing is **insignificant** compared to the savings achieved by reducing the amount of virgin clothing needed. Indeed, the benefits generated by the reuse exceed the overall impacts by about 25 times for T-shirts and about 20 times for pants (Farrant et al., 2010). By assuming a life span of 50 washes and a replacement rate of 100%, reusing 100 T-shirts instead of throwing them away reduces the global warming impact of their life cycle by 14%. The impact of acidification is reduced by 28% and 25% respectively (Farrant et al., 2010). In addition, a 24% savings in human toxicity in soil was estimated (Farrant et al., 2010). The reuse of 100 pants (made of 35% of cotton and 65% of polyester) induces greater savings in global warming impact (23%). In addition, acidification is reduced to the same extent as for T-shirts. The reduction of human toxicity in water and soil amounts to 45% and 30% respectively (Farrant et al., 2010). Overall, the savings generated by the reuse of polyester/cotton pants are on average higher than for T-shirts. This is because the impacts associated with the raw material and manufacturing stages are more significant (Farrant et al., 2010).

Similarly, a study by Babel et al. (2019) was conducted on the environmental benefits of choosing second-hand clothing as a counterfactual to purchasing similar new items. The results demonstrated substantial environmental savings in terms of global warming potential, primary energy demand, and blue water consumption when choosing second-hand clothing over new clothing. These results are based on the assumption that each piece of second-hand clothes replaces a brand new one and that each garment still has 70% of its useful life left (Babel et al., 2019). The **net environmental benefits** of purchasing one second-hand piece are: 7.9 kg of CO_2e of global warming potential, 122.5 MJ of primary energy demand and 292.9 litres of water. Based on the total number of second-hand clothes sold by the second-hand shop *ThredUP* in the United States in 2018, close to 100 million kg of CO_2e were avoided from being spread out in the environment, more than 3 million litres were conserved and over 1 billion MJ energy was saved (Babel et al., 2019). These figures consider the product systems of fabric manufacturing as well as the processing operations of *ThredUP* (Babel et al., 2019). Last, this study also showed the differences in avoided impact for each piece of clothing. For

instance, a second-hand dress avoids 8.4 kg of CO_2e, 61.3 MJ of energy and 91.9 litres of water, while active pants avoid 20.9 kg of CO_2e, 151 MJ of energy and 286 litres of water (Babel et al., 2019). Basically, this highlights the fact that each garment has a different production process (manufacturing, assembly, etc.) and that therefore, has a different avoided impact when reused as a second-hand garment (Babel et al., 2019). Overall, significant ecological savings in all three impact categories were made by replacing new clothes by second-hand ones (Babel et al., 2019).

In addition, Woolridge et al. (2006) showed that the **energy consumption** of retailing and distribution activities associated with second-hand clothes is much lower than the energy consumed to produce virgin materials. The study found that the entire process of reusing clothing, including retail, distribution, and donation, **consumes significantly less energy** than manufacturing clothing from virgin materials (Woolridge et al., 2006). Only one point eight percent of the energy required to manufacture clothing from virgin material is consumed by the reuse of one ton of polyester clothing. As for the reuse of a ton of cotton clothing, this consumes a little less than three percent of the energy required to manufacture these articles from virgin materials (Woolridge et al., 2006). On top of that, each kg of virgin cotton displaced by second-hand clothes conserved about 65 kilowatt-hours (kWh) and for each kg of polyester about 90 kWh is saved when considering the entire life cycle of clothes (Woolridge et al., 2006).

Also, Roos et al. (2015) and Sandin et al. (2019) evaluated the extent to which collaborative consumption can provide an environmental benefit in Sweden. To do so, they evaluated several scenarios with various parameters such as the **extension of the life span** of clothing through the collaborative consumption model, the type of consumer transportation (bus, walking, bicycle, car, etc.) as well as whether the collaborative model is **offline or online**. Different impact categories were evaluated such as climate change, energy use, water scarcity, acidification, freshwater eutrophication, ecotoxicity or human toxicity (Roos et al., 2015). The report of Sandin et al. (2019) updates the research of Roos et al. (2015). The conclusions of these studies were that **extending** the effective life of clothing before disposal (which is what second-hand does) is **effective** in reducing the impact on the environment (Sandin et al., 2019). In fact, increasing the use of clothing reduces the impact per use, except for the use phase (as laundry, drying, and ironing increase). In terms of numbers, using a

garment twice as long **reduces the impact on climate change** by 49%, the impact on energy consumption by 42% and the impact on water scarcity by 48% (Sandin et al., 2019). Therefore, as second-hand increases the life span of clothes, it effectively reduces all impact categories over almost the entire life cycle through increased usage (Roos et al., 2015).

On top of that, it seems that **online collaborative consumption** has more environmental benefits than offline. This is due to an additional transport impact of the consumer journey to the shops. Indeed, collection points are on average closer to consumers than the shops (one third of the distance) (Gray et al., 2022; Roos et al., 2015). On top of that, physical shops require heating, lighting, and a greater amount of space than online (Gray et al., 2022).

As mentioned above, the **collection, processing, and transportation** of second-hand clothing has an insignificant impact compared to the savings from reducing the amount of virgin clothing needed (Farrant et al., 2010). Nevertheless, it is important to detail the negative environmental impact of second-hand processing operations as it influences the net environmental impact of second-hand clothing detailed in the previous paragraphs. Collection, processing, and transportation have a negative environmental impact compared to clothing that has the same life span but has only one user (Klepp et al., 2020). In fact, the **means of transportation** used by consumers to retrieve clothing impacts the environmental benefits. Low-impact consumer transportation (100% bus, bike or walk) provides a significant environmental benefit compared to medium impact. In contrast, high impact transportation (100% car) results in an environmental loss compared to medium impact transportation. In addition, the **location of stores and pick-up points** is an important variable in estimating the environmental impact of collaborative consumption (Roos et al., 2015). On top of that, **sorting and additional laundry** also generate a negative environmental impact (Klepp et al., 2020).

In conclusion, all these studies allow concluding that second-hand garments generate net positive impact in different environmental categories. Indeed, they avoid the acquisition of new items while prolonging the life of existing clothes (Klepp et al., 2020). But also, because the process involved in implementing second-hand (collection, processing, etc.) have an insignificant impact compared to the savings generated. However, a rebound effect on the environmental impact can be generated in certain situations (Roos et al., 2015). We will

elaborate on this potential rebound effect in one of the following section (cf. infra Rebound Effect p.50).

C. Rebound Effect

In various studies, a question has often been raised regarding the potential for a **rebound effect or problem-shifting** that would negate the environmental gains generated by second-hand clothing. It reflects the situation where the impact of second-hand clothing (transport, processing, etc.) is greater than the savings generated by second-hand (avoidance of the production of a new product), which is resulting in a higher overall environmental impact (Van Loon et al., 2021).

A **rebound effect or problem shifting** defines the situation in which resource savings, as well as increased resource efficiency, do not lead to a decrease in resource consumption in macroeconomic terms, as they are overcompensated by increased resource use (Leismann et al., 2013).

First, a rebound effect can occur **between the phases** (e.g. production, use, etc.) of clothes life cycle (Drew et al., 2021; Zamani et al., 2017). Roos et al. (2015) and Zamani et al. (2017) have demonstrated that sometimes second-hand clothing can result in a more negative environmental impact than the linear model. Indeed, in some specific situations, the environmental gain from avoided production is offset by the amount and mode of transport and the increase in usage (Zamani et al., 2017). For example, a rebound effect is induced in a situation where a second-hand garment is purchased in a store (offline channel) and the means of transport used by the consumer has a high environmental impact (Zamani et al., 2017). In this specific situation, the rebound effect leads to a negative net environmental impact and, therefore, second-hand clothing is not beneficial for the environment. This demonstrates the importance of adopting a life cycle perspective when assessing environmental impact to account for this type of problem change between life cycle stages (Zamani et al., 2017). This type of rebound effect is usually created when the **replacement rate** of new clothes by second-hand clothes is **low**. In fact, second-hand clothes are considered as extras by some people and therefore they are bought in addition to the new product rather than replacing it (Drew et al., 2021). This reflects the fact that there is no deep questioning of

the consumer's relationship with clothing, and that society continues in a pattern of consumption, or even overconsumption, even with second-hand products. Young people, in particular, are in a logic of capitalisation and think about whether or not they will be able to resell a new product easily when they buy it (Cohen et al., 2022c; Paz, 2022).

Second, a rebound effect can also happen **between impact categories** (cf. supra Impact categories p.36). While climate change and energy consumption are the most commonly examined impact categories, other relevant environmental impact categories that also contribute to environmental gains or losses in textile supply chains are sometimes not overlooked (Sandin & Peters, 2018). This limited focus can lead to a displacement of problems, such as reducing climate change while increasing other environmental impacts like land transformation and toxicity. To avoid this, a broader set of relevant environmental impact categories should be considered. For example, the studies by Allwood et al. (2006); Beton et al. (2014) and Roos et al. (2015) provided a broad overview of environmental hotspots in textile supply chains and thus avoid this effect (Sandin & Peters, 2018).

VIII. WRAP UP

The subject of the environmental impact of fashion, as you have read, can be approached from many different angles. Throughout this literature review, we have attempted to bring together all the most relevant material, to best inform and provide a comprehensive view of this topic. Below are the main findings from the seven sections of our literature review.

Firstly, the **fashion industry** has grown at such a fast pace that it is today the 4th largest industry in the world. However, this consumer society based on a traditional linear model and fast fashion has caused much social and environmental damage.

This is why a new model has emerged: the **circular economy**. A movement that goes against it and proposes to consume less and better by reusing.

Consumers, who are now very concerned about the environment and want to engage in a more circular economy, have found in **second-hand clothes** the ideal solution to their desire to have more whilst reducing the damage inflicted by the fast fashion industry. However, their use of second-hand reflects a variety of reasons.

The advent of second-hand has been made possible by the arrival of **online platforms** and a disruptive player: *Vinted*! At the same time, given the scale of this industry, it was necessary to regulate its excesses to preserve the environment. This is why various **laws and regulations** have been introduced in Europe and the United States.

To comply with these regulations, companies have to be more transparent, and monitor the damage they cause to the environment. The best way to do this is through a **Life Cycle Assessment**, which analyses various categories of impact throughout the production chain.

Finally, by giving clothes a second life, we reduce their **environmental burden**; however, there are important variables that can diminish these benefits, such as the replacement rate or the rebound effect.

Having learned about the subject, we will now try to model these ideas at our scale in the second part of this thesis.

CHAPTER TWO: QUANTITATIVE RESEARCH

I. RESEARCH QUESTION: ANALYSIS MODEL & HYPOTHESES

The subject of this work questions the environmental impacts of the market for second-hand clothes. As discovered in the previous literature review, this subject is broad and can be approached from various perspectives.

In the scope of this master thesis, we aimed to define a precise research question to answer, and for which we would run practical research. To do so, we defined several dimensions on which we could narrow down the subject: the origin of the clothes purchases, the actors, the geographical scale, the timeframe, the environmental impact categories to consider, and finally : what type of clothes to consider.

A. Research question

Based on the literature review and the belief that it is more sustainable to buy second-hand than buying new clothes, we defined an explanatory research question to understand if buying on the disrupting platform *Vinted*, is effectively doing good for the environment, or not? After assessing different options, we have come to the decision that we should specify the research question of this thesis as follows: ***"Does buying second-hand clothes on Vinted in Belgium generates environmental benefits?"***.

This research question is the contraction of a more precise interrogation that will guide our reflection in this quantitative section: "***What is the avoided environmental impact in terms of global warming potential and water consumption of second-hand clothes, specifically a pair of jeans, a sweater and a T-shirt, bought on Vinted by a Belgian resident during the past year and how factors such as the life span left, and replacement rate influence it? ".***

To formulate this research question in a clear and concise way, we took care to pre-define our **dependent and independent variables** correctly. In the simplified and short version of the question, our dependent variable is *"the environmental benefits"* and the independent variables is *"the act of buying second-hand on Vinted for Belgian residents"*. In the extended

version, the dependent variable is *"the environmental impact avoided (in terms of GWP and water consumption)"* and the independent variables are "*types of clothing (jeans, sweatshirt, T-shirt), life span left, and replacement rate.".*

For feasibility reasons notably, we have reduced the scope of the research to the present:

- **Topic of the study** : We have defined the focus of this study as an analysis of the environmental benefits of buying a garment on *Vinted*, as opposed to buying a new garment. This thesis does not aim to offer an in-depth analysis of the supply and demand dynamics of the *Vinted* market.
- **Origin of the clothes purchased**: As presented in the literature review, *Vinted* has been the disruptor of the fashion-second-hand economy; hence, this is why we only consider purchases made on this platform for the purposes of this thesis.
- **Actors :** This paper focuses on the buyers and the act of purchasing. It does not attempt to focus on the seller, nor on his or her motivations for selling on *Vinted.* We have therefore made the assumption that the offer is present and stable on the platform, i.e. that it will always be possible for *Vinted* buyers to buy on the market if they wish. We did not want to delve into the study of seller behaviour as this would require a second research project, for which we unfortunately have neither the resources nor the time.
- **Geographical scale:** This research specifically targets *Vinted* buyers residing in Belgium, irrespective of their nationality. We therefore consider *Vinted* parcels delivered to any *Mondial Relay* point in Belgium. It is important to note that the study's scope does not extend to sellers. Consequently, sellers involved in transactions can originate from any country that permits delivery to Belgium. Notably, *Vinted* has designated buying zones in Europe, enabling buyers in Belgium to purchase items from sellers located in Belgium, France, Luxembourg, the Netherlands, and Spain (Vinted, n.d.).
- **Timeframe:** we took the past year, from April 2022 until March 2023, as a reference. Our questionnaire surveyed the respondents regarding their habits during the three past months, and we have enlarged it to a scale of one year to ease comprehension;

- **Environmental impacts to consider:** due to the scale of this thesis, which was written in the space of a year and a half, and our studies in management and not in engineering or sustainability, this work focuses on only two from the six impact categories presented in the previous literature review (cf. supra. Impact categories part 1 p.36). These impact categories are the climate change expressed in terms of Global Warming Potential (GWP) and the water consumption. The reasoning behind this decision will be elucidated later (cf. infra Environmental impact categories part 2 p.64).
- **Which clothes to include in the study**: we chose to assess the environmental impact of the three most bought pieces on the *Vinted* platform according to our survey : a T-shirt (68.6%), a pair of jeans (Levis 501 model) (45.8%) and a sweater (80.9%) (cf. Appendix 15). They therefore constitute the most representative sample to be analysed (cf. infra Functional units p.62).

A link between second-hand and its environmental impact has already been established by **studies**. The formulation of this research question therefore stems from studies such as Babel et al. (2019); Gray et al. (2022); Klepp et al. (2020); Roos et al. (2015) ; Woolridge et al. (2006). As described in our literature review (cf. supra Environmental benefits of second-hand clothes p.46), the second-hand can significantly reduce the environmental burden of the fashion industry and make environmental savings in water consumption and global warming potential. As explained by Dottle & Gu (2022), the consumer today is aware of the importance of sustainability in the fashion world. But a problem is slowly emerging: overconsumption. And as described by Cohen et al. (2022c) and (Paz, 2022), the easy access to second-hand through actors like *Vinted*, ends up encouraging buyers to buy more and more and perhaps negating any environmental benefit that this initiative had created. Our research question, based on theoretical sources, therefore aims to understand whether *Vinted* in Belgium ultimately beneficial for the environment or not. In addition, we will play with various variables in order to understand which ones have a significant impact on this final result.

DNA of the research

Through this research question, we aimed to achieve different objectives.

Firstly, we wanted to explore the growing **societal effect** of buying on *Vinted* in Belgium. It raises the interesting question of whether buying second-hand is not a fad or a way out to ease one's conscience, while our consumption pattern remains very high, and hence does not help to reduce one's environmental impact. As of today, no Life Cycle Assessment has been conducted to analyse the impact of clothes bought on *Vinted* in Belgium. This thesis therefore aims to fill this gap in the literature. Moreover, it will also allow us to understand the *Vinted* user and its attitude towards the platform.

Subsequently, through this work, we wanted to bring a bit of **originality and innovation.** In fact, despite a good number of theses written at LSM on this subject, none of them challenged the relationship between *Vinted* and its environmental consequences on the Belgian territory.

Moreover, as management students, it was obvious that the answer to our research question should lead to **managerial reflection** and produce quality recommendations. You will therefore find our managerial responses further down in our analysis (cf. infra CHAPTER FOUR: MANAGERIAL RECOMMENDATIONS p.98).

Subsequently, one criterion for a research question to be relevant is its **precision**. By limiting our research via two axes: the source of environmental impact, *Vinted*, and the geographical area, Belgium, we impose a strict framework, and our research question is therefore well defined and specific. Focusing only on the second-hand source *Vinted* and Belgian being a small country also allowed us to meet the **feasibility criterion**, as access to information to conduct this study was therefore easier.

On top of that, we both have a double interest in writing on this topic: a **professional interest**, but also a **personal one**. As keen consumers and shoppers on *Vinted*, we have a strong attraction to fashion. Hence, the subject of this research was of special interest to us. This interest is also professional as we may wish to pursue careers in the fashion and/or sustainability sector after our master.

All of these reasons led us to conduct this research and compare it with our learning from the review literature. Being environmentally conscious, we hope to find a positive answer to our research question. And if not, we look forward to producing quality recommendations to improve the current environmental impact of *Vinted* in Belgium.

B. Hypotheses to test

After posing the research question, we will explore if *Vinted* can provide environmental benefits and examine the factors that may impact this. The following hypotheses have been identified for further analysis :

General hypothesis: ***"Buying second-hand clothes on Vinted in Belgium brings environmental benefits compared to buying new clothes."***

This hypothesis was then broken down into three sub-hypotheses :

- **Sub-hypothesis 1:** ***"The environmental benefits of buying second-hand clothes on Vinted in Belgium will depend on the specific types of clothes purchased (among a T-shirt, a pair of jeans and a sweater), with some types of clothes having greater environmental benefits than others."***
- **Sub-hypothesis 2: "*Belgian consumers' buying habits on Vinted translate a 50% replacement rate, meaning that consumers need to purchase two second-hand clothes to replace one new clothes."***
- **Sub-hypothesis 3:** ***"The life span left of the second-hand clothes sold on Vinted in Belgium is high (70%), indicating that these clothes have a majority of their life span remaining."***

Methodology to formulate the hypotheses

To formulate these hypotheses, we relied on our literature review, including studies that each addressed those independent variables that may have an effect on environmental benefits.

Main hypothesis

In particular, we drew on the findings of the following two studies:

Firstly, the study **"*Environmental benefits from reusing clothes*"** by Farrant et al. (2010), which draws the conclusions that reusing clothes can reduce environmental burdens. In this study, Farrant (2010) describes that the benefits generated by the reuse exceed the overall impacts by about 25 times for T-shirts and about 20 times for pants (for more details, refer to the literature review (cf. supra Environmental benefits of second-hand clothes p.46). However, this study was not specific to *Vinted* and only considered second physical shops. Furthermore, this study was conducted in Denmark, Sweden, and Estonia. It is therefore relevant for us to conduct a similar new analysis but focusing on the resale platform and in Belgium, which has consumers with different buying habits than in the northern countries.

The second key study that inspired us in defining our hypotheses is the one by ***ThredUP*** (Babel et al., 2019), an online consignment and thrift store located in the US, in which they did a comparative LCA of second-hand and new clothing. Their goal was to estimate the environmental savings from buying second-hand clothing sold by *ThredUP* online *instead* of buying brand new clothes. This study helped us to approach the second-hand online sales platform aspect, which we did not have in the previous source. *Vinted* has its own specificities and its own system flow different from *ThredUp*, as well as different consumers in Belgium than the Americans in the US who took part to Babel's study.

Sub-hypotheses

With regard to the sub-hypotheses, we had identified in our literature review three variables on which environmental benefits depend. Here is the research that helped us to define our sub-hypotheses in a SMART way.

For the first, which focuses on the **three different types of clothing**, it was the Babel et al. (2019) study that showed a different impact for *ThredUP* in the US depending on the clothing. We therefore wanted to find out whether this was the case in Belgium. In order to define which garments to analyse, i.e. jeans, a T-shirt and a jumper, we used a bottom-up thought

process as we chose the three most purchased garments on the platform based on the responses to our survey.

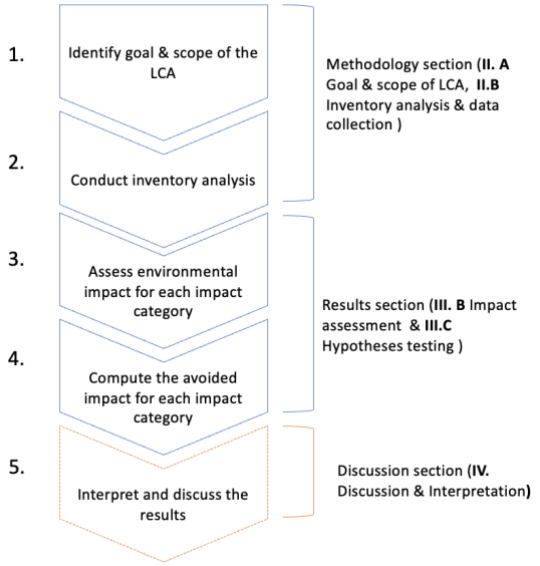
Furthermore, concerning the **replacement rate** hypothesis, it is the analysis of Nørup et al. (2019) that mentioned the importance of taking into account the replacement rate in the calculation of environmental benefits especially needed in countries where one is trying to understand the impact of second-hand textiles. Many studies assume 100% replacement rate which is not realistic as it depends on a multitude of factors such as the behaviour of individuals or their demand for second-hand textiles. Furthermore, Babel et al. (2019) also mentioned this through their scenario analysis which demonstrated the importance of replacement rate variation on the environmental benefit. We will also evaluate it later in the work (cf. infra Scenario analysis p.84). For our study, to estimate a realistic percentage, we therefore looked at the estimates of Farrant et al. (2010) who defined it ranging from 60 to 85% for northern countries and Africa for physical shops. We revised this figure downwards following the study by Stevenson & Gmitrowicz (2012) which placed it at 27% and that of Gray et al. (2022) which set it at 54% in view of the expansion of e-commerce. The latter case is the closest to our study, which is why we have rounded up our hypothesis to 50%.

Finally, the last hypothesis focuses on the **life span left**. We reflected on the concept of previous practical service life and technical life for our garments that we had discovered in the literature review thanks to Farrant et al. (2010) and Klepp et al. (2020). These studies concluded that reusing clothes has a real environmental benefit. Indeed, reusing clothing increases the remaining life of the garment, which influences the environmental benefits. To estimate this remaining life rate, we looked at the study by Babel et al. (2019) who assumed a remaining technical life of 70%. This assumption agrees with Farrant et al. (2010) who claim that second-hand clothing generally still has a significant technical life. Therefore, we decided to assume 70% as well.

II. METHODOLOGY

The following section summarises the methodology used to evaluate and compare the environmental benefits of a pair of used jeans, a cotton T-shirt, and a wool sweater. Before explaining it in more detail, it is important to note that we adopted a Life Cycle Assessment methodology that consists of five main steps, as you can see in Figure 7. This will be done for the three selected garments, which means that three LCAs will be performed simultaneously.

Figure 7: Flowchart of the methodology followed



Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

1. **Identify goal & scope of the LCA:** First, in the goal and scope section, we will define the specific objectives of the assessment and determine the boundaries of our analysis, the process flow, the functional unit, and the environmental impacts that will be considered in this study. These are the same for the 3 selected garments cited above.
2. **Conduct inventory analysis:** Second, data will be collected on the inputs and outputs associated with all phases of our garment's life cycle from its first life to its second life, this is called the inventory analysis.

These first two steps will be developed in the Methodology section (cf. infra GOAL & SCOPE OF LCA p.62; cf. infra INVENTORY ANALYSIS AND DATA COLLECTION p.66).

Afterwards, we will move on to the Results section (cf. infra RESULTS p.76) with the following steps:

3. **Assess environmental impact for each impact category** : We will apply impact assessment methods to the data gathered in the inventory analysis to quantify the environmental impacts associated with the clothes assessed.
4. **Compute the avoided impact for each impact category :** We will compute the avoided impact for each impact category. This means that we will compare the environmental impacts associated with the life cycle of a new identical garment (from raw materials, through manufacturing, to distribution to the end user) and the environmental impact associated with the life cycle of a second-hand garment replacing a new identical garment. Then based on that, we will quantify the difference as the avoided impact. Indeed, when a second-hand garment is purchased, the life cycle impact of a similar but new item (from raw materials through manufacturing to distribution to the end user) is avoided. However, as explained in the literature review, second-hand clothes do not usually fully replace new clothes (Farrant et al., 2010) and as a result, the replacement rate and the life span left need to be considered when evaluating the avoided impact associated with second-hand clothes. In short, this calculation of the avoided impact will be done for each impact category identified in the impact assessment step and the replacement rate and life span left of the clothes will be evaluated as well. This will provide a clear picture of the potential environmental benefits of using second-hand clothes. Based on that, we will be able to address the hypothesis raised.

   In addition to these two steps (3 & 4), we conducted a **socio-demographic analysis** of the survey respondents (survey done in the inventory analysis, step 2 of the Figure 7). This was included in the Results section (cf. infra Social and demographic profile of survey's respondents p.76) to gain a better understanding of the results obtained from steps 3 and 4. Furthermore, we will conduct a scenario analysis to further enhance our understanding of the findings (cf. infra Scenario analysis p.84).

Finally, in the last part of this thesis (cf. infra Discussion & Interpretation p.88) you will find the last step:

5. **Interpret & discuss the results:** Where we will interpret and discuss the results in the context of the hypothesis raised.

A. GOAL & SCOPE OF LCA

The objective of this study is to determine the potential environmental benefits associated with the resale and reuse of three different clothing, a pair of jeans, a cotton T-shirt and a wool sweater, bought on the platform *Vinted* by a Belgian resident. To do so, we performed an LCA for each of the 3 garments following the general guidelines of the *ISO standards 14040* and *ISO 14044*[1]. As *Gabi* and *Simapro* softwares[2] were not available as they are only available for students of *Ecole Polytechnique de Louvain*, we followed the *ReCiPe 2008* method tool guidelines (cf. Appendix 12) to be able to build our LCA and obtain results to address the hypothesis raised.

Functional units

In the present investigation, the functional unit of each LCA is a garment (i.e. a cotton T-shirt, a pair of denim pants, or a wool sweater) sold online on *Vinted* in Belgium and potentially replacing a similar new item purchased by consumers in Belgium. Table 1 describes the technical information of the three selected clothing.

Table 1: Technical information of the studied clothing

Selected clothes for this study	Main textile material	Mass [kg]	Other information
Cotton T-shirt	Cotton (100%)	0.153	Short-sleeved
Woollen sweater	Wool	0.3 of Merino wool	Full garment life is 109 wears
Levi's 501 jeans	Cotton	0.8	/

[1] The ISO standards 14040 and ISO 14044 are defined as "the leading international standards on life cycle assessment (LCA). They focus mainly on the process of performing LCA, following a product's impact from cradle to grave. ISO 14040 describes the" principles and framework for LCA", while the ISO 14044 "specifies requirements and provides guidelines" for LCA" (Pallas, 2021).

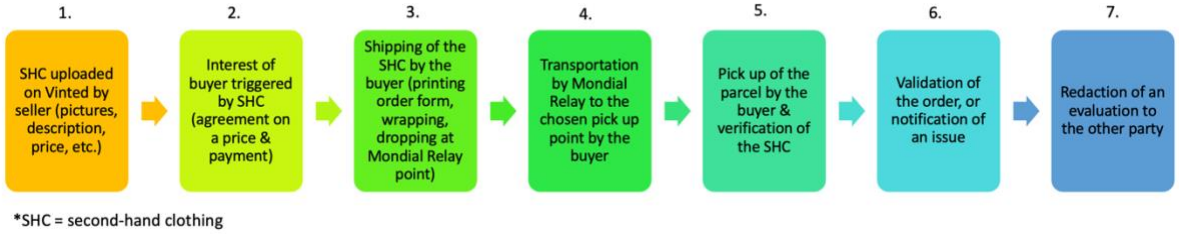
[2] Widely used LCA software tools

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Adapted from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). (Stevenson & Gmitrowicz, 2012) Copyright 2020. Adapted with permission. Adapted from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015. Adapted from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.

Reference flow / System description

When a consumer no longer wishes to keep an item of clothing, they can sell it on *Vinted*. **To sell an item**, the seller takes photos of the garment and provides a description of its condition, size, brand, colours and a detailed description (step 1 on Figure 8). When a *Vinted* user, also known as "Vintie", is interested in purchasing the item, they must agree on a price with the seller and proceed to the payment (step 2 on Figure 8). Afterwards, the vendor can proceed to the shipping by printing the order form he has received by email, wrapping the item in a box or a bag, and dropping it off at the nearest *Mondial Relay* collection point (step 3 on Figure 8). We assume that the package contains only one piece of clothing and is 100% reused from a previous order the seller has received. We also assume that *Mondial Relay* is the only carrier available on *Vinted*. From there, *Mondial Relay* takes care of sending the parcel to *the Mondial Relay* collection point selected by the buyer (step 4 on Figure 8). Once the package is retrieved by the buyer (step 5 on Figure 8), he/she should ensure that the garment is as described. He must then validate this purchase or notify the platform in case of problems (step 6 on Figure 8). Finally, both parties can leave a positive or negative evaluation to the other on the platform (step 7 on Figure 8).

Figure 8:Vinted overall operation model



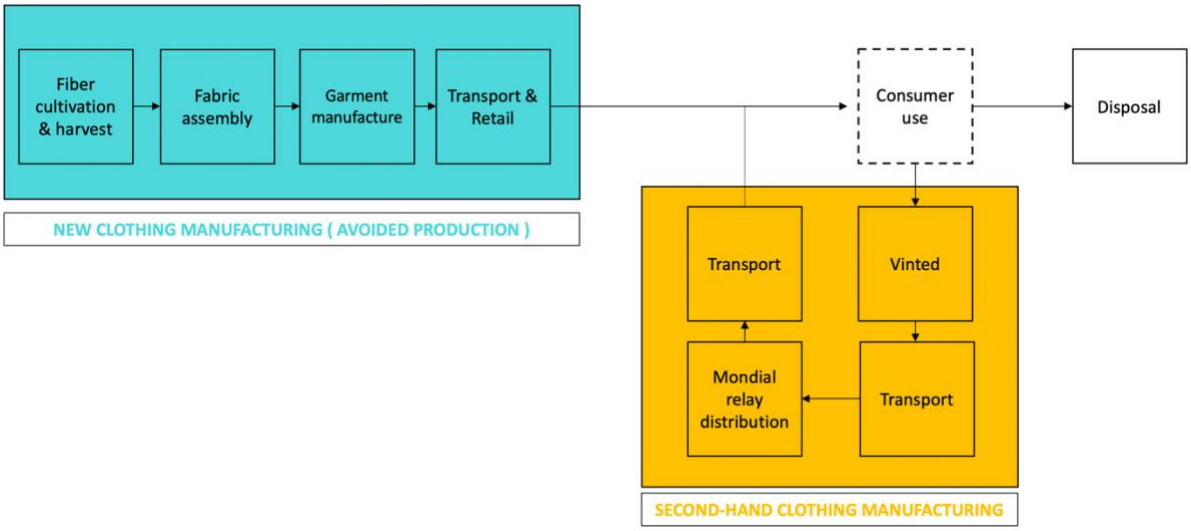
Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

System boundaries

As mentioned in the literature review, we need to set the boundaries of our study. This research addresses the **life cycle** of a pair of jeans, a cotton T-shirt, and a wool sweater,

incorporating certain stages of the life cycle of new and second-hand clothing. This includes for new clothing: raw material production, fabric production, garment manufacturing, transportation and distribution. For second-hand clothing, it includes *Vinted* platform operations (mainly the use of online services e.g. servers), *Mondial Relay* operations and transportation to and from *Mondial Relay* points. As you can see on Figure 9, we excluded the use phase and the end-of life phase from our analysis as it is outside the scope of our study and largely dependent on consumer behaviour, which can be difficult to predict and measure accurately.

Figure 9: Second-hand clothes system boundaries



Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on *Comparative Life Cycle Assessment (LCA) of second-hand vs new clothing*, by Babel et al. (2019). https://cf-assets-tup.thredup.com/about/pwa/thredUP-Clothing-Lifecycle-Study.pdf Copyright 2019. Adapted with permission.

Environmental impact categories

This study focuses on evaluating the environmental benefits across two impact categories, namely: **Global Warming Potential (GWP)** and **Water consumption** as you can see on Table 2. These are presented in the *ReCiPe 2008* guidelines tool (cf. Appendix 12) as essential environmental impact categories. We chose these two impact categories for two reasons. Firstly, they are crucial factors for consumers to consider when making a purchase (Hackett, 2015), and secondly, we wanted to develop a comprehensive understanding on factors that are recognised as critically impacting nature (Babel et al., 2019). However, we are aware that

other impacts such as eutrophication or land occupation may be relevant but decided to exclude them from this study.

Table 2: Impact categories considered in this study

Impact categories	**Description**	**Units**
Climate change	Global warming potential of greenhouse gases release to the environment.	Kg CO_2 e
Water consumption	Volume of water utilised during the production process minus water returned to the same watershed at the same quality or better.	Litres

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on *A Comparative Life Cycle Assessment of Denim Jeans and a Cotton T-shirt: The Production of Fast Fashion Essential Items From Cradle to Gate*, by Hackett. (2015). https://uknowledge.uky.edu/mat_etds/9/ Copyright 2015. Adapted with permission.

Global warming potential was chosen as an impact category because it is one of the most important environmental challenges we face today. The results of the impact categories are expressed as the amount of CO_2 equivalents (kg CO_2e) per functional unit.

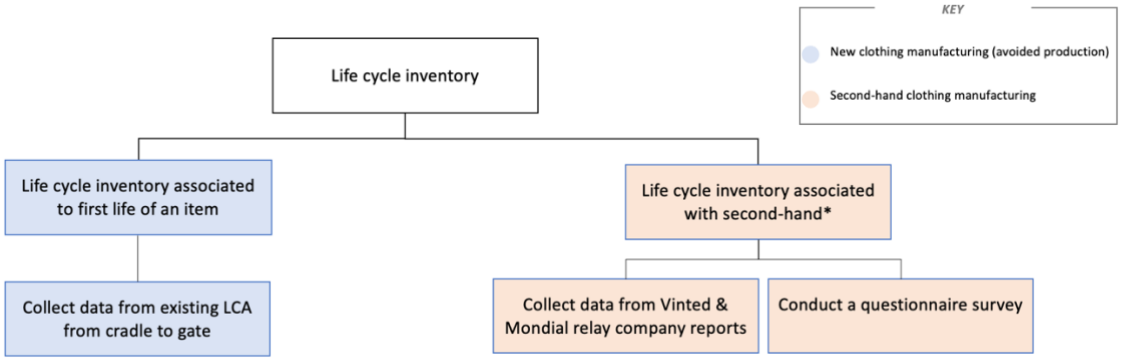
Next, water scarcity is increasingly becoming a critical issue worldwide, particularly in developing countries where a significant amount of textile fibre is produced. Therefore, we decided to measure the **water consumption**. This was quantified based on the volume of water utilised during the production process. Results for this impact category are expressed in kilograms (kg) of water used per functional unit.

B. INVENTORY ANALYSIS AND DATA COLLECTION

In order to create an LCA for each chosen garment, we gathered the life cycle inventory data for each individual item of clothing. In the following sections, the **process modelling** for each phase will be briefly described in terms of the assumptions made and the data sources.

More specifically, as you can see on Figure 10, this inventory analysis consists in **two main steps.** First, we collected data on the life cycle stages associated with the first life of each of the three items (i.e. from raw materials through manufacturing to distribution to the end user) (in blue). Next, we collected data on the additional impact associated with second-hand use, these are the same data for the three garments (in orange). As noted earlier, the life cycle stages associated with the first life of an item are considered *"avoided impacts"*, while the life cycle stages associated with second life of an item (transportation to *Mondial Relay* pick-up points, *Mondial Relay* operations, and the *Vinted* platform operations) are *"additional impacts".*

Figure 10: Life cycle inventory analysis visual



Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

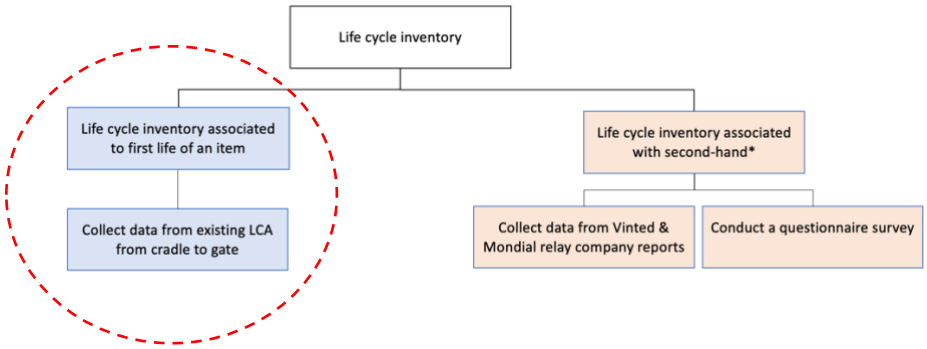
Life cycle inventory [3] associated to the first life of the garments

To build the first part of the LCAs, we gathered data for every phase of the supply chain of each garment from cradle to gate[4] (see Figure 11).

[3] LCI

[4] Cradle to gate is defined as "an assessment of a partial product life cycle from resource extraction (cradle) to the factory gate (ex. before it is transported the consumer)" (Hackett, 2015).

Figure 11: Life cycle inventory associated to first life of an item



Own elaboration (Clotuche, L. & Hanon, C. 2023).

Due to the inability to run an LCA using *SimaPro* or *Gabi* softwares, we collected **data from existing LCAs available** for each of the three selected clothes. The data for the jeans comes from an LCA performed by Levi Strauss & Co. (2015) named *"The Life Cycle of a Jean. Understanding the environmental impact of a pair of Levi's® 501® jeans".* The data used for the cotton T-shirt was collected using the *"Life cycle assessment of cotton T-shirts in China"* performed by Babel et al. (2019). Regarding the wool sweater, the data used was obtained from *"Environmental impacts associated with the production, use, and end-of-life of a woollen garment"* performed by Wiedemann et al., 2020, which used an attributional Life cycle assessment (aLCA) approach[5].

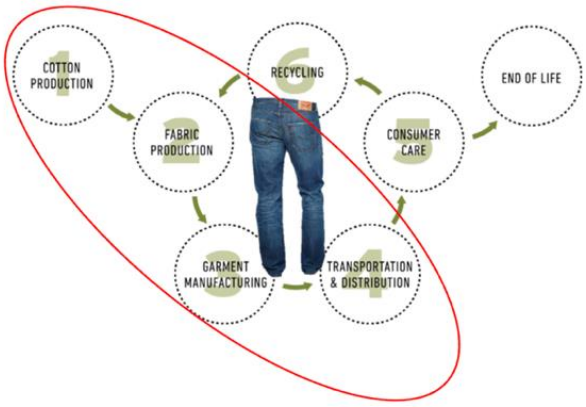
To make a more accurate comparison of the environmental impacts of a pair of jeans, a cotton T-shirt, and a wool sweater, we used the ***ReCiPe 2008*** **method tool** (cf. Appendix 12) to adjust all the data collected. We also made sure to respect the system boundaries that were set beforehand (cf. supra System boundaries p.63). However, it is important to note that the accuracy and reliability of the data may vary depending on the specific processes examined in the original studies. For example, the environmental impacts of transportation between different production phases may vary depending on the countries where the products are produced.

[5] Attributional Life Cycle Assessment is a LCA with a *"focus on describing environmentally relevant physical flows to and from a life cycle and its subsystems"* (ScienceDirect, 2023).

LCI for the pair of jeans

On Figure 12, you can see the different phases of the LCA of *Levi's* 501 jeans for which we collected data.

Figure 12: The life cycle of Levi's ® jeans



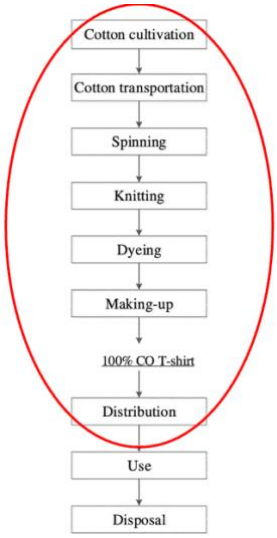
Note. Adapted from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.

Specifically, we collected data for the following phases: Fibre (cotton production), Fabric (fabric production), Cut, Sew & Finish (garment manufacturing), Sundries & Packing (garment manufacturing) and Transport, Logistics & Retail (transportation & distribution).

LCI for the cotton T-shirt

For the cotton T-shirt, the data collected came from the: cotton cultivation and production, textile manufacturing (cotton transportation, spinning, knitting, dyeing and making up) and *distribution* phases, as you can see on Figure 13. Apart from the transportation of cotton, transportation between different phases is also considered.

Figure 13:The life cycle of a cotton T-shirt

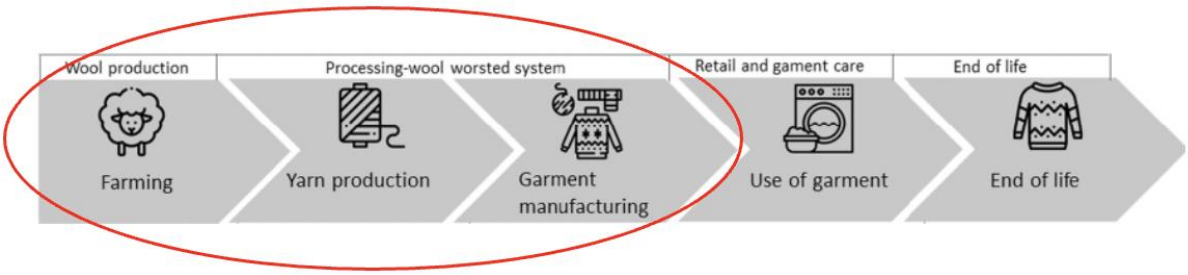


Note. Adapted from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015.

LCI for the wool sweater

For the wool sweater life cycle assessment (LCA), we gathered data from the following phases: wool production (specifically farming) and processing-wool worsted system (specifically yarn production and garment manufacturing) (see Figure 14). It is important to mention that throughout the value chain, transport is taken into account and included in the impact of each phase (Wiedemann et al., 2020).

Figure 14: The life cycle of a wool sweater



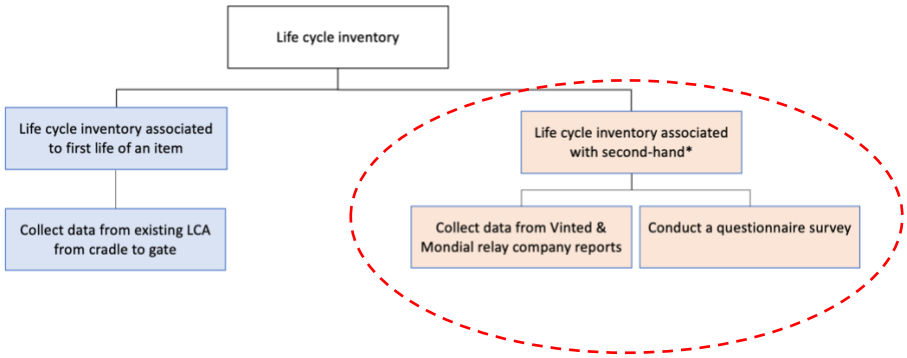
Note. Adapted from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

As you can see in the LCI for the pair of jeans, cotton T-shirt and wool sweater, the inventory data was accounted by life cycle phase, from cradle to gate. The data from these phases will then be aggregated for each garment in the next chapter (cf. infra First life impact assessment p.78).

Life cycle inventory associated with second-hand

To gather data related to the additional impact associated with the second hand, we used two types of sources: company reports to obtain data on the corporations involved (*Vinted* and *Mondial Relay*) and a customised survey to collect information on consumer behaviour when purchasing second-hand clothing (see Figure 15).

Figure 15: Life cycle inventory associated with second-hand



Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

Company reports

To perform the life cycle assessment (LCA), it was essential to gather data on the environmental impact of *Vinted* and *Mondial Relay*. To this end, we obtained information about carbon emissions and water consumption from the companies' respective 2021 annual reports .

Survey

Survey - Method

To carry out LCAs with the most relevant information for the scope of our study, we designed a questionnaire to understand best the habits of *Vinted* consumers in Belgium. The aim of this study was therefore to assess the avoided impact of second-hand clothing as best as possible, through direct input from the targeted audience and understand the buying and selling habits of consumers.

We therefore conducted a **quantitative survey** that collected 400 responses from people living in Belgium. To distribute the survey, we used different channels: social networks, our personal contact lists, but also contacted users of the platform directly on *Vinted*. This online survey was created on the *Google Forms* platform, it was launched on 4 March 2023 and left open for three weeks until 26 March 2023.

It is important to note that we ensured that each respondent was anonymous. However, we left the possibility for respondents to leave their contact details at the end if they were interested in knowing the results of our research. The following points describe the methodology we used.

Type of questionnaire

We opted for a **web-based survey** using *Google Form*, as we wanted to maximise the number of respondents, we needed the process to be fast, and have a good geographical coverage of the Belgian territory. Moreover, this seemed to be the most cost-effective and user-friendly option for both of us and the respondents (Lambin & de Moerloose, 2016). Online surveys allow for easy dissemination via social media or email, allowing for a large number of respondents to participate. They also offer lower error rates than traditional paper-based surveys. In addition, online surveys do not require the intervention of an interviewer, which helps ensure the objectivity of the responses received (Lambin & de Moerloose, 2016).

Questions

To make it easier for respondents to answer, we selected **closed-ended, structured, and predominantly single-choice questions** for our survey. Only a few questions required multiple-choice answers. Moreover, we translated all questions from French to English to target all three regions of Belgium. Our decision to use closed-ended questions was based on the fact that respondents often find open-ended questions more challenging to answer (Emde, 2014). To ensure clarity and ease of comprehension, we used simple and commonly understood words in our questions and defined the less familiar terms. By carefully defining the wording of each question, we have avoided any problems of ambiguity or bias. The order of the questions was well thought out in sections, and we used pivotal and closed dichotomous questions to guide the respondents through the sections that concerned them.

For example, only a participant who answered to be a seller on the platform had access to the questions for sellers. You can read our questionnaire in Appendix 14 (cf. Appendix 14).

Measurement scale

In our study, we collected a variety of data from our respondents. First, we asked them to provide **demographic information**, including age, city of residence, zip code, country of origin, gender, occupation, status, family status (children or not), as well as their budget for purchasing clothing.

Next, we asked questions related to the use of second-hand clothes. These questions mostly had **nominal scales with categorical answers**, such as asking whether they bought second-hand clothes in thrift shops or on *Vinted*, or what types of clothes they purchased. We also asked **several ordinal questions**, such as those related to budgets, the frequency of checking *Vinted*, and percentages of clothing ownership. For these questions, the answers were often expressed as intervals.

We did not use scale variables such as the Likert scale, as they were not necessary for our study. Instead, we used nominal and ordinal scales to quantify concrete answers and simplify the analysis and categorisation of responses. Additionally, we did not push for open-ended responses, but we always provided the option "Other" in our questions so that respondents could express themselves if they did not find the proper answer to our proposals.

Questionnaire design – building

Our questionnaire had thirteen sections with logical sequencing and pivotal questions guiding respondents' answers. The first page provided the purpose, topic, definition, and link to the *Vinted* platform.

The first section aimed to collect the demographic data of the respondents to analyse the diversity of the profiles who took part in the survey. The second section tackles the heart of the subject and the use of second-hand clothing. It aimed to understand if the respondent buys or not second-hand, and where. We then moved on to the heart of the matter, the following sections from four to nine were designed to question the sellers and buyers on the *Vinted* platform. We also focused on the purchase of second-hand clothing as an "extra" through section 6.

Finally, in sections ten to twelve, all respondents were asked to provide information about their nearest Mondial Relay point, how they dispose of clothes and their current opinion about the environmental impact of second-hand clothing. The last section allowed them to leave their contact information if they wished to be kept informed of our conclusions to this study, and they could also comment on anything they would find relevant to tell us after taking part to this survey.

Pilot test

Before releasing the survey publicly, we performed a pilot testing. In other words, we sent it to ten people in the target audience to get their feedback and to help us identify possible inconsistencies or clarify some questions. This also allowed us to check that the answers were automatically transcribed into our Excel file.

Among the recommendations that we have received, we have been asked to improve the **clarity** of some questions, for example, formulate better the question "*Approximately what percentage of your wardrobe was purchased in second-hand on Vinted?"* so the reader would understand that the percentage asked was the number of clothes bought on *Vinted* among the entire wardrobe, and not among the second-hand clothes they own.

Moreover, we had to review which questions were **mandatory** to answer, and which ones were not. As we had some respondents who didn't buy second-hand, they were blocked at some point by "second-hand focused questions" when they filled the questionnaire. Hence, we reviewed the entire questionnaire to make sure all respondents had to answer questions that were relevant to their profile.

Finally, we also received advice to improve the **English quality** of our questionnaire.

Data processing

We analysed the data collected through the survey using three software tools: *Tableau Prep Builder*, *Tableau Desktop*, and *Excel*. Initially, the survey results were gathered in an *Excel* sheet and cleaned using *Tableau Prep Builder*. For example, this involved organising the data by retaining only the English versions of the questions and answers.

To streamline the analysis process, two additional databases were created from the main database, one for sellers and one for buyers. This allowed for a more focused analysis. After the data was cleaned, *Tableau Desktop* and *Excel* were used concurrently for further analysis.

While the graphs generated by *Google Forms* based on our survey results provide a first understanding of our sample (cf. Appendix 15), we sought to perform a more in-depth analysis of the demographics of survey participants. To this end, we used *Tableau Desktop* software to **further explore the data**. Our analysis produced a variety of informative charts that examine different variables (cf. infra Social and demographic profile of survey's respondents p.76; cf. Appendix 17).

Additionally, *Excel* was first utilised to calculate the data required for the life cycle assessments (LCA). Then, we used *Excel* to perform the life cycle assessment, to calculate avoided impacts as well as to perform scenario analysis (cf. Appendix 16).

Further explanations of the data processing can be found in Appendix 13 (cf. Appendix 13).

Possible limitations of the data collection

While we took great care in designing our questionnaire and pre-tested it to avoid issues, our study has limitations that may have impacted the accuracy and generalisability of our results.

Firstly, our **sample size** of 400 respondents may not be sufficient to provide a representative picture of the Belgian population, and the findings from our questionnaire should be interpreted with caution, as they may not be generalisable to the broader population.

Furthermore, our sample was selected through **convenience sampling**, which means that we did not have control over who participated in the questionnaire. This limits the generalisability of our results, as it's possible that certain groups were over- or under-represented in our sample.

Additionally, the **self-reported nature** of the questionnaire means that the accuracy and reliability of the data collected may be limited, as participants may not have reported their behaviour accurately or truthfully. Social desirability bias is also a possibility, where participants may have reported what they believed to be socially acceptable or desirable.

Lastly, some respondents provided **feedback** suggesting improvements to our questionnaire, including the addition of the *"accessories"* category to the types of purchases made on the platform and confusion around the question on the nearest pick-up point for nonusers. While we intentionally left this question open to all respondents to collect as much data as possible on the Relay points, some non-users did not understand why they were required to answer it.

In light of these limitations, caution should be exercised when interpreting the results of our questionnaire. However, we believe that our findings still provide valuable insights into the behaviour and preferences of our sample, which can inform future research in this field.

Inventory analysis and data collection wrap-up

By integrating data from the **survey, company reports**, and **existing life cycle assessment (LCA) studies** in the literature, we are now able to conduct the impact assessment of the life cycle analysis.

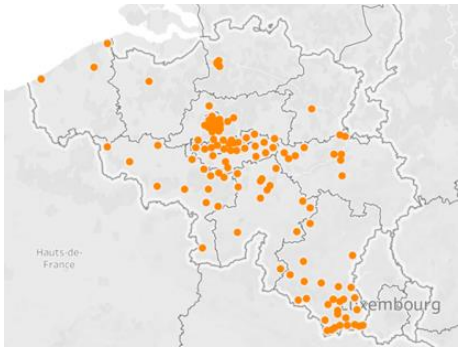
III. RESULTS

In this chapter, we will present the findings of our study. Firstly, we will outline the significant demographic and social data gathered through our survey. Following this, we will conduct an impact assessment study, which will enable us to address our hypothesis testing and conduct a scenario analysis.

A. Social and demographic profile of survey's respondents

As stated in our inventory analysis, we conducted a survey to collect data to build our three LCAs and evaluate the environmental benefits of buying second-hand clothes on the *Vinted* platform in Belgium. The paragraphs below are intended to provide a more complete overview of the respondents' profiles. We believe that **understanding the respondents** from whom we collected data is essential to interpreting the results of the LCAs accurately in the discussion chapter.

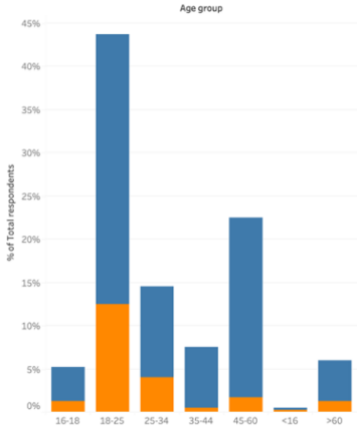
Figure 16: Map of survey's respondents



Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on *data from Excel Survey results. (2023).*

Firstly, the majority of respondents are situated in three primary provinces of Belgium: Brussels-Capital, Walloon Brabant Province, and Luxembourg Province (Figure 16). Therefore, our sample mainly consists of French-speaking Belgians, with fewer respondents who speak Dutch. Nonetheless, we have at least one respondent from each province in the country.

Figure 17: Age groups and Gender analysis of our sample



Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on *data from Excel Survey results. (2023).*

We then examined the age and gender demographics of the sample. It is important to note that 78.5% of our respondents are female. In terms of age groups, around 45% of respondents are aged between 18 and 25 years and 22.5% of respondents are between 45 and 60 years old. As you can see on Figure 17, the dominant group in our sample are females aged between 18 and 25 years.

To gain a better understanding of respondents who act as buyers and/or sellers on *Vinted*, we conducted a cross-tabulation analysis (see Figure 18). Our findings indicate that 30% (121 respondents) of our sample did not use *Vinted* at all. Nearly half of our sample (47.5% / 190 respondents of our sample) comprised individuals who both buy and sell items on *Vinted*, while we also identified a few users who solely buy (11.5% / 46 respondents of our sample) or sell (10.75% / 43 respondents) on the platform.

Figure 18: Cross-table of Vinted buyers and sellers of our sample

	Seller on Vinted	
Buyer Vinted	No	Yes
No	121	43
Yes	46	190

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on *data from Excel Survey results. (2023).*

After conducting a general analysis, we focused our attention on the characteristics of ***Vinted* users** in our sample.

Vinted buyers

Regarding *Vinted* buyers, our findings indicate that approximately 55% of them belong to the **18-25 year-old** age group, with 41% of them being **female**. Additionally, around 15% of buyers are aged between 25 and 34 years, while a little over 15% are between 45 and 60 years old (cf. Appendix 17.1 – Figure 36).

Regarding their activities, 48% of buyers are **students**, a little over 30% are full-time workers, and 11% are part-time workers (cf. Appendix 17.1 – Figure 37). Moreover, 45.3% of respondents who bought on *Vinted* claimed that they purchased second-hand clothes as **additional items**, while 28.4% said they bought second-hand clothes as replacements for new ones (cf. Appendix 17.1 – Figure 38). The top reasons cited by buyers for using *Vinted* were environmental concerns (60% of respondents), ethical considerations (44% of our respondents), and **financial benefits** (76% of our respondents) (cf. Appendix 17.1 – Figure 39).

Vinted sellers

Finally, 233 out of 400 respondents identified themselves as **sellers on *Vinted***. Interestingly, just like the buyers, more than half of these sellers belong to the **18-25 year-old age** group, with a **female** predominance (cf. Appendix 17.2 – Figure 40).

Regarding the activities of sellers, 45% of them said they were **students**, while 35% had full-time jobs (cf. Appendix 17.2 – Figure 41). When it comes to the condition of clothes sold on *Vinted*, a large majority of sellers (80%) said the items they offered were in **very good condition**, while around 12% said they were in good condition, 6.5% were new and the remaining items were in satisfactory condition (cf. Appendix 17.2 – Figure 42). Additionally, 34% of respondents said the clothes they sold on *Vinted* had been **worn less than five times**, while 25% said they had worn their clothes between 5 and 10 times (cf. Appendix 17.2 – Figure 43).

B. Impact assessment

Now that we have a clearer understanding of the social and demographic profile of the survey respondents, it is time to proceed with the impact assessment study. For the sake of clarity, it will be divided into two parts: first, assessing the impact of the **first life** of the three representative garments, and second, assessing the impact of their **second-hand life**. Finally, by combining all this information, we will be able to address the hypothesis presented in the previous section (cf. supra Hypotheses to test p.57).

First life impact assessment

The impact assessment is established using the impact categories and system boundaries chosen earlier (cf. supra System boundaries p.63). To represent the environmental impact of the first life cycle of clothing, from cradle to gate, we aggregated input and output inventory data for each selected garment for every impact categories. Together, they represent the **impact avoided** as a result of purchasing second-hand clothing. It is important to note that the input and output data required for LCA modelling are approximate for the three selected garments, as we did not use the LCA software. However, the data used are indicative of the production processes involved in creating a pair of *Levi's* 501 jeans, a cotton T-shirt, and a

wool sweater. The results of the environmental impact of the first life of the three representatives products are the following:

Table 3: Environmental impacts in terms of GWP and water consumption associated with the first life of each of the three selected items

Representative clothing	GWP [kg CO_2e]	Water consumption [L H_2O]
Levi's 501 jeans	20	2922
Cotton T-shirt	4.99	1522
Wool sweater	17.45	255

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission. Adapted with permission. Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015. Based on data from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.

More detailed explanations of these results and the use of first life data for a pair of *Levi's* 501 jeans, a cotton T-shirt, and a wool sweater can be found in the Appendix 2, Appendix 3 and Appendix 4 (cf. Appendices 2,3 and 4).

Second-hand impact assessment

For the phases associated with the second-hand life of the three selected clothes, the environmental impact of the transportation of users, *Vinted* operations (use of online servers, etc.). and the carrier *Mondial Relay* operations need to be taken into account. Aggregated, they represent the **additional impact** associated with second-hand.

It is important to mention that for this part of the assessment, we assumed that the impacts of transportation, *Vinted* operations and *Mondial Relay* operations was the same for the three types of garments analysed. Unfortunately, we did not have information available to adjust the impact based on the type of clothing. While this assumption simplifies our analysis, it is important to keep in mind that the environmental impacts of different types of clothing varies mainly based on factors such as the type of fibre used, production processes, which is already considered in the first life impact assessment. As a result, the environmental footprint per clothing unit for jeans, T-shirts, and sweatshirts is equivalent in terms of GWP and water

usage, based on the life cycle analysis of second-hand garments sold on *Vinted* in Belgium and presented in the Table 4 below.

Table 4: Environmental impacts in terms of GWP and water consumption associated with the second-hand life for each selected item

Representative clothing	GWP [kg CO_2e]	Water consumption [L H_2O]
Levi's 501 jeans	1.1	0
Cotton T-shirt	1.1	0
Wool sweater	1.1	0

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on data from *Survey conducted in this Study. (2023).* Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission. Based on data from *Annual report 2021,* by InPost. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

More detailed explanations of the process to come to these results can be found in the Appendices 5 to 9 (cf. Appendices 5 to 9).

C. Hypotheses testing

Based on the data presented, we have successfully constructed the Life Cycle Assessment (LCA) of second-hand clothing and quantified the avoided impact. However, to accurately assess the extent of this impact, we need to consider two critical variables: the replacement rate and the remaining life. These variables play a crucial role in determining to which extent the impact can be avoided by extending the life of a garment, as illustrated in Figure 19.

Figure 19: Net avoided impact formula

Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

Therefore, we are now able to address the hypotheses raised (cf. supra Hypotheses to test p.57). To do so, we will use a bottom-up approach. First, we will address sub-hypothesis 3, which focuses on the remaining life span of garments. Once we have established the life span left, we will move on to address sub-hypothesis 2 which concerns the replacement rate of

garments. By addressing these two variables, we will have all the necessary information to evaluate the avoided impact and address sub-hypothesis 1, as well as the main hypothesis.

Sub-Hypothesis 3 : life time span

Sub-hypothesis 3: "The life span left of the second-hand clothes sold on Vinted in Belgium is high (70%), indicating that these clothes have a majority of their life span remaining."

To test this sub-hypothesis, we calculated the life span left of second-hand clothes purchased on *Vinted* using data from our questionnaire. In short, based on the survey, we estimated the remaining life of the clothes sold on the platform. Sellers provided information about the condition of the clothes they were selling (like new, very good state, good state, satisfactory). Assumptions were made for the remaining life of each condition: "like new" (100%), "very good" (80%), "good" (65%), and "satisfactory" (50%). Using the percentage of *Vinted* vendors who chose each option, a weighted average was calculated to determine the average remaining life of the garments (cf. Appendix 11). Assuming that the respondents were representatives of the *Vinted* sellers population, we found that, on average, **79% of the life span** of clothing resold on *Vinted* is retained, indicating a significant potential to reduce environmental impact compared to new clothing. The calculated value of 79% is actually higher than the hypothesised value of 70%, which means that the remaining life of second-hand clothes sold on *Vinted* in Belgium is even higher than expected. **We can therefore validate this sub-hypothesis.**

Sub-Hypothesis 2 : replacement rate

Sub-hypothesis 2: "Belgian consumers' buying habits on Vinted translate a 50% replacement rate, meaning that consumers need to purchase two second-hand clothes to replace one new clothes."

To address this sub-hypothesis, we estimated the extent to which Belgian consumers replace the purchase of new clothes with the purchase of second-hand clothes on *Vinted*. To do so, we used the formula on Figure 20 developed by Stevenson & Gmitrowicz (2012) to estimate the replacement rate of new clothes with second-hand clothes bought on *Vinted*. First, we counted second-hand clothes purchased on *Vinted* by buyers who actively substitute new

garments with second-hand alternatives. Subsequently, we divided this figure by the total number of second-hand clothes purchased on *Vinted* by buyers in our survey, irrespective of their buying behaviour.

Figure 20: Replacement rate formula

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on data from *Study into consumer second-hand shopping behavior to identify the re-use displacement affect,* by Stevenson and Gmitrowicz. (2012). https://zerowastescotland.org.uk/sites/default/files/Study%20into%20consumer%20second-hand%20shopping%20behaviour%20to%20identify%20the%20re-use%20displacement%20affect.pdf Copyright 2012. Adapted with permission.

As you can see on Figure 20, determining the replacement rate required the collection of data regarding the purchasing habits of *Vinted* shoppers and the average quantity of items they buy on the platform. This information was obtained through our survey, and the detailed responses can be found in Appendix 10 (cf. Appendix 10). Our analysis revealed that the actual replacement rate of our survey sample is only 23.8%, which is lower than the proposed rate of 50%. Detailed explanations about this phenomenon will be provided further in this work (cf. infra Replacement rate p.89). Out of 840.5 second-hand clothes bought in the past three months by our respondent, only 200 replaced new items. **We therefore reject this sub-hypothesis.**

Based on these sub-hypotheses, we are now able to address the last sub-hypothesis and last, the main hypothesis.

Sub-Hypothesis 1: types of clothes

Sub-hypothesis 1: "The environmental benefits of buying second-hand clothes on Vinted in Belgium will depend on the specific types of clothes purchased (among a T-shirt, a pair of jeans and a sweater), with some types of clothes having greater environmental benefits than others."

To test this hypothesis, we calculated the net avoided environmental impact resulting from the purchase of second-hand clothes on *Vinted* in Belgium using the results of the LCA we computed ourselves and the results of the two previous sub-hypotheses. Indeed, as you can see on the formula on Figure 19, we took the results of the first life of the clothes (cf. supra First life impact assessment p.78) which represents the impact avoided by the purchase of a second-hand sweater, jeans or sweatshirt. To this, we subtracted the results of second-hand impact assessment (cf. supra Second-hand impact assessment p.79), which quantify the additional impact associated with second-hand jeans, T-shirts or pants purchased on *Vinted* in Belgium.

As a result, the net avoided environmental impact of purchasing second-hand clothes on *Vinted* in Belgium is given in Table 5.

Table 5: Impact avoidance in terms of GWP and water consumption from second-hand clothes bought on Vinted in Belgium for each selected item

Representative clothing	GWP [kg CO_2e]	Water consumption [L H_2O]
Levi's 501 jeans	2.66	549.39
Cotton T-shirt	-0.16	286.2
Wool sweater	2.18	47.95

Note. Own elaboration (Clotuche, L. Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission. Adapted with permission. Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015. Based on data from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.Based on data from *Survey conducted in this Study. (2023).* Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission. Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

As shown in Table 5, the net avoided environmental impact varies by garment type, with the reuse of Levi's jeans having the largest avoided impact in terms of GWP and water consumption, followed by the wool sweater. Therefore, we can **validate the sub-hypothesis that the environmental benefits of buying second-hand clothes on *Vinted* in Belgium depend on the specific types of clothes purchased.**

General Hypothesis: environmental benefits out of second-hand

General hypothesis: "Buying second-hand clothes on Vinted in Belgium brings environmental benefits compared to buying new clothes."

However, regarding the main hypothesis, **we cannot fully validate it** since the net avoided environmental impact in terms of GWP is negative for the cotton T-shirt (see Table 5). Nevertheless, for the *Levi's* 501 jeans and the wool sweater, Belgian customers purchasing second-hand clothes on *Vinted* rather than new garments can avoid the environmental impact associated with the manufacturing of those new garments to some extent, which reduces the overall environmental impact.

D. Scenario analysis

In this section, we aimed to examine **the influence** of sub-hypothesis 1 (life span left) and 2 (replacement rate) on the main hypothesis for each selected garment. To do so, we conducted a scenario analysis as this allows to examine the impact of several input variables on the output variable under different possible scenarios (CFI Team, 2023).

Specifically, we considered **two different values for each input variable**. For the life span left, we examined the baseline assumption of 70% (sub-hypothesis 1) and the result for sub-hypothesis 1, which indicated a life span left of 79%. Similarly, for the replacement rate, we examined the baseline assumption of 50% (sub-hypothesis 2) and the result for sub-hypothesis 2, which indicated a replacement rate of 23.8%. These different input values allowed us to create four unique scenarios, each with a specific net avoided impact value for the two impact categories (as illustrated in Table 6, Table 7 & Table 8).

Before going more into details of each table below, we can observe in overall that the results demonstrate that **both variables have a positive effect on the avoided impact**. Indeed, increasing the replacement rate (going to 50% instead of 23.6%) increases the net avoided impact as well. Similarly, raising the life span left of clothing (from 70% to 79%) have also a notable effect on impact avoidance for all environmental indicators. These observations are valid for each studied garment type.

Sub-hypothesis 1& 2 (baseline assumptions)

Results of sub-hypothesis 1 & 2

Jeans

Table 6: Impact avoidance in terms of GWP and water consumption for the jeans from different scenarios for replacement rate and life span left

Replacement rate	**50%**		**23.8%**	
Life span left	**79%**	**70%**	**79%**	**70%**
GWP [kg CO_2 e]	6.8	5.9	2.66	2.24
Water consumption [L]	1154.19	1022.7	549.39	486.81

Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

On Table 6, we can observe that for the jeans, transitioning from the worst-case scenario (replacement rate of 23.8% and life span left of 70%) to the best-case scenario (replacement rate of 50% and life span left of 79%) resulted in an increase in avoided impact of 4.56 kg of CO2e and 667.38 litres of water. Moreover, the baseline scenario (replacement rate of 50% and life span left of 70%) showed a higher avoided impact in terms of GWP (3.24 kg CO2e) and water consumption (473.31 litres) compared to the results scenarios (replacement rate of 23.8% and life span left of 79%).

T-shirt

Table 7: Impact avoidance in terms of GWP and water consumption for the T-shirt from different scenarios for replacement rate and life span left

Replacement rate	**50%**		**23.8%**	
Life span left	**79%**	**70%**	**79%**	**70%**
GWP [kg CO_2e]	0.88	0.65	-0.16	-0.26
Water consumption [L]	601.27	532.77	286.2	253.6

Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

By comparing the worst-case scenario (replacement rate of 23.8% and life span left of 70%) to the best-case scenario (replacement rate of 50% and life span left of 79%) for the T-shirt, we can observe a significant increase in the avoided impact of 0.62 kg of CO_2e and 347.67 Litres of water (see Table 7). Additionally, it is worth saying that the baseline scenario (replacement rate of 50% and life span left of 70%) has a higher avoided impact in terms of both global warming potential (GWP) and water consumption than the results scenarios (replacement rate of 23.8% and life span left of 79%). Specifically, with the baseline scenario, the avoided impact is 0.72 kg of CO_2e higher and 315.07 Litres of water higher than the result scenarios.

Sweater

Table 8: Impact avoidance in terms of GWP and water consumption for the sweater from different scenarios for replacement rate and life span left

Replacement rate	**50%**		**23.8%**	
Life span left	**79%**	**70%**	**79%**	**70%**
GWP [kg CO_2 e]	5.8	5.01	2.18	1.81
Water consumption [L]	100.73	89.25	47.95	42.48

Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

For the sweater, we can see that going to from the worst-case scenario (replacement rate of 23.8% and life span left of 70%) to the best-case scenario (replacement rate of 50% and life span left of 79%) allows to increase the avoided impact of 3.99 kg of CO2e and 58.25 Litres of water (see Table 8). Also, we can see that the baseline scenario (replacement rate of 50% and life span left of 70%) has a higher avoided impact in terms of GWP and water consumption than our results scenarios (replacement rate of 23.8% and life span left of 79%). In fact, the avoided impact in terms of both GWP and water consumption more than doubled from the result scenario to the baseline scenario.

Overall, our scenario analysis provided valuable information on the impact of sub-hypotheses 1 and 2 on net avoided impacts. Our results indicate that **increasing the replacement rate** to 50% (as suggested by sub-hypothesis 2), while keeping other factors unchanged, can **significantly increase the environmental benefits** of purchasing used clothing from *Vinted*.

Our calculations show that this replacement rate avoids more impacts than the calculated 23.8%. In addition, our analysis highlights the **positive impact of a longer life span left** for clothing sold on *Vinted*. Specifically, a life span left of 79%, compared to the baseline assumption of 70%, results in more avoided impacts. Note that these general observations apply to the three selected items, indicating that the influence of replacement rate and life span left is consistent.

Furthermore, if we had validated sub-hypothesis 2 alongside sub-hypothesis 1, we would have obtained the best-case scenario, which would have avoided even more impacts when purchasing second-hand clothing. For example, with a 50% replacement rate, the avoided impact of the cotton T-shirt in terms of GWP is no longer negative.

CHAPTER THREE: DISCUSSION & INTERPRETATION

Throughout this discussion, we will explore the primary aim of your master's thesis, which is to assess the environmental benefits of purchasing second-hand clothing on *Vinted* in Belgium. We will highlight the key findings of our research, including confirming certain aspects of existing literature while disproving others.

Firstly, to assess the environmental benefits of purchasing second-hand clothing on *Vinted* in Belgium, we must consider the results of the two variables that influence the net avoided impact: the **replacement rate of clothing** and **the life span left** of clothing. As it has been proven that these factors have a significant impact on the overall environmental benefits of purchasing second-hand clothing.

Once we have discussed these variables, we will move on to consider the avoided impacts for **different types of clothes**. This will involve assessing the avoided impacts for specific types of clothing such as a T-shirt, a pair of jeans, and a sweater, as well as analysing the **environmental benefits of purchasing second-hand clothing in general**.

This will then allow us to comment on the possibility of a **rebound effect** for *Vinted* in Belgium, as well as to question the **consumption pattern** of its users nowadays. In parallel, based on the demographic and social data we have analysed in the previous chapter (cf. supra Social and demographic profile of survey's respondents p.76), we will try to understand if *Vinted* is a stable market or if demand and offer don't match.

Overall, this analysis will provide a comprehensive understanding of the environmental benefits of purchasing second-hand clothing on *Vinted* in Belgium and contribute to the growing body of knowledge on sustainable fashion practices.

A. Life span left

First, our results reveal that many of the second-hand items sold on *Vinted* are in excellent condition. Indeed, they show that these garments still retain approximately **79% of their technical life**, suggesting that they have seen minimal or no wear before being listed for sale.

This confirms the literature and mostly particularly Babel et al. (2019) and Farrant et al. (2010) who claimed that the remaining technical life of second-hand clothes was significant. A life span left of 79% indicates that purchasing second-hand clothing from *Vinted* can make effective use of the remaining life span of these garments, which were not likely to be worn anymore by their previous owners. Rather than contributing to the demand for new production, which often involves significant resource consumption and environmental impact, individuals (who are decided to buy a garment) can make a positive difference by opting for second-hand items. This reduces waste and helps protect the environment. This observation underscores the immense value of buying second-hand clothing. Not only can buyers save money by buying something almost new but less expensive, but they can also positively impact the environment by avoiding the purchase of a new garment.

However, it is important to note that the quality of second-hand clothing can vary depending on a variety of factors, including the type of garment, its age and how it has been cared for. Nevertheless, by extending the life of clothing and reducing waste, we can move towards a more environmentally and responsible future.

B. Replacement rate

In terms of replacement rate, it should be noted that Belgian *Vinted* users show a **significantly lower replacement rate** than what is commonly reported in the literature. Specifically, *Vinted* users in Belgium have a replacement rate of only 23.8%, which is far beneath the 100% perfect replacement rate assumed in the literature and the 50% estimated by *WRAP* for resale platforms (Stevenson & Gmitrowicz, 2012). Moreover, this also contradicts the survey led by the *Chaire Tex&Care* (Cohen et al., 2022c), presented in the literature review, where half of the respondent claimed that second-hand clothes could replace a new purchase. A rate of 23.8% means that consumers must buy 4.2 second-hand clothes to replace a new one.

The low replacement rate can mainly be attributed to the fact that a significant proportion of respondents (45.3%) use *Vinted* to complement their new clothing purchases rather than as a substitute. This is consistent with the findings of Farrant et al. (2010), who noted that in some cases the purchase made at a second-hand store is an additional purchase rather than a substitution for a new item. As a result, the replacement rate of new clothing purchases with

second-hand clothing is very low, translating to only 23.8% of the first life impact of the garment avoided when buying a second-hand item of clothing. This behaviour goes against the platform's values of promoting slow fashion and reducing the environmental impact of fast fashion. By providing the ability to extend the life of clothing, *Vinted* has the potential to significantly reduce the environmental impact of the fashion industry. However, the behaviour of some consumers who use the platform to complement their new clothing purchases, rather than as a substitute, significantly limits the potential environmental benefits. This is going to be discussed in the next paragraphs.

Excessive consumption: a shift from fast fashion to second-hand

As seen in the literature review, the consumer nowadays doesn't only consume, but over-consumes. The fast fashion industry has been able to switch consumers' minds from a *"buying clothes because we need it"* mindset, to a "*buying the most clothes for less money*". Hence, as Kaikobad et al. (2015) mentioned it, customers today shop every three weeks to get the latest trends in their closet although they don't need them.

During the past years, more and more awareness campaigns have been conducted to educate consumers about the excesses of **fast fashion** (cf. supra Fast fashion: the birth of a disruptor p.8). Consumers, wanting to do the right thing, shifted their consumption towards second-hand clothes (Machado et al., 2019). This thesis therefore had an ambitious goal to understand if this new trend of buying second-hand, and in this specific case: *Vinted* in Belgium, can alleviate this consumption drift on the environmental side. The results of our study and LCA, now allow us to put a finger on a new problem: **changing the source of our clothing purchases is not the solution**. Keeping the same behaviour of buying not out of need, but out of a desire to follow trends, even with second-hand clothes, does not reduce the environmental impact of the fashion industry, or at least not enough.

By looking at the data collected, we were able to analyse that *Vinted* has succeeded in getting into the **minds of consumers as a solution to shop more responsibly**. Indeed, consumers who use *Vinted* to buy clothes are generally motivated by three main reasons: financial, ethical and environmental. While the financial motivation is understandable and justifies additional purchases that might not otherwise have been made, the environmental and ethical motivations are paradoxical. 45.3% of buyers surveyed admitted to buying "extra" clothes that

they otherwise would not have bought. There is therefore no questioning of the way buyers consume and they continue to buy in "excess". Because they want to follow the trends, they have simply shifted their source of supply from fast-fashion shops to second-hand.

As explained above, this behaviour limits the environmental benefits of second-hand, as it reduces the replacement rate. This therefore highlights the common **misconception in buyers' mentality** that using *Vinted* is better for the environment (60.5% of the respondents to our survey believe it), when in reality the environmental impact of the platform ultimately depends on how it is used by consumers. As pointed out before, our sample of respondents is mostly composed of young women (cf. supra Social and demographic profile of survey's respondents p.76). It would therefore be relevant to ask whether this excessive consumption could potentially come from this majority consumer. This would be an interesting line of enquiry to develop but is outside the scope of our study.

In short, *Vinted* has the potential to create significant environmental benefits, but in order to realise these benefits, **consumers must rethink their approach to clothing consumption**. Purchases made on the platform should be deliberate and necessary, rather than impulsive and excessive. By doing so, we would see a significant increase in the replacement rate. This observation also highlights the necessity for more extensive research into consumer behaviour when using the platform.

C. Types of clothing

Now focusing more on the avoided impact generated by second-hand, it is first important to highlight the differences in environmental benefits for each type of garment. As viewed by Babel et al. (2019), the avoided impact varies **depending on the environmental impact of its first life.** For example, the production of cotton-based garments like T-shirts and jeans requires a significant amount of water (six times more water for the T-shirt and 11 times more for the jeans) compared to wool-based garments like sweaters, resulting in a higher negative impact on the environment. Thus, purchasing second-hand cotton-based garments can prevent further water consumption for their production, making it environmentally beneficial. On the other hand, it is important to note that the impact from the first life of a T-shirt is less significant in terms of global warming potential (GWP) compared to sweatshirts and jeans

(5 kg CO_2e for the T-shirt versus 17 kg CO_2e for the sweater and 20 kg CO_2e for the jeans). Therefore, the avoided impact of buying a second-hand T-shirt in terms of GWP is lower than that of jeans and a sweatshirt.

As a result, we can mention that jeans and sweaters, which require a considerable amount of resources and emit higher levels of greenhouse gases during their manufacture, have a greater potential for impact reduction when purchased second-hand. Conversely, a T-shirt that has a comparatively lower negative environmental impact during production may have no significant impact avoided when purchased second-hand. Therefore, the **environmental advantages of second-hand clothing depend on the garment type** and its initial environmental impact. However, it's worth noting that the benefits of second-hand purchases may not always be significantly depending on the garment's replacement rate and the additional impact from second-hand sales on *Vinted*.

D. Avoided impact of second-hand clothes

Regarding the avoided impact, it is important to note that our results show that buying second-hand clothes on *Vinted* induces certain **GWP and water consumption benefits**, except for the GWP of the T-shirt. These findings are consistent with the existing literature on the topic. However, it is important to acknowledge that the avoided impacts values observed in our study are lower than those reported in the Babel et al. (2019) study. In fact, their reported net avoided impacts for our selected garments were two to six times larger than our results. This difference can be primarily attributed to the lower replacement rate observed in our study compared to the Babel et al. (2019) study. Indeed, we have a replacement rate of 23.8% while Babel et al. assumes a replacement rate of 100%.

Specifically, our results show that purchasing a pair of used *Levi's* 501 jeans on *Vinted* saves 2.66 kg of CO_2e and 549.39 L H_2O compared to purchasing a pair of new *Levi's* jeans. To put this in perspective, the amount of CO_2e saved is equivalent to driving a car for approximately 12 kilometres. The 549.39 L of water saved, it's equivalent to the quantity of water required to fill up a standard-sized swimming pool. Similarly, buying a used wool sweater saves 2.18 kg of CO_2e and 47.95 L of water compared to buying a new wool sweater. Table 9 presents a comparison between the environmental impacts associated with an item's first life and the

net avoided impact generated by purchasing second-hand items. While the avoided impact in terms of GWP, may appear modest, it still represents a non-negotiable environmental outcome.

Table 9: Comparison of impact associated with the first life of a Levi's 501 jeans and a wool sweater and their net avoided impact when purchased on Vinted

Levi's 501 jeans	**GWP [kg CO_2 e]**	**Water consumption [L]**
Impacts associated with its first life	20	2922
Net avoided impacts (results of our study)	2.66	549.39
Wool sweater	**GWP [kg CO_2 e]**	**Water consumption [L]**
Impacts associated with its first life	17.45	255
Net avoided impacts (results of our study)	2.18	47.95

Note. Own elaboration (Clotuche, L. & Hanon, C. 2023).

On top of that, we were able to observe through the scenario analysis that the avoided impacts could potentially be better. This is only if consumers adopted a more sustainable behaviour by using second-hand clothes on *Vinted* as a substitute for their new clothing purchases, the replacement rate would increase, leading to even greater environmental benefits. Indeed, by increasing the replacement rate **from 23.8% to 50%,** the environmental benefits of the jeans and sweater in terms of GWP and water consumption can more than double. This is not negligible, and this means there is improvement to make regarding the use of *Vinted* platform.

Indeed, the scenario analysis showed that if consumers adopted a more sustainable behaviour by using second-hand clothes on *Vinted* as a substitute for their new clothing purchases, the

replacement rate would increase, leading to even greater environmental benefits (cf. supra Scenario analysis p.84).

Concerning the T-shirt, Table 10 allows to put into perspective the environmental impacts associated with a T-shirt's first life and the net avoided impact generated by purchasing second-hand T-shirt.

Table 10: Comparison of impact associated with the first life of a cotton T-shirt and its net avoided impact when purchased on Vinted

Cotton T-shirt	**GWP [kg CO_2 e]**	**Water consumption [L]**
Impacts associated with its first life	4.99	1522
Net avoided impacts (results of our study)	-0.16	286.2

Note. Own elaboration (Clotuche, L. Hanon, C. 2023).

In this case, we can see that buying a second-hand cotton T-shirt on *Vinted* has a negative GWP of -0.16 kg CO_2e, meaning that the purchase of a second-hand cotton T-shirt actually **adds carbon to the atmosphere** instead of avoiding it. This creates a **rebound effect** which will be discussed in the next paragraphs. Regarding water, oppositely, purchasing a used cotton T-shirt on *Vinted* saves 286.2 L H_2O compared to purchasing new clothing.

Rebound Effect

As mentioned in the previous paragraph, a rebound effect has been observed in the case of the reuse of a T-shirt. Specifically, this is a situation in which the additional impact generated by the second-hand T-shirt (i.e. *Vinted* operations, transport, etc.) is more significant than the environmental saving (avoided production) than it generates. This translates a situation where the **net avoided impact is negative**, and carbon emissions are emitted due to the purchase of the second-hand T-shirt on *Vinted.*

As mentioned in the literature review, a rebound effect or problem shifting can take place when the replacement rate of clothes is low (Drew et al., 2021). As analysed in the results,

45.3% of our survey's respondents consider the second-hand clothes as extra purchases. Moreover, our scenario analysis confirmed that the avoided impact is negative mainly due to this **low replacement rate** of 23.8%.

Ideally, if *Vinted* users bought more second-hand clothes to replace purchases of new clothes, the replacement rate would increase and the GWP avoided impact would no longer be negative. Here again, our scenario analysis allowed us to understand that the avoided impacts of the T-shirt are not immutable. Indeed, the net avoided impact could be positive and in terms of GWP and higher in terms of water consumption. It mainly depends on the behaviour of the consumer when buying a second-hand T-shirt (and therefore on the associated replacement rate). For instance, going from a replacement rate of 23.8% to 50%, with everything else unchanged, avoids 0.72 kg of CO_2 e and has a net positive avoided impact (cf. supra Scenario analysis p.84). As a result, buying a second-hand T-shirt would benefit the environment, offsetting this rebound effect. This led us to understand that consumer behaviour when purchasing clothing on *Vinted* plays a decisive role in determining the environmental benefits of buying used clothing.

E. Exploring the dynamics of Vinted - starting point for further investigations

The last part of our analysis looks at *Vinted* as a marketplace and aims to understand whether it is well in equilibrium thanks to a balanced meeting between supply from sellers and demand from buyers.

Based on our survey, it was found that *Vinted* platform users are equally divided between buyers and sellers, with **59%** of respondents identifying as **buyers** and **58.4%** as **sellers**. Additionally, **47.5%** of respondents reported using the platform for both **buying and selling**. It is worth noting that out of the 400 respondents, 46 use *Vinted* **exclusively for buying**, while 43 respondents use it **exclusively for selling**. These results suggest a balanced distribution of user roles on the platform without a clear majority in favour of one group over the other.

Concerning the **categories of products** bought on the platform, we have T-shirts and jumpers in the majority (bought by 68.6% and 80.9% of the respondents), followed by trousers and dresses closely with each 45.8% and 44.5%, and finally skirts by 25.8%. All other sections (shoes, jackets, coats, etc.) turned out to be minimal: under 2.5% of respondents buy them.

However, we did not collect the data to analyse what the sellers offer in return. But we can observe that the five categories mentioned above are the most traded on this market.

Having left an open-question section in our questionnaire for comments, we can understand that **variety** is an important element for buyers. Indeed, although certain garments are the most traded, buyers' tastes, sizes and reasons vary. Some buyers are looking for precise garments, such as ski boots, or washable nappies, etc. And the reasons for their purchases may be much more specific than just economic or financial. Some shoppers have found this platform particularly useful for buying children's clothes that grow up quickly, some find their Christmas presents here, some want to buy brands that are only in "new with or without tags" condition, etc.

We get it, the **power of fast fashion** is extremely strong these days. And our survey respondents seem to be aware of this. Many commented that they were afraid of the negative effects that the platform can cause: overconsumption, the rebound effect, emissions from transport, etc. However, as mentioned earlier, their consumer behaviour seems to remain very paradoxical despite the awareness that some have of their actions.

Finally, what about **the frictions** of the second-hand market? The *Vinted* platform has removed the distance barrier through its digital use. However, it has also created new ones, as respondents who were sceptical of the platform said they did not use it because of fears. The first one is not being able to try on and therefore buy clothes that do not actually suit them. Secondly, some are afraid of being ripped off on the quality of the items listed (no quality control), the accuracy of the descriptions, and the reliability of the shipping process. Finally, some are also sceptical because of the transportation and shipping costs as consumers realise that it is probably not more environmentally friendly to have a garment shipped from the other side of Europe. However, one element that pushes the use of *Vinted* is the absence of fees for the sellers.

F. Discussion wrap up

In summary, the study found that purchasing used clothing on *Vinted* has some benefits in terms of reduced GWP and water consumption. However, the **avoided impacts observed** in the study are **small** compared to those reported in the Babel et al. (2019) study due to a lower

replacement rate. The results also showed that purchasing a used cotton T-shirt on *Vinted* generates additional carbon emissions, resulting in a negative avoided impact in terms of GWP seen as a rebound effect. This can be attributed to consumer behaviour, which translates an excessive consumption, despite the willingness of the population to do better for the environment. Our scenario analysis confirmed that an increase in the replacement rate would have a positive avoided impact on GWP and water consumption impacts. Therefore, consumer behaviour plays a critical role in determining the environmental benefits of buying used clothing on *Vinted*. These LCAs allowed us to spot that switching from fast fashion to second-hand is not the solution to generate environmental benefits, but that the consumers need to lower their consumption. **Overall, the study highlights the importance of responsible behaviour and responsible use of the platform to maximise the environmental benefits of buying used clothing on *Vinted.***

CHAPTER FOUR: MANAGERIAL RECOMMENDATIONS

Based on the study's findings, we suggest implementing specific actions to maximise the potential environmental benefits offered by *Vinted*. In order to do so, we have developed nine recommendations that target three players who can have an impact: the corporation *Vinted*, the Belgian government, and the consumers.

A. Recommendations for Vinted

Firstly, it is essential to raise awareness and educate Belgian consumers about second-hand practices on *Vinted*. The first actor who can do so, is the platform itself. While some consumers assume that using *Vinted* is automatically better for the environment, the environmental impact depends on their usage and replacement rate. To maximise the potential environmental benefits, here are four actions *Vinted* could implement.

The first thing *Vinted* needs to do is to implement a campaign to encourage frugality & sobriety of consumption. According to the Cambridge Dictionary (2023), frugality is defined as *"the quality of being careful when using money or food".* The online sales platform needs to change its communication, and make its buyers understand that they should not buy if they don't need to. Recent studies have shown that second-hand, is becoming the new fast fashion, since consumers consume it in excess, not by need but by desire to consume and have always more. This campaign of *"less is more",* has already been widely used by the sustainable clothing brand Patagonia, who hoped to disincentivise the purchase of their products if not necessary by using the slogan *"do not buy this jacket". Vinted* should therefore do a similar awareness campaign.

Although *Vinted* is a for-profit company, it is important to prioritise environmental sustainability alongside profitability. As a platform committed to supporting the ecological transition of the fashion industry, *Vinted* needs to contribute reducing the negative environmental impacts of excessive consumption. By implementing this campaign for frugality and sober consumption*, Vinted* can demonstrate its commitment to a more responsible and ethical approach to fashion. In addition, to mitigate the effect of this campaign on its

immediate profit margins, *Vinted* can explore alternative strategies to offset any financial impact. One of these is to consider adjusting the transaction fees taken on each sale made. By increasing the fee charged on each transaction, *Vinted* can generate additional revenue to support its sustainability initiatives and investments. This approach enables *Vinted* to strike a balance between economic viability and environmental responsibility, ensuring long-term success while actively contributing to a more sustainable fashion industry.

A second, harder suggestion, in order to limit the rebound effect present on the platform, would be to introduce a limit on the number of items a user can buy, or at least bookmark, during a certain period of time to prevent excessive consumption. However, we can hardly imagine a for-profit business depriving itself of a part of its revenue by doing so.

The third recommendation proposed to *Vinted,* and the most important one in our opinion, would be to introduce a means of measuring the sustainability of each garment. Indeed, just like the nutri-score for food, an eco-score for clothes has been created. In France already, the *AGEC law* (cf supra. Environmental Textile and Clothing Legislation p.30) requires the textile industry to display the geographical origin of each of its products, and to specify the sites where each step of their manufacturing took place since January 2023. The labels also have to specify the proportion of recycled materials, the presence of plastic microfibres, and the presence of hazardous materials (Chassany, 2023). We would like to propose a similar approach for *Vinted.* Although it would be impossible for sellers to assess score for clothes bought before the appearance of this eco-score, and it would be difficult for them to remember it when they put their clothes on sale. *Vinted* could on its side, based on the impact of the first life of the garment, give an average score for each brand sold/bought on the platform and in addition, add a transport pollution index, depending on the country from which the garment is sent from the seller to the buyer. This would not be sufficient to provide a complete eco-score calculated with the *PEF* (*Product Environmental Footprint*) method proposed by the European Commission (Sinkevicius, 2021), but it is already a step towards consumer awareness.

Finally, *Vinted* could promote sustainable fashion practices by changing its platform policies. It could require users to take easy and short workshops, seminars, and e-learning that encourage them to buy second-hand clothes as replacements for new clothes purchases. This

approach could include incentives for sellers or buyers such as being able to use a paid feature for free during a limited period of time (i.e. highlight of the user's dressing). We would recommend that kind of incentive rather than a coupon, so as not to be counterproductive and encourage buying.

B. Recommendation for the Belgian government

Secondly, to continue to pursue this aim to consume better, a player that can bring an important leverage is the government. For this actor, we have developed two recommendations:

The government could set aside a certain budget to develop an awareness campaign to educate consumers about the impact of fashion on the environment and promote sustainable consumption practices. Through this campaign, the government would work hand in hand with *Vinted* in order not to "demonise" this actor of sustainable fashion, but to make the citizens of Belgium understand that it is necessary to reason their consumption. Social media could be an effective public channel to inform consumers that *Vinted* is not inherently beneficial to the environment, but its environmental impact depends on their actions. Encouraging consumers to adopt sustainable behaviours, such as using second-hand clothes to replace new clothes rather than simply complementing them, will be crucial.

A second initiative is stricter and would be the implementation of a regulation. The government could also regulate the second-hand fashion industry to reduce its impact on the environment. Very recently, in April 2023, Belgium decided to impose on anyone who makes more than 2000€/year from sales or conducts more than 30 transactions on *Vinted*, the obligation to declare this income on their tax form from January 2024 onwards (Ma, 2023). Moreover, on the buyer side, governments could introduce penalties such as additional taxes on consumers who buy second-hand clothes as extras on *Vinted*. This measure will discourage consumers from considering second-hand clothes as extras and reduce purchases when they do not need additional clothes. However, we doubt they would take action to restrain consumers to spend their money.

C. Recommendations for consumers

Finally, what about the consumer himself? Although the latter can be influenced by government or *Vinted* awareness campaigns, the choice of consumption is his own. Here are three recommendations that broaden the scope and propose solutions to reduce the environmental impact of second-hand clothing consumption:

First, the consumer must realise that buying second-hand is not more beneficial for the environment than buying new, if his consumption and frequency of purchase are excessive and the replacement rate of clothing is low. The consumers must therefore inform themselves and assimilate what are sustainable consumption practices and learn to buy less but better. This does not mean buying everything second-hand, especially on *Vinted,* only. It includes trying to opt for sustainable and ethical brands, as long as the purchase of a garment is necessary and replaces another one. It is the responsibility of every consumer as a citizen of society to try to make responsible choices in order to best preserve the environment.

Another recommendation takes us back to the Theory of R's (cf. supra The theory of R's p.15) and concerns repair and use. Consumers can also repair and reuse their clothes instead of constantly buying new items. Upcycling has become a real trend these days, with many vendors selling their creations on *Vinted*. The sales platform could encourage this behaviour in two ways: first, by highlighting these upcycling vendors; second, by promoting repair and providing resources on how to do it.

Finally, for this third recommendation aimed at the consumer, we again refer to the Theory of R's (cf. supra The theory of R's p.15) and want to highlight the sharing economy. Consumers could also rent clothes instead of buying them. There is a real market for renting clothes, and many brands are starting to do so. It is therefore the opportunity for *Vinted* to introduce this new market by introducing features that promote the rental of items on the platform. This could also compensate for the revenues "lost" by the overconsumption awareness campaign mentioned above (cf. supra Recommendation for the Belgian government p.100).

D. Recommendations wrap-up

In a nutshell, by encouraging consumers to replace new items with used ones and increase the replacement rate, we can reduce the environmental footprint of fashion (fast and second) and promote a more sustainable fashion industry. Therefore, implementing these recommendations could help improve users' behaviour on the platform and maximise the environmental benefits. We believe that consumers, governments and *Vinted* can play an essential role in promoting sustainable fashion practices and that if everyone contributes, the second-hand fashion industry can reach a greater potential in terms of environmental benefits.

E. One step further: sustainable future for the global fashion industry…

The subject of our thesis is the environmental impact of the second-hand, and we have made this clear by analysing the environmental benefits of *Vinted*. The previous recommendations were therefore aimed at improving these.

However, in the course of writing this report, we became aware that the environmental challenges of the fashion industry itself are much greater and more important than second-hand. Indeed, the problem of production, availability (in shops or through platforms) and excessive consumption is a **global problem for the fashion industry.** Raising awareness on consumption is a good recommendation in the short to medium term, but we wanted to close this thesis with a more macroeconomic recommendation and share a bonus proposition that challenges the fashion industry more globally.

In the long term, to solve the environmental, social and societal problems of the global fashion industry (cf. supra The drifts of fast fashion p.11), while at the same time satisfying economic growth, our recommendations would be to push research on **recycling of clothing fibres** and generalise production of new clothes with recycled yarn. Please note that this method is totally different from downcycling, in which the original material is broken down into a lower-value product.

The process of recycling textile fibres into new fabrics and products is a complex one, as the different types of fibres must be successfully separated from each other. However,

successfully converting old garments back into yarn spools would be the most sustainable way **to close the loop** and allow for the creation of new garments that meet new fashion trends, without the need to overexploit cotton fields, limit water use, etc.

Today, a number of **ongoing research projects** aim to improve methods for separating textile fibres and recycling them into yarn. A promising strategy is chemical recycling, which involves dissolving textiles into their constituent fibres with the use of chemical products. Another strategy is mechanical recycling, which entails cutting up the textiles into little pieces and using heat and pressure to turn them into new products (Peterson, 2015).

As this initiative is a hot topic, **many companies** are trying to develop their own techniques. These include: *Infinited Fibre* (Finland) which produces a new type of fibre called *Infinna* (Infinited Fiber, 2020), *Renewcell* (Sweden) which recycles cotton and other cellulosic fibres (Renewcell, n.d.), *Worn again* (UK) which has developed a method to separate polyester and cotton fibres from mixed textiles (Worn Again, n.d.), *Evrnu* (US) which converts cotton into other fibres (Evrnu, n.d.). Two companies are the most interesting and close to Belgium. The first one is *WeTurn,* that collects and recycles unsold products made with natural fabrics such as cotton, wool and cashmere, as well as blends with less than 20% synthetic fibre (Weturn, n.d.). The second one is *Les Filatures du Parc*, which is able to transform old sweaters and jeans to create new spools of yarn, it is the only company in France to have a patent (Midi en France, 2016).

In general, there is a significant interest in creating new textile recycling technologies, and many businesses are attempting to come up with creative solutions to this issue. However, enhance the use of recovered textiles in the fashion industry and to make textile recycling more efficient and affordable, there is still more work to be done…

CONCLUSION

To sum up, our research sought to answer the question of whether buying second-hand clothes on *Vinted* in Belgium generates environmental benefits. We found that while the second-hand clothing market has the potential to reduce the environmental impact of the fashion industry, its benefits are contingent on responsible consumption practices. Hence, for readers who may not have had the opportunity to fully engage with this comprehensive 100-page research study, the following conclusion presents all key findings and insights you need to remember.

Throughout this master's thesis, we aimed to comprehend the environmental impact of the second-hand fashion industry. Although perceived as a solution to reduce the fashion industry's status as the fourth most polluting industry in the world, the second-hand clothing market may not be as environmentally friendly as previously thought. Our investigation into circular fashion revealed loopholes that piqued our interest in exploring the environmental benefits of the second-hand fashion industry.

Our research delved into the concepts that play a crucial role in measuring the environmental impact of second-hand clothing, such as the remaining life span of clothes placed on the second-hand market, the replacement rate of new clothes with second-hand ones, and a potential rebound effect that would negate the benefits of this eco-friendly initiative.

To quantify the environmental impact, we narrowed the scope of our study and focused on determining the avoided environmental impact by *Vinted* buyers who reside in Belgium. We conducted a Life Cycle Assessment analysis on the three most frequently purchased items on the website according to our survey: a T-shirt, a sweater, and a pair of jeans. This impact analysis focused on the two most significant impact categories: Global Warming Potential and water consumption.

Based on the results of our Life Cycle Assessment, we were able to validate or refute several hypotheses. Firstly, we confirmed that second-hand clothes sold on *Vinted* of our survey sample have a high life span (70%), indicating that these clothes can be worn for the majority of their life span. Our questionnaire data showed an even higher life span of 79%. Secondly, we refuted the hypothesis that Belgian consumers of our sample have a 50% replacement rate

when purchasing second-hand clothes on *Vinted*. Our analysis revealed that the actual replacement rate is only 23.8%, which is much lower than what is commonly reported in the literature. This low rate can be attributed to many users using *Vinted* to supplement their purchases of new clothes, rather than as a replacement. Finally, we argued that the environmental benefits of buying second-hand clothes on *Vinted* in Belgium depend on the type of clothes purchased, as some clothing items have higher benefits than others. Our results showed that buying second-hand clothes on *Vinted* has some benefits in terms of global warming potential (GWP) and water consumption. However, we were only able to partially validate the hypothesis that "Buying second-hand clothes on *Vinted* in Belgium brings environmental benefits compared to buying new clothes" when considering the GWP impact of a T-shirt. The T-shirt produced more CO2 than it saved when bought on *Vinted*, translating a rebound effect. However, the water consumption of the T-shirt was non-negligible and brought significant environmental savings.

To compute the LCA, we needed to know more about the behaviour of *Vinted* users in Belgium. To achieve this, we conducted a survey analysis, which helped us identify the low replacement rate. Our results shed light on a new problem - changing the source of our clothing purchases is not enough. *Vinted* has been perceived by consumers as a responsible shopping solution, but if not used properly, it can lead to paradoxical situations. Consumers may end up buying second-hand clothes they don't need, negating any environmental benefits.

To validate this statement, we conducted a scenario analysis that revealed an increase in the replacement rate from 23.8% to 50% could more than double the environmental benefits in terms of GWP and water consumption. This emphasises the importance of responsible behaviour and use of the platform to maximise environmental benefits.

Finally, this master thesis provides recommendations for three key stakeholders, namely *Vinted*, the Belgian government, and consumers, with the aim of raising awareness and promoting sobriety in clothing consumption. We also finish by encouraging to push research on recycling of clothing fibres and generalise production of new clothes with recycled yarn for a better global fashion industry.

In conclusion, our study highlights the importance of responsible consumption practices in maximising the environmental benefits of second-hand clothing. We hope that our findings will inspire readers to take steps towards more sustainable consumption patterns, and to spread the word about the importance of frugality and sustainability in the fashion industry.

I. Limitations

While this study has provided valuable insights into the environmental impact of second-hand clothing on *Vinted* in Belgium, it is important to acknowledge limitations related to our quantitative study.

First, although we have a **sample** size of 400 respondents, it is too small to be fully representative of the entire Belgian population. Second, the sample is heavily skewed towards women in the 18-25 age group, as we used our social networks to collect the questionnaire responses. It is also worth noting that there is a significant representation of women in the 45-60 age group, as we also used our parents' acquaintances to participate in the study. This over-representation of women may be explained in part by their infatuation with fashion, including second-hand fashion, which may have motivated them to participate in the study (Chea, 2011). In addition, it is essential to mention that a large majority of the respondents came from the same areas of Belgium (the province of Walloon Brabant, Luxembourg, and the Brussels-Capital Region) and that the Flemish province is poorly represented. Finally, there is uncertainty regarding the comprehensive coverage of different economic backgrounds in our survey sample, potentially hindering our ability to account for the full spectrum of socio-economic factors. We recognise that obtaining a larger and more diverse sample in terms of gender, age group, geography and economic background would allow us to obtain a greater representation of the population. This would allow us to better understand consumer behaviour on *Vinted* in Belgium and improve the overall validity of our study.

Secondly, with regard to the **implementation of the LCAs**, it is important to note that, we did not have access to *Simapro* and/or *Gabi* softwares which would have allowed us to create our own LCA using their databases. We therefore had to build our own LCA manually, which required considerable effort and may not have been as precise as using these software tools. Indeed, we relied on existing literature to obtain inventory data for the first life of the garment. As a result, we recognise that these results may be biased depending on the assumptions made in these studies and the type of database feeding the model. This is especially true for the life cycle analysis of the *Levi's* 501 jeans, as our assessment is based solely on data provided by the company itself. Therefore, the reliability of this analysis becomes a valid subject of examination. It is possible that *Levi's*, through this report, is

downplaying or hiding some of its environmental impact. Moreover, many hypotheses have been made throughout our study to develop LCAs based on our functional units. These assumptions can introduce potential inaccuracies into the results obtained, which limits the precision of our results.

Next, while we have conducted a thorough analysis of the most commonly purchased second-hand clothing items on *Vinted* (according to our survey results), it is important to note that our study is limited to **only three types of clothing**: T-shirts, jeans, and sweaters. The review of the literature and the discussion of our results highlight the fact that the magnitude of the net avoided environmental impact varies depending on the production and manufacturing processes of each garment. As a result, our findings may not be fully representative and only provide a partial understanding of the overall environmental benefits of all second-hand clothing sold on the *Vinted* platform.

In addition, we recognise that our analysis is limited by the fact that we only **considered two categories of impact**: global warming potential (GWP) and water consumption. The literature review indicated that a wider range of impact categories should be considered to gain a comprehensive understanding of environmental impacts and to assess the possibility of rebound effects across different categories. However, recognising the complexity of some impact categories and the need for specialised scientific knowledge, we decided to concentrate on two categories for which we had the necessary expertise and access to the data.

Although we used Stevenson & Gmitrowicz's (2012) formula to calculate the **replacement rate** based on the responses to our questionnaire, we believe that a more in-depth analysis of this measure could improve its representativeness. In fact, in Appendix 10, we explained how we had to modify our answers to the questionnaire to match Stevenson's formula. Specifically, we treated the answer *"I only buy second-hand clothes"* as a non-replacement scenario, as this response does not suggest the possibility of purchasing a new garment to replace an old one (cf. Appendix 10). However, we believe that this approach has its limitations, as this answer could somehow be taken into account in the calculation of the replacement rate. Therefore, a more detailed study of consumer behaviour on *Vinted* would be interesting to

gain an overall understanding, refine our methodology and provide a more accurate representation of the replacement rate.

Furthermore, our calculations on the **life span left** of the clothes were based on the data we gathered from the survey. Nevertheless, we recognise the importance of obtaining a more detailed analysis for each garment selected for our study to better understand their use and life span. Although we collected some data on this during the survey, due to time constraints, we were not able to conduct an in-depth analysis of each individual item of clothing. Therefore, relying solely on a general life span left for the three selected garments when sold on *Vinted* may limit the accuracy and validity of our results.

Finally, we did not consider the **restrictions of the *Vinted* market**. As explained in our study, we have assumed that the supply of second-hand clothing on *Vinted* is strong and constant, and that any buyer will therefore find what he or she is looking for on the platform. However, it is important to note that the availability of desired items on the platform does not always correspond to this assumption. Indeed, certain items that are in high demand and have limited availability on the platform, leading to higher prices or longer wait times for buyers.

II. Recommendations for future studies

While our study emphasises the environmental benefits of second-hand clothing, we recognise that there are many other fascinating aspects to explore in this area. To further explore this topic, we suggest several areas of research.

First, we suggest **expanding the sample of clothing** items studied and considering **a broader range of impact categories** to better understand the environmental benefits of second-hand clothing. Building on the work of Roos et al. (2015), we believe that a larger sample and more comprehensive analysis would provide valuable information and a more holistic view of environmental benefits.

Second, a more thorough examination of the purchasing **behaviour of *Vinted* buyers** in Belgium is needed to accurately determine the platform's replacement rate. We recommend an in-depth analysis of the socio-demographic factors of buyers who purchase on *Vinted* in order to develop a more appropriate formula to calculate the replacement rate, thus providing a more accurate representation of reality.

Next, as we did not have the opportunity to study it in this thesis, we think it would be interesting to examine the **dynamics of supply** on the *Vinted* marketplace and its **environmental impact**. Firstly, a comprehensive analysis of sellers' offers, and behaviour would provide valuable information. This would enable us to gain an understanding of the seller's point of view, complementing the buyer-centric study carried out as part of this thesis. To do this, future studies could focus on collecting more granular data on user behaviour. By analysing these factors in detail, researchers could better understand the underlying drivers of supply and demand in the *Vinted* marketplace and better include it in their environmental assessment of used clothing purchases on this platform. In terms of its environmental impact, the platform potentially encourages sellers to think less when buying new items, because if they change their mind or are not satisfied, they can easily recover part of their investment through resale on *Vinted*. This underlines the fact that it would be interesting to understand whether the ease of resale does not lead to an increase in purchases.

On top of that, we recommend conducting a **comparative study** to assess the environmental impact of **second-hand online markets** such as *Vinted* versus **traditional thrift stores** in Belgium. Specifically, the study should include life cycle assessments to compare the environmental impact of online and offline consumption in this country. The goal of this study would be to determine if *Vinted* is a more environmentally friendly option than traditional thrift stores in Belgium, and to validate Gray et al.'s (2022) claims regarding the environmental benefits of online collaborative consumption. This study will determine the extent to which *Vinted* offers environmental advantages over traditional thrift stores in the Belgian market.

Finally, we suggest that engineers with access to specialised **life cycle assessment softwares**, such as *Simapro* and *Gabi,* conduct further research on this topic. This would allow for the construction of an even more customised assessment for the second-hand clothing studied, *Vinted* and Belgium, leading to more accurate results.

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APPENDICES

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1. Survey - Statistical analysis

As we did a survey, it is essential to conduct a thorough statistical analysis of the survey data. This involves providing a brief overview of the demographic characteristics of the sample and reviewing the measurement scales to ensure their accuracy and appropriateness for analysis.

1.1. Description of the sample

In our study, we obtained **276 valid responses** from individuals who had used the *Vinted* platform as either a buyer, a seller, or both, out of a total of 400 respondents. Among the valid responses, 229 were from female participants and 47 were from male participants. Notably, a majority of both female (167) and male (23) users reported engaging in both buying and selling on the platform. However, it is worth mentioning that our study had a relatively low representation of male participants. Our respondents spanned a broad range of ages, from under 16 to over 60, reflecting a diverse sample. Further analysis of the distribution of respondents based on their socio-demographic characteristics will be provided in the results section (cf. supra Social and demographic profile of survey's respondents p.76).

1.2. Verification of scales

In terms of scale verification, our study primarily used **nominal scales** with categorical responses and a few ordinal scales. To assess their validity, we examined the distribution of responses for each question to ensure that they were distributed meaningfully. This allowed us to verify that responses were not heavily skewed towards any one category, indicating that our survey captured a range of perspectives. For instance, when participants were asked to estimate the percentage of second-hand clothing in their wardrobe, the responses were well distributed across various ranges. Indeed, 14.5% of respondents reported having between 5% and 10% of their wardrobe as second-hand, 21% reported having between 1% and 5%, 10% reported having between 10% and 15%, and so on. This distribution of responses suggests that the scale used to measure the percentage of second-hand clothing in the wardrobe was effective in capturing a range of estimates from the participants. In conclusion, it appears that the responses were reasonably distributed, and our scales were thus deemed valid.

2. Inventory data related to first life phases collected from the LCA of Levi's 501 jeans

Levi-Strauss (2015) conducted an LCA on a pair of *Levi's* 501 jeans, using it as a functional unit. In our study of the environmental impact of a pair of jeans, we drew on data provided by *Levi-Strauss'* existing LCA. To do so, we made the assumption that *Levi'*s 501 jeans are consumed in Belgium. Table 11 lists the data we used in the *Levi-Strauss* study to assess the first life environmental impact of a pair of *Levi's* 501 jeans in our own LCA.

Table 11: Environmental impacts in terms of GWP and water consumption by life cycle phase from cradle to gate in the production of a pair of Levi's jeans

Levi's 501 jeans	Fibre	Fabric assembly	Cut, Sew, Finish	Sundries & Packaging	Transport, Logistics, Retail
GWP [kg CO_2 e]	2.9	9.0	2.6	1.7	3.8
Water consumption [L]	2565	236	34	77	10

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.

Then, we aggregated these data as we were interested in knowing the total environmental impact of the first life of a pair of jeans. The values in Table 12 represent the environmental impact according to the two categories of the first life of a pair of jeans. This is the first part of our LCA for the *Levi*'s 501 jeans.

Table 12:Total environmental impacts in terms of GWP and water consumption of the first life of a Levi's 501 jeans

Environmental impact of Levi's 501 jeans	
GWP [kg CO_2 e]	20
Water consumption [L]	2922

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *The Life Cycle of A Jean. Understanding the environmental impact of a pair of Levi's 501 jeans*, by Levi Strauss & Co. (2015). https://www.levistrauss.com/wp-content/uploads/2015/03/Full-LCA-Results-Deck-FINAL.pdf Copyright 2015.

3. Inventory data related to first life phases collected from the LCA of wool sweater

In 2020, Wiedemann et al. carried out a life cycle assessment (LCA) on a lightweight woollen sweater made of 300 g wool, with a technical life span of 109 wears. The functional unit of their study was one woollen sweater used for a single wear event. To use this study, we made the assumption that this specific type of woollen sweater with 300 g of merino wool was consumed in Belgium. We collected the results of this study and made adjustments in two steps, first for global warming potential (GWP) and then for water consumption. Please note that in this study, transportation has not been considered as a separate stage but rather included in every stage of the sweater's life cycle.

Table 13 lists the results of GWP per garment wear of the Wiedemann et al. (2020) study.

Table 13:Total environmental impacts in terms of GWP and water consumption of the first life of a Levi's 501 jeans

Lightweight woollen sweater	Wool production	Processing	Retail and garment care
GWP [kg CO_2 e]	0.1	0.05	0.025

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

To incorporate the findings of the life cycle assessment (LCA) study of Wiedemann et al. (2020) into our own analysis, we needed to modify the results pertaining to retail and garment care phase, as our focus was solely on the retail phase. To make this adjustment, we assumed that the impact of retail in terms of GWP per wear of one woollen cotton was one third of the total impact reported in the WIED study. As a result, we calculated: 0.025 kg CO_2 e / 3 = 0.0083 kg CO_2 e, which we rounded up to 0.01 kg CO_2 e (see Table 13).

Table 14:Environmental impact per garment wear in terms of GWP by adjusted life cycle phase compared to the study from cradle to gate in the production of a wool sweater

Lightweight woollen sweater	Wool production	Processing	Retail
GWP [kg CO_2 e]	0.1	0.05	0.01

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

To integrate the results of Table 14 into our own life cycle analysis of a wool sweater, we had to multiply it by the total number of uses (109 wears) to align them with our own functional unit. Therefore, we obtained the following results for the GWP per woollen sweater (see Table 15).

Table 15: Environmental impact in terms of GWP by adjusted life cycle phase compared to the study from cradle to gate in the production of a wool sweater

Lightweight woollen sweater	Wool production	Processing	Retail
GWP [kg CO_2 e]	10.9	5.45	1.1

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

Concerning the water consumption, the water consumption inventory over a lifetime was available in the supplementary data section of the Wiedemann et al. (2020) study. Therefore, we collected the result of water consumption for a woollen sweater in Table 16.

Table 16:Environmental impact in terms of water consumption by life cycle phase compared to the study from cradle to gate in the production of a wool sweater

Lightweight woollen sweater	Wool production	Processing	Retail & garment care
Water consumption [L]	205	35	70

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

To incorporate the findings of the life cycle assessment (LCA) study of Wiedemann et al. (2020) into our own analysis, we needed to modify the results pertaining to retail and garment care phase, as our focus was solely on the retail phase. To make this adjustment, we assumed that the impact of retail in terms of water consumption per woollen sweater was one fifth of the total impact reported in the WIED study. As a result, we calculated: 70 litres of water / 5 = 14 L, which we rounded up to 15 L of water (see Table 17).

Table 17:Environmental impact in terms of water consumption by adjusted life cycle phase compared to the study from cradle to gate in the production of a wool sweater

Lightweight woollen sweater	Wool production	Processing	Retail
Water consumption [L]	205	35	15

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

Then, we aggregated these data as we were interested in knowing the total environmental impact of the first life of a woollen sweater. The values in Table 18 represent the environmental impact according to the two categories of the first life of a woollen sweater. This is the first part of our LCA for the woollen sweater.

Table 18:Total environmental impacts in terms of GWP and water consumption of the first life of wool sweater

Environmental impact of sweater	
GWP [kg CO_2 e]	17.45
Water consumption [L]	255

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Environmental impacts associated with the production, use, and end-of-life of a woollen garment,* by Wiedemann et al. (2020). https://doi.org/10.1007/s11367-020-01766-0 Copyright 2020. Adapted with permission.

4. Inventory data related to first life phases collected from the LCA of cotton T-shirt

In 2015, Zhang et al. carried out a life cycle assessment (LCA) on a cotton T-shirt produced in China. The functional unit of their study was one cotton T-shirt. To use this study, we made the assumption that cotton T-shirt produced in China are consumed in Belgium. First, we collected the results of this study for GWP and water consumption that are exposed on Table 19.

Table 19:Total environmental impacts in terms of GWP and water consumption from cradle to grave of a T-shirt

Cotton T-shirt	From cradle to grave
GWP [kg CO_2 e]	6.05
Water consumption [L]	1770

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015.

However, since we focus on collecting impact results only for the first life of the cotton T-shirt, we had to adjust the above values as they are the cradle-to-grave results. To do so, we examined the relative contribution of the different phases to GWP and water consumption. Table 20 presents the data collected in this study regarding these contributions. For the sake of clarity, we have combined the contributions of spinning, knitting, dyeing, and garment making into one, as they represent the manufacture of the T-shirt.

Table 20:Contribution of cradle-to-gate phases to total GWP and water consumption of a T-shirt

Cotton T-shirt	Cotton Cultivation	Spinning, knitting, dyeing & making up	Distribution	Transportation	TOTAL
GWP [kg CO_2 e]	7%	73%	0.5%	2%	83%
Water contribution [L]	79%	7%	0%	0%	86%

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015.

Therefore, based on Table 19 and Table 20, we were able to assign the result of this LCA study to each phase by multiplying the contribution of each phase and the total result for each impact category.

Table 21 shows the results attributed to each phase of the life cycle of the T-shirt for its first life.

Table 21:Environmental impacts in terms of GWP and water consumption by life cycle phase from cradle to gate in the production of a T-shirt

Cotton T-shirt	Cotton cultivation	Textile manufacturing	Distribution	Transportation
GWP [kg CO_2 e]	0.42	4.42	0.03	0.12
Water consumption [L]	1398.3	123.9	0	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015.

Finally, we were able to obtain the values that you can see in Table 22. These values represent the environmental impact according to the two categories of the first life of a 100% cotton T-shirt produced in China. This is the first part of our LCA for the cotton T-shirt.

Table 22: Total environmental impacts in terms of GWP and water consumption of the first life of T-shirt

Environmental impact of cotton T-shirt	
GWP [kg CO_2 e]	4.99
Water consumption [L]	1522.2

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Life cycle assessment of cotton T-shirts in China, by Zhang et al. (2015). DOI 10.1007/s11367-015-0889-4 Copyright 2015.

5. Inventory data for Vinted user transportation

Transportation is a crucial aspect to consider when evaluating the impact of buying used clothing on *Vinted*. This is because the purchased clothing must be dropped off by the *Vinted* seller and picked up by the *Vinted* buyer at a *Mondial Relay* point, which has an environmental impact. The environmental impact depends on two critical variables: the mode of transportation used and the distance to the Relay point. To assess the impact of these variables, we conducted a survey. In addition, we assumed that the impact of transportation was equivalent for the three garments used.

Thanks to our survey, we determined the mode of transportation used by our respondents. We assumed that our respondents were representative of the Belgian population and that the percentage of respondents using each mode of transport was relevant. With this information, we were able to determine the percentage of people using each of the following modes of transport, as you can see in Table 23.

Table 23: Percentage of respondents using each means of transport in the survey

Means of transport	% of respondent
By car	58.80%
By bike / on foot	36.50%
Public transportation	4.74%

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Survey conducted in this Study. (2023).

In addition, we sought to determine the distance individuals travelled to a *Mondial Relay* collection point. We again assumed that our sample of respondents was representative of the Belgian population. In our questionnaire, we asked respondents to choose the option that best represented the distance between their residence and the nearest *Mondial Relay* location. They could choose between the following options: 0-2 km, 2-4 km, 4-6 km, 6-10 km and more than 10 km. To calculate the average distance of Belgian *Vinted* users to a *Mondial Relay* point, we simplified each option by one number by taking the highest number from each possible answer, as shown in Table 24. This means that our calculation of the average distance

Belgians travel to reach a *Mondial Relay* point may be overestimated. Based on the percentage of respondents and the estimated distance, we calculated a weighted average of the distance Belgians travel to reach a *Mondial Relay* point.

Table 24: Calculation of the weighted average distance travelled by Belgians to reach a Mondial Relay collection point

Distance from Mondial Relay points	Estimation of distance	% of respondent
0-2 km	2	52.70%
2-4 km	4	21%
4-6 km	6	14.60%
6-10 km	10	7.40%
+10 km	15	4.30%
Weighted average [km]		**4.155**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

After obtaining the average distance travelled and the percentage of respondents using each mode of transportation, we need to assess the impact of each mode of transportation in terms of GWP and water consumption. To obtain this information, we collected data from US EPA (2016) and European Environment Agency (2020a), which are presented in Table 25. It is important to note that for public transport, the GWP is an average obtained from different public transport sources. In addition, we assumed that only one person went to the *Mondial Relay* location.

Table 25: Assumption of the impacts in terms of GWP and water consumption of each mode of transportation

	GWP [kg CO_2e] per km	Water consumption [L] per km
By car	0.125	0
By bike / on foot	0	0
By public transport	0.02	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Greenhouse Gas Emissions from a Typical Passenger Vehicle, *by United States Environmental Protection Agency. (2022).* https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle Copyright 2022. Adapted with permission. Based on data from Greenhouse Gas Emissions from transport in Europe, by European Environment Agency. (2020). https://www.eea.europa.eu/data-and-maps/indicators/transport-emissions-of-greenhouse-gases-7 Copyright 2020. Adapted with permission.

On this basis, we were able to multiply the value in Table 25 by our average distance in Belgium to a *Mondial Relay* Point, which is 4.155 km. The results of these calculations are in Table 26.

Table 26: GWP and water consumption impacts of our different mode of transportation based on the calculated average distance

	GWP [kg CO_2e]	Water consumption [L]
By car	0.52	0
By bike / on foot	0	0
By public transport	0.08	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Then, based on Table 26, we could weigh the impact obtained by the percentage of use of each means of transportation in Belgium (see Table 27).

Table 27: GWP and water consumption impacts of our different mode of transportation based on the calculated average distance and weighted by the percentage of use

Means of transport	% of respondents	GWP [kg CO_2e]	Water consumption [L]
By car	58.80%	0.3	0
By bike / on foot	36.50%	0	0
Public transportation	4.7%	0.04	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Subsequently, we aggregated these values for each impact category, as shown in Table 28. These values represent the overall environmental impact in Belgium of an average mode of transport and an average distance in Belgium to a *Mondial Relay* point. It is important to note that we considered only one-way for the drop-off and one for the pick-up. This approach is based on the assumption that users may have multiple errands or activities planned during their trip to the pick-up point. By considering the one-way trip twice, we wanted to recognise that the environmental impact of transportation is not solely related to the purchase of second-hand clothing. Therefore, these values will be used only twice (and not four times) in the LCA, as they are relevant for both the seller and the buyer of the second-hand clothes. The seller drops off the package at the *Mondial Relay* location for delivery to the buyer, while the buyer picks up the package.

Table 28: Total environmental impacts in terms of GWP and water consumption of transportation

Environmental impact of transportation per FU	
GWP [kg CO_2 e]	0.34
Water consumption [L]	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

6. Inventory data for package associated with second-hand

Concerning the packaging used to wrap the second-hand garment sold, this study considers it as an overlooked aspect.

7. Inventory data for Vinted operations

To start with, it is important to mention that we made the assumption that the impact of *Vinted* was equivalent for the three types of garments analysed as we did not have information available to adjust the impact based on the type of clothing. Also, given the lack of available data specific to *Vinted*'s activities and environmental impact in Belgium, we have assumed that the consolidated annual report of *Vinted* in 2021 reflects the company's operations in Belgium.

To assess *Vinted*'s environmental impact as a platform, we reviewed the company's consolidated annual report of 2021. Specifically, we focused on *Vinted*'s carbon dioxide equivalent (CO2e) emissions, as no information was available regarding water consumption (therefore, we considered it insignificant) (see Table 29) .

Table 29: Environmental impact in terms of water consumption of Vinted operations

	Water consumption [L]
Vinted	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission.

Then, carbon dioxide equivalent emissions were reported using the *Streamlined Energy and Carbon Reporting (SECR)* framework. Since the *SECR* framework uses global warming potential (GWP) as a conversion factor, we can assume that the reported emissions are based on GWP.

We used a table detailing *Vinted*'s total CO2e emissions in 2021 (see Figure 21) to estimate the environmental impact of *Vinted'*s operations. This table is divided into two categories: scope 1 and scope 2.

Figure 21:Vinted's carbon dioxide equivalent emissions in 2021

Carbon Dioxide Equivalent Emissions	Year ended 31 December 2021	Year ended 31 December 2020
Scope 1 (kg CO2e)	322	456
Scope 2 (kg CO2e)		
With Market Based Electricity	340,931	298,955
With Location Based Electricity	587,629	460,002
Intensity ratio CO2e kg/revenue (with market based electricity)	0.001	0.002
Intensity ratio CO2e kg/revenue (with location based electricity)	0.002	0.003

Note. Adapted from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission.

To conduct a complete life cycle assessment (LCA) of the used clothing sold on *Vinted*, it is important to consider both scope 1 and scope 2 emissions, as they are associated with the company's operations. For our analysis, we focused on Scope 1 and on Scope 2 emissions with market-based electricity (see Table 30). This is because the latter allows for a more comprehensive assessment of *Vinted*'s environmental impact, as it considers the emission intensity of the electricity mix at the time of consumption.

Table 30: Vinted's GWP impact divided into scope 1 and scope 2 emissions

Vinted	GWP [kg CO_2 e]
Scope 1	322
Scope 2 market-based electricity	340931
TOTAL	**341253**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission.

Next, since the life cycle functional unit (LCA) for each of our 3 garments is a unit of clothing, we need to reduce the values in the above tables to this unit. However, in the absence of information on the exact number of garments sold on *Vinted* in 2021, we had to make an assumption. Based on the available information, we estimated the number of items sold on *Vinted* in 2021. According to *Vinted*'s website, over 200 million used items have been sold on the platform since its launch in September 2021 (Vinted, 2023a). Assuming that this number was 200 million at the beginning of September 2021 and that *Vinted* continued to grow at a

steady rate, we estimated the number of items sold in 2021 by calculating the percentage of the total number of items sold on *Vinted* that were sold between January 1, 2021, and September 1, 2021. For example, assuming that *Vinted* sold 180 million items at the end of 2020, if 10% of the total number of items sold on *Vinted* were sold between January 1, 2021, and September 1, 2021, and an additional 3% were sold between September 1, 2021, and December 31, 2021, we estimated that approximately 20.6 million items were sold on *Vinted* in 2021. However, keep in mind that this is an estimate, and the actual number may vary depending on several factors.

Therefore, we divided the GWP (Table 30) and the water consumption (Table 29) by the total number of clothes sold on *Vinted* in 2021. This leads us to the results on Table 31.

Table 31: Total environmental impacts in terms of GWP and water consumption of Vinted operations

Environmental impact of Vinted per FU	
GWP [kg CO_2 e]	0.02
Water consumption [L]	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission.

8. Inventory data for Mondial Relay operations

When calculating the life cycle assessment (LCA) of our three second-hand clothing items, it was important to factor in the environmental impact of the delivery operations carried out by *Mondial Relay*. We assumed this company is responsible for transporting the clothes from the seller's *Mondial Relay* point to the buyer's *Mondial Relay* point.

To start with, it is important to mention that we made the assumption that the impact of Mondial was equivalent for the three types of garments analysed as we did not have information available to adjust the impact based on the type of clothing. Also, given the lack of available data specific to *Mondial Relay*'s activities and environmental impact in Belgium, we have assumed that the French operations of *Mondial Relay* reflects the company's operations in Belgium.

To assess *Mondial Relay*'s environmental impact, we reviewed the *InPost S.A*.'s annual report of 2021 and specifically looked at the *Mondial Relay* data (*Mondial Relay* makes part of InPost S.A.). First, as no information was available regarding water consumption, we considered it insignificant (see Table 32).

Table 32: Environmental impact in terms of water consumption of Mondial Relay operations

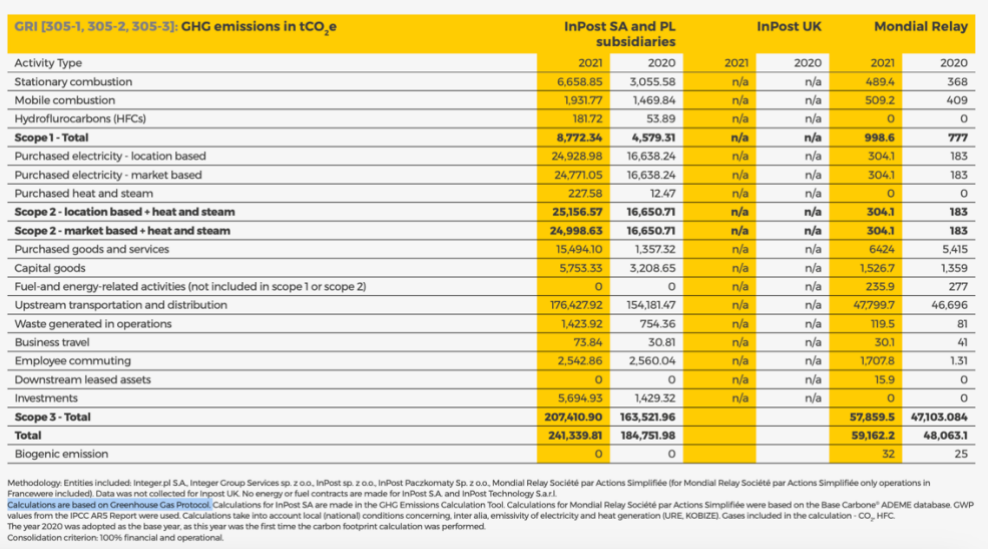
	Water consumption [L]
Mondial Relay	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

Then, we focused on carbon dioxide equivalent (CO2e) emissions. Since the methodology used by InPostto calculate CO2 emissions for *Mondial Relay* is the *Greenhouse Gas Protocol (GHG Protocol)* (InPost, 2021), we have assumed that the emissions reported are based on the Global Warming Potential (GWP). The *GHG Protocol* is a widely recognised standard for calculating and reporting greenhouse gas emissions and includes guidance on calculating emissions using GWP factors for different gases (Greenly, 2023).

To estimate the environmental impact of *Mondial Relay*'s operations on second-hand clothing sold on *Vinted,* we used Figure 22 detailing the company's total CO2e emissions in 2021.

Figure 22: Mondial Relay's GHG emissions in 2021



GRI [305-1, 305-2, 305-3]: GHG emissions in tCO_2e	InPost SA and PL subsidiaries		InPost UK		Mondial Relay	
Activity Type	2021	2020	2021	2020	2021	2020
Stationary combustion	6,658.85	3,055.58	n/a	n/a	489.4	368
Mobile combustion	1,931.77	1,469.84	n/a	n/a	509.2	409
Hydroflurocarbons (HFCs)	181.72	53.89	n/a	n/a	0	0
Scope 1 - Total	**8,772.34**	**4,579.31**	**n/a**	**n/a**	**998.6**	**777**
Purchased electricity - location based	24,928.98	16,638.24	n/a	n/a	304.1	183
Purchased electricity - market based	24,771.05	16,638.24	n/a	n/a	304.1	183
Purchased heat and steam	227.58	12.47	n/a	n/a	0	0
Scope 2 - location based + heat and steam	**25,156.57**	**16,650.71**	**n/a**	**n/a**	**304.1**	**183**
Scope 2 - market based + heat and steam	**24,998.63**	**16,650.71**	**n/a**	**n/a**	**304.1**	**183**
Purchased goods and services	15,494.10	1,357.32	n/a	n/a	6424	5,415
Capital goods	5,753.33	3,208.65	n/a	n/a	1,526.7	1,359
Fuel-and energy-related activities (not included in scope 1 or scope 2)	0	0	n/a	n/a	235.9	277
Upstream transportation and distribution	176,427.92	154,181.47	n/a	n/a	47,799.7	46,696
Waste generated in operations	1,423.92	754.36	n/a	n/a	119.5	81
Business travel	73.84	30.81	n/a	n/a	30.1	41
Employee commuting	2,542.86	2,560.04	n/a	n/a	1,707.8	1.31
Downstream leased assets	0	0	n/a	n/a	15.9	0
Investments	5,694.93	1,429.32	n/a	n/a	0	0
Scope 3 - Total	**207,410.90**	**163,521.96**			**57,859.5**	**47,103.084**
Total	**241,339.81**	**184,751.98**			**59,162.2**	**48,063.1**
Biogenic emission	0	0			32	25

Methodology: Entities included: Integer.pl S.A., Integer Group Services sp. z o.o., InPost sp. z o.o., InPost Paczkomaty Sp. z o.o., Mondial Relay Société par Actions Simplifiée (for Mondial Relay Société par Actions Simplifiée only operations in Francewere included). Data was not collected for Inpost UK. No energy or fuel contracts are made for InPost S.A. and InPost Technology S.a.r.l.
Calculations are based on Greenhouse Gas Protocol. Calculations for InPost SA are made in the GHG Emissions Calculation Tool. Calculations for Mondial Relay Société par Actions Simplifiée were based on the Base Carbone® ADEME database. GWP values from the IPCC AR5 Report were used. Calculations take into account local (national) conditions concerning, inter alia, emissivity of electricity and heat generation (URE, KOBIZE). Cases included in the calculation - CO_2, HFC.
The year 2020 was adopted as the base year, as this year was the first time the carbon footprint calculation was performed.
Consolidation criterion: 100% financial and operational.

Note. Adapted from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

This table is divided into three scopes: scope 1, scope 2 and Scope 3. To carry out a complete life cycle analysis (LCA) of garments, we considered the three scopes, as they are associated with the operations of the company (see Table 33).

Table 33: Mondial Relay's GWP impact divided into scope 1, scope 2 and scope 3 emissions

Mondial Relay	GWP [kg CO_2 e]
Scope 1	998600
Scope 2	304100
Scope 3	57859500
Total	**59162200**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdfCopyright 2021. Adapted with permission.

As a result, for our analysis, we focused on the total emissions (scope 1+ scope 2+ scope 3) of 2021. In the report, it is reported that *Mondial Relay* delivered 145 million parcels that year (see Table 34). Since our life cycle functional unit (LCA) for each of the three garments is a garment unit, we needed to have *Mondial Relay*'s impact for this unit. Thus, as we only had

access to the number of parcels delivered by Mondial Relay, we assumed that each package delivered by *Mondial Relay* contained only one garment, which allowed us to estimate the impact values for each functional unit.

Table 34: Parcels delivered by Mondial Relay in 2021

Mondial Relay	Number of parcels delivered in 2021
	145000000

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

To do this, we divided the total emissions by the number of packages to obtain the GHG emissions (Table 33) and water consumption (Table 32) per package delivered (Table 34) and therefore per unit of clothing. This allowed us to obtain the environmental impact per functional unit (see Table 35).

Table 35: Total environmental impacts in terms of GWP and water consumption of Mondial Relay operations

Environmental impact of Mondial Relay per FU	
GWP [kg CO_2 e]	0.41
Water consumption [L]	0

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

9. Total environmental impacts associated with second-hand

By aggregating all the above results (transport, *Vinted* operations and *Mondial Relay* operations), we can assess the environmental impact in terms of GWP and water consumption of the life cycle of a second-hand garment on *Vinted* in Belgium (see Table 36).

Table 36: Environmental impacts in terms of GWP and water consumption associated with the second-hand life

Per FU (jeans = T-shirt = sweater)	GWP [kg CO_2e]	Water consumption [L H_2O]
Vinted operations	0.02	0
Transport (clothing drop-off))	0.34	0
Mondial Relay operations	0.41	0
Package	0	0
Transport (clothing pick-up)	0.34	0
Total	**1.1**	**0**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Survey conducted in this Study. (2023).* Based on data from *Annual report and financial statements For the year ended 31 December 2021,* by Vinted Limited. (2021). https://bijlagen.nos.nl/artikel-17749325/companies_house_document.pdf Copyright 2021. Adapted with permission. Based on data from *Annual report 2021,* by Inpost Eu. (2021). https://inpost.eu/sites/default/files/2022-07/Annual%20Report%202021.pdf Copyright 2021. Adapted with permission.

10.Replacement rate

Based on our questionnaire, we were able to identify 3 types of behaviour on *Vinted* among the buyers who answered our questionnaire (see Table 37). First, there are the buyers for whom their second-hand purchase replaces a new clothing purchase. Secondly, there are the buyers who mostly buy second-hand items and would never buy new ones. The last behaviour is the buyer who buy second-hand garments as extras in addition to buying new garments. It is important to mention that, when evaluating the replacement rate, we made the strong assumption that our respondent is representative of the Belgian population using *Vinted.*

Table 37: Attitudes of Vinted buyers towards second-hand purchase on Vinted, as reported in the survey

Attitudes of Vinted buyers	% of repondents
Number of buyers that replace new garment by second-hand	28.4%
Number of buyers for whom second-hand is extra purchase	45.3%
Number of buyers who mostly buy second-hand	26.3%

Note. Own elaboration (Clotuche &Hanon, 2023). Based on data from Excel Survey results. (2023).

To evaluate the replacement rate, we decided to use the formula developed by Stevenson and Gmitrowicz (2012). The formula is the following (see Figure 23).

Figure 23: Methodology of Stevenson and Gmitrowicz (2012) to calculate the replacement rate

Calculation of the replacement rates was based on the following question:

- Q27: For each textile item purchased, would you have bought a similar item new if you had not found it in a second-hand shop or market?

The respondents were given the options 'yes', 'no' or 'maybe', for up to five purchased second-hand textile items. This method is in line with the method used by Stevenson and Gmitrowicz (2013) and partly in Farrant et al. (2010).

Calculation for replacement rates: R:

$$R = \frac{\text{Q27 (Total number of items with Yes responses} + \tfrac{1}{2}\text{ of the number of items with Maybe responses)}}{\text{Q27 Total number of items purchased}}$$

Note. Adapted from *Study into consumer second-hand shopping behaviour to identify the re-use displacement affect,* by Stevenson and Gmitrowicz. (2012). https://zerowastescotland.org.uk/sites/default/files/Study%20into%20consumer%20second-hand%20shopping%20behaviour%20to%20identify%20the%20re-use%20displacement%20affect.pdf Copyright 2012. Adapted with permission.

To adapt Stevenson's formula to our collected data, we made two modifications. Firstly, we excluded the "maybe" responses to Stevenson's question since they were not applicable to our study. Secondly, we categorised behaviours based on whether buying new was avoided by buying used.

We identified two groups of buyers: those who replace new clothing purchases with second-hand purchases, and those who buy second-hand clothes in addition to new ones. The former group would answer "yes" to Stevenson's question, while the latter group would answer "no".

With this categorisation, we were able to link each behaviour in our study to a response to Stevenson's question (see on Figure 24).

Figure 24: Linking of the behaviour of our survey and Stevensons and Gmitrowicz (2012) study

Clotuche, L. Hanon, C. 2023

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Study into consumer second-hand shopping behaviour to identify the re-use displacement affect,* by Stevenson and Gmitrowicz. (2012). https://zerowastescotland.org.uk/sites/default/files/Study%20into%20consumer%20second-hand%20shopping%20behaviour%20to%20identify%20the%20re-use%20displacement%20affect.pdf Copyright 2012. Adapted with permission.

Using this approach, we derived our own formula (based on Stevenson's formula) that allows us to calculate the replacement rate for second-hand clothing purchases in our sample (see Figure 25).

Figure 25: Constructed formula to evaluate replacement rate

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from *Study into consumer second-hand shopping behaviour to identify the re-use displacement affect,* by Stevenson and Gmitrowicz. (2012). https://zerowastescotland.org.uk/sites/default/files/Study%20into%20consumer%20second-hand%20shopping%20behaviour%20to%20identify%20the%20re-use%20displacement%20affect.pdf Copyright 2012. Adapted with permission.

Now that the formula is constructed for our specific study, we collected data on the number of second-hand clothes purchased in the past three months, both by the group of buyers who replace their new clothes purchases with second-hand purchases and by the total number of second-hand clothes purchased in the past three months.

To do so, we used the data collected in our survey. As you can see from Table 38, our questionnaire included ranges of responses. To simplify the ranges for calculation purposes, we took the average of the smallest and largest values. For example, a range of 3 to 5 pieces became 4 pieces. For the range over 10, we assumed the midpoint was 15, although we did not know this value beforehand.

To calculate the total number of garments purchased by our *Vinted* shoppers in the past three months, we multiplied the simplification of each range by the number of respondents who chose each range. For example, if 10 respondents chose a range of 3-5 garments, we multiplied 4 (the midpoint of the range) by 10 to get 40. We repeated this process for all ranges and added up the results to get a total of 840.5 garments purchased on *Vinted* in the last 3 months by our surveyed *Vinted* shoppers (see Table 38).

Table 38: Evaluation of the number of clothes purchased on Vinted the past 3 months by the Vinted buyers respondent in the survey

Number of second-hand items bought on Vinted	Simplification	# respondent	% respondent	TOTAL
1-2 p	1.5	135	57.20%	202.5
3-5 p	4	62	26.30%	248
5-10 p	7.5	26	11.00%	195
>10P	15	13	5.50%	195
TOTAL NUMBER OF SECOND-HAND CLOTHES BOUGHT ON VINTED		**236**	**100.00%**	**840.5**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Next, we looked specifically at the number of second-hand clothes purchased over the last three months by *Vinted* buyers, replacing the purchase of new clothes with second-hand clothes. As you can see in Table 39, we used the same reasoning as for the previous table (see Table 38). Thus, 200 garments purchased over the last 3 months replace the purchase of new garments.

Table 39 : Evaluation of the number of clothes purchased on Vinted the past 3 months by the Vinted buyers respondent replacing new items by second-hand items in the survey

Number of second-hand clothes bought by respondent replacing new clothes by second-hand clothes	# respondents	Total clothes
1.5	46	69
4	14	56
7.5	4	30
15	3	45

TOTAL CLOTHES REPLACING NEW ITEMS		**200**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Finally, based on the formula explained in Figure 25 inspired by Stevenson and Gmitrowicz (2012) and Farrant et al. (2010), we were able to compute the replacement rate as follows: 200/840.5 = 23.8% (see Table 40). The replacement rate of new clothes by second-hand clothes in Belgium on *Vinted* buyers is 23.8%.

Table 40: Calculation of the replacement rate

Replacement rate calculation	# of second-hand clothes
Second-hand clothes replacing the purchase of new clothes	200
Second-hand clothes bought on Vinted	840.5
Replacement rate	**23.80%**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

11.Life span left

To assess the remaining life of clothes sold on *Vinted*, we surveyed sellers on the platform using our survey and asked them to indicate the condition of the clothes they put up for sale. We assumed their answer was applicable to any type of clothing and that our respondents are representative of the Belgian population using *Vinted.* The survey included four options to choose from, as shown in Table 41.

We then estimated the remaining life span for each possible answer, based on our expertise in sustainable fashion and apparel durability. For example, we estimated that clothes labelled as "like new" had an average remaining life of 100%, while those labelled as "very good" had an average remaining life of 80%, those labelled as "good condition" had an average life span of 65% and those labelled as "satisfactory" had an average life span of 50%. We then calculated a weighted average of the remaining life spans considering the percentage of seller respondents who selected each of the options. This allowed us to estimate the average remaining life span of clothes offered for sale by *Vinted* sellers in Belgium. As a result, the average life span left of clothes sold on *Vinted* by our respondent is 79%.

Table 41: Calculation of the average life span left of second-hand clothes sold on Vinted

Main condition of the clothes when being resold	Life span left	#people	% people
New	100%	15	6.40%
Very good state	80%	187	80.30%
Good state	65%	27	11.60%
Satisfactory	50%	4	1.70%
Weighted average main condition of the clothes when being resold on Vinted	**79%**		

Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

12.ReCiPe 2008 tool guidelines

The *ReCiPe 2008* tool repository is a methodology for assessing the environmental impact of a product or process throughout its life cycle, from the extraction of raw materials to its disposal or recycling. This methodology provides a standardised set of impact assessment categories and indicators that can be used to harmonise the results of different LCAs. By applying the *ReCiPe 2008* method to existing LCA data, it is possible to compare and integrate the results of different studies, even if they used different impact evaluation methods (Goedkoop et al., 2009).

In addition, the *ReCiPe 2008* methodology offers intermediate and final impact categories, which can help provide a more comprehensive understanding of the environmental impacts of a product or process. The middle categories represent the specific environmental mechanism or stressor that is affected, while the effect categories represent the potential harm or damage caused by the impact (Goedkoop et al., 2009).

By using the *ReCiPe 2008* methodology to harmonise existing LCA data, it is possible to (Goedkoop et al., 2009):

- Compare and integrate results from different LCAs more easily
- Provide a more complete picture of the environmental impacts of a product or process
- Identify areas for improvement and support decision-making towards more sustainable alternatives

More information can be found on the following document: https://web.universiteitleiden.nl/cml/ssp/publications/recipe_characterisation.pdf

13. Data processing detailed explanations

We used three softwares, namely *Tableau Prep Builder*, *Tableau Desktop* and *Excel*, to analyse the data collected through our questionnaire. The survey results were first collected in an Excel sheet, which we cleaned up using *Tableau Prep Builder*.

Tableau Prep Builder

In *Tableau Prep Builder*, we **organised the collected data** by keeping only the English versions of the questions and responses. Next, we simplified the name of each column to reflect the specific variable being studied in that column, as each column represented a question on our survey. This streamlining process made it easier to analyse the data in *Tableau Desktop* and *Excel*. In addition, for questions where respondents could type in data, we sorted and grouped the responses from *Vinted* users to better understand their comments. To streamline our analysis process, we created two additional databases based on our main database of 400 survey respondents. One database consisted solely of respondents who identified themselves as sellers, while the other included only those who identified as buyers. This filtering process enables us to conduct a more focused and efficient analysis going forward.

After cleaning the data, we worked simultaneously with *Tableau Desktop* and then *Excel* to analyse it.

Tableau Desktop

While the graphs generated by *Google Forms* based on our survey results provide a first understanding of our sample (cf. Appendix 15), we sought to perform a more in-depth analysis of the demographics of survey participants. To this end, we used *Tableau Desktop* software to **further explore the data**. Our analysis produced a variety of informative charts that examine different variables.

Initially, we examined the overall composition of our sample by mapping the distribution of respondents across Belgium and assessing their demographic characteristics, such as gender and age. Furthermore, we investigated whether participants identified as both sellers and buyers (cf. supra Social and demographic profile of survey's respondents p.76; cf. Appendix 17).

Next, we created graphs that analysed the specific **profiles of the buyer and seller** respondents in terms of their age, sex, status, and activity. In particular, for buyers, we delved into their motives for purchasing second-hand clothing on *Vinted* and their shopping behaviours when buying second-hand clothes on *Vinted.* For sellers, we investigated the primary conditions of the clothes they sell on *Vinted* and the number of times a garment is worn before being sold.

The collection and analysis of these demographic data from the Belgian population proved to be an invaluable asset, providing an essential element to our study and enabling us to obtain complete and coherent results.

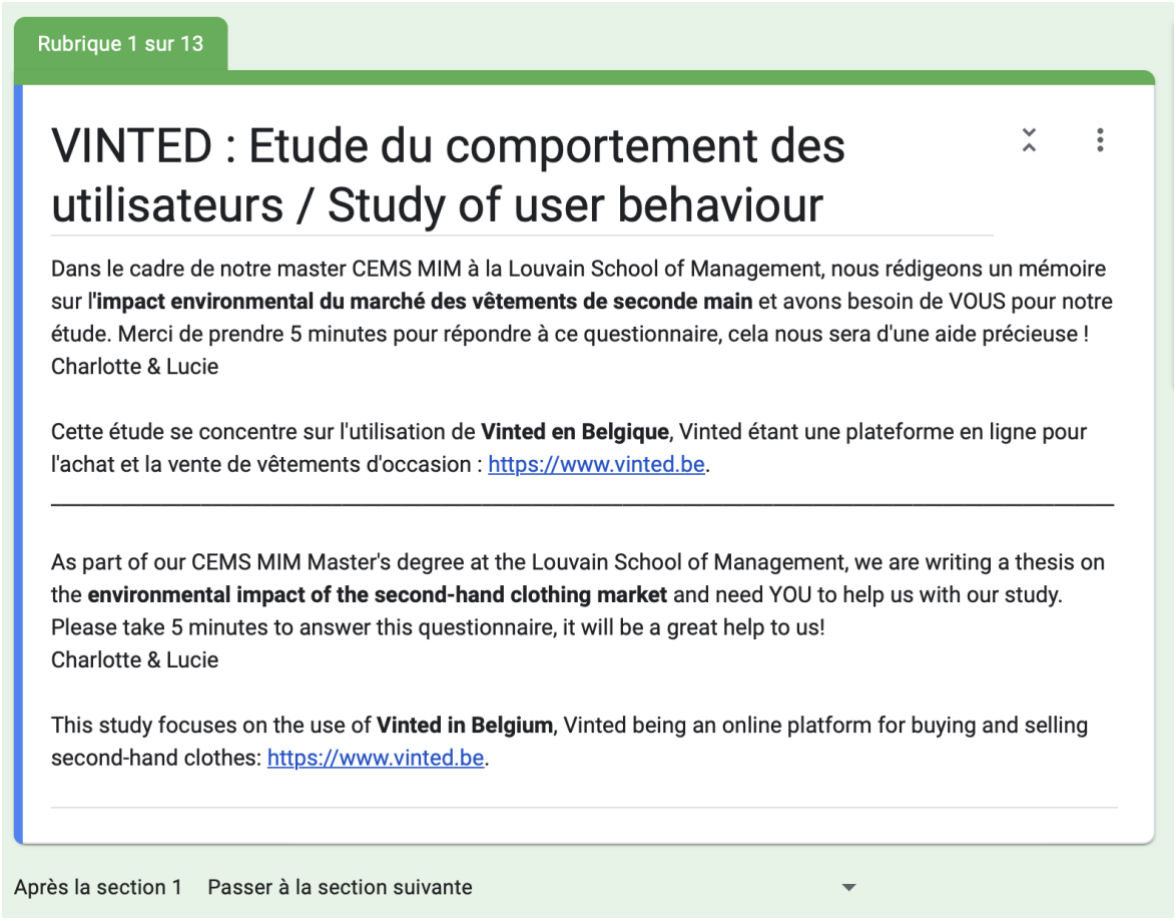
Excel

Then, we used Excel to **calculate the data needed to run the LCAs**. First, focusing on *Vinted* buyers, we sought to understand the type of second-hand clothing they purchase on the platform. In addition, we looked at their behaviour to determine the replacement rate (cf. Appendix 16).

We then analysed the condition of the clothes resold on *Vinted* by the sellers. This helped us estimate the life span left of clothes sold on *Vinted* (cf. Appendix 16).

Finally, based on the data collected from both buyers and sellers regarding the shipment of *Vinted* clothing packages, we analysed the distance between their home and the nearest *Mondial Relay* point, as well as the most commonly used means of transportation for this route. This analysis allowed us to calculate the average distance travelled by *Vinted* users to drop-off/pick-up a second-hand clothing and estimate the ratio of means of transport used (cf. Appendix 16).

14.Survey questions



Rubrique 1 sur 13

VINTED : Etude du comportement des utilisateurs / Study of user behaviour

Dans le cadre de notre master CEMS MIM à la Louvain School of Management, nous rédigeons un mémoire sur l'**impact environmental du marché des vêtements de seconde main** et avons besoin de VOUS pour notre étude. Merci de prendre 5 minutes pour répondre à ce questionnaire, cela nous sera d'une aide précieuse !
Charlotte & Lucie

Cette étude se concentre sur l'utilisation de **Vinted en Belgique**, Vinted étant une plateforme en ligne pour l'achat et la vente de vêtements d'occasion : https://www.vinted.be.

As part of our CEMS MIM Master's degree at the Louvain School of Management, we are writing a thesis on the **environmental impact of the second-hand clothing market** and need YOU to help us with our study. Please take 5 minutes to answer this questionnaire, it will be a great help to us!
Charlotte & Lucie

This study focuses on the use of **Vinted in Belgium**, Vinted being an online platform for buying and selling second-hand clothes: https://www.vinted.be.

Après la section 1 Passer à la section suivante

Rubrique 2 sur 13

Données démographiques / Demographic data

Ce questionnaire est anonyme. / This questionnaire is anonymous.

Quel âge avez-vous? / How old are you? *

- <16 ans / years old
- 16-18 ans / years old
- 18-25 ans / years old
- 25-34 ans / years old
- 35-44 ans / years old
- 45-60 ans / years old
- >60 ans / years old

Dans quelle ville habitez-vous en Belgique ? / In which city do you live in Belgium? *

Réponse courte

Quel est votre code postal ? / What is your postcode? *

Réponse courte

Quel est votre pays d'origine ?/ What is your home country ? *

Réponse courte

Quelle est votre ville d'origine ? / What is your hometown ? *

Réponse courte

Quel est le code postal de votre ville d'origine?/ What is the postcode of your hometown ? *

Réponse courte

A quel genre vous identifiez-vous? / Which gender do you identify with? *

- Homme / Male
- Femme / Female
- Autre / Other

Quel est votre occupation? / What is your activity? *

- Etudiant / Student
- Doctorant
- Saisonnier / Seasonal
- Travailleur à temps plein / Full-time worker
- Travailleur à temps partiel / Part-time worker
- Au chômage / Unemployed
- Entrepreneur
- Au foyer / At home
- Pensionné / Retired

Quel est votre statut? / What is your status? *

- Célibataire / Single
- Marié / Married
- Divorcé / Divorced
- En ménage / Living with a partner
- Veuf-Veuve / Widow-Widower

Avez vous des enfants? / Do you have children? *

- Oui/ Yes, 1
- Oui/ Yes, 2
- Oui/ Yes, 3
- Oui/ Yes, 4
- Oui, plus que 4 / Yes, more than 4
- Non / No

Quel est le budget mensuel moyen que vous allouez pour **acheter vos vêtements** (seconde main incluse) ? / What is the average monthly budget you allocate to buy your clothes (including second hand)? *

- Je n'achète pas de vêtements/ I don't buy clothes
- Entre 1€ & 20€ / Between 1€ & 20€
- Entre 20€ & 50€ / Between 20€ & 50€
- Entre 50€ & 100€ / Between 50€ & 100€
- Entre 100€ & 200€ / Between 100€ & 200€
- Entre 200€ & 300€ / Between 200€ & 300€
- Plus de 300€ / More than 300€

Rubrique 3 sur 13

Utilisation des vêtements seconde main (hors accessoires et chaussures) / Use of second-hand clothing (excluding accessories and shoes)

Cette section s'intéresse à votre rapport avec les vêtements de seconde main. / This section looks at your relationship with second-hand clothes.

Achetez-vous des vêtements de seconde main ? / Do you buy second-hand clothes? *

- ◯ Oui / Yes
- ◯ Non / No

Si oui, où achetez-vous de la seconde main? / If yes, where do you buy second hand? *

- ☐ Dans des friperies / In thrift shops
- ☐ Sur Vinted / On Vinted
- ☐ Sur une autre plateforme (Vestiaire Collective, RealReal, Ebay, etc.) / On another platform (Vestiaire Co...
- ☐ Dans des magasins sociaux (Les Petits Riens, La Croix Rouge, Oxfam) / In social shops (Les Petits Rie...
- ☐ Je n'achète pas de seconde main / I don't buy second hand
- ☐ Autre...

Quel est le budget moyen que vous allouez pour l'achat de vêtements de **seconde main** par mois? / What is the average budget you allocate to buying **second-hand** clothes per month?

- ◯ Entre 0€ & 20€ / Between 0€ & 20€
- ◯ Entre 20€ & 50€ / Between 20€ & 50€
- ◯ Entre 50€ & 100€ / Between 50€ & 100€
- ◯ Entre 100€ & 200€ / Between 100€ & 200€
- ◯ Entre 200€ & 300€ / Between 200€ & 300€
- ◯ Plus de 300€ / More than 300€

Quel est le **pourcentage approximatif** de vêtements achetés en seconde main dans votre garde-robe? / What is the approximate percentage of second-hand clothing purchased in your wardrobe? *

- 0%
- 1 - 5%
- 5 - 10%
- 10 - 15%
- 15 - 20%
- 20 - 40%
- 40 - 50%
- + 50%

Combien de **pièces en moyenne** achetez-vous en seconde main par mois? / On average, how many used parts do you buy per month? *

- Moins de 1 vêtement / Less than 1 garment
- Entre 1 & 2 pièces / Between 1 & 2 items
- Entre 3 & 5 pièces / Between 3 & 5 items
- Entre 6 & 10 pièces / Between 6 & 10 items
- Plus que 10 pièces / More than 10 items

Après la section 3 Passer à la section suivante

Rubrique 4 sur 13

Achats sur Vinted / Shopping on Vinted

Cette section est destinée à savoir si vous faites des achats sur Vinted. / This section is intended to find out if you shop on Vinted.

Achetez-vous sur Vinted ? / Do you buy on Vinted? *

- ○ Oui / Yes
- ○ Non / No

Après la section 4 Passer à la section suivante

Rubrique 5 sur 13

L'achat seconde main sur Vinted (hors accessoires et chaussures) / Second-hand purchases on Vinted (excluding accessories and shoes)

Cette section est destinée aux personnes qui achètent des vêtements sur Vinted. / This section is for people who buy clothes on Vinted.

Pour qui achetez-vous des vêtements sur Vinted? / Who do you buy clothes for on Vinted? *

- ☐ Pour moi / For me
- ☐ Pour mon/ma conjoint(e) / For my partner
- ☐ Pour mes enfants / For my children
- ☐ Autre...

A quelle fréquence consultez-vous Vinted ? / How often do you go on Vinted? *

- ○ Une fois par jour / Once a day
- ○ Une fois par semaine / Once a week
- ○ Une à trois fois par mois / Once to three times a month
- ○ Une fois par mois / Once a month
- ○ Moins d'une fois par mois / Less than once a month
- ○ Autre...

Quel type de vêtements achetez-vous sur Vinted ?/ What is the type of clothes you buy on Vinted? *

- ☐ Des vêtements de tous les jours / Daily clothing
- ☐ Des vêtements pour des occasions-évènements / Clothing for special occasions and events
- ☐ Des vêtements de sport / Sportswear
- ☐ Autre...

Quel type de vêtements achetez-vous sur Vinted (hors accessoires et chaussures)? / What types of clothes do you buy on Vinted (excluding accessories and shoes)? *

- ☐ T-shirt / T-shirt
- ☐ Pull / Jumper
- ☐ Pantalon / Trousers
- ☐ Robe / Dress
- ☐ Jupe / Skirt
- ☐ Autre...

Quel est le pourcentage approximatif de vêtements dans votre garde-robe ayant été achetés en **seconde main sur Vinted** dans votre garde-robe? / Approximately what percentage of your wardrobe were **purchased in second-hand on Vinted**? *

- ○ 1 - 5%
- ○ 5 - 10%
- ○ 5 - 15%
- ○ 15 - 20%
- ○ 20 - 40%
- ○ 40 - 50%
- ○ +50%

Combien de vêtements **avez-vous acheté sur Vinted** durant les 3 derniers mois? / How much clothing have you **bought on Vinted** in the last 3 months? *

- ○ 1 à 2 pièces / 1 to 2 items
- ○ 3 à 5 pièces / 3 to 5 items
- ○ 5 à 10 pièces / 5 to 10 items
- ○ Plus que 10 pièces / More than 10 items

Pourquoi achetez-vous en seconde main sur Vinted? / **Why** do you buy second-hand on Vinted? *

- ☐ Pour des raisons éthiques / For ethical reasons
- ☐ Pour des raisons environnementales / For environmental reasons
- ☐ Pour des raisons financières / For financial reasons
- ☐ Car j'apprécie fouiller Vinted afin de trouver la pièce unique ("chasse au trésor") / Because I enjoy sear...
- ☐ Car je ne trouve pas ce vêtement en neuf / Because I can't find this item of clothing new in shops
- ☐ Car cela correspond à ce que dont je recherche (style) / Because this is what I am looking for (style)

Quand vous achetez un vêtement en seconde main sur Vinted : / When you buy a second-hand garment on Vinted : *

- ○ Vous l'auriez acheté neuf si vous ne l'aviez pas trouvé en seconde main / You would have bought it ne...
- ○ Vous l'achetez en plus d'achats de vêtements neufs. Vous considérez les vêtements de seconde main ...
- ○ Vous n'achetez (presque) jamais de vêtements neufs. / You (almost) never buy new clothes.

Après la section 5 Passer à la section suivante

Rubrique 6 sur 13

Achats de vêtement "extra" sur Vinted en plus d'achats de vêtements neufs / Purchases of "extra" clothing on Vinted in addition to new clothing purchases

Cette section est destinée à comprendre votre consommation de vêtements neufs ainsi que de vêtements "extra" achetés sur Vinted. / This section is intended to understand your consumption of new clothing as well as " extra" clothing purchased on Vinted.

En moyenne, combien de vêtements neufs achètes-tu par mois ?/ On average, how many new clothes do you buy per month? *

- ○ 1 pièce / garment
- ○ 2 pièces / garments
- ○ 3 pièces / garments
- ○ 4 pièces / garments
- ○ 5 -10 pièces / garments
- ○ 10-15 pièces / garments
- ○ > 15 pièces / garments
- ○ Autre...

En moyenne, combien de vêtements "extra" (= vêtements achetés en plus de l'achat de vêtements neufs) achètes-tu par mois sur Vinted ?/ On average, how many "extra" clothes (=clothes bought in addition to new clothes) do you buy per month on Vinted? *

- 1 pièce / garment
- 2 pièces / garments
- 3 pièces / garments
- 4 pièces / garments
- 5 -10 pièces / garments
- >10 pièces / garments
- > 15 pièces / garments
- Autre...

Après la section 6 Passer à la section suivante

Rubrique 7 sur 13

Vente sur Vinted / Selling on Vinted

Cette section est destinée à savoir si vous vendez des vêtements sur Vinted. / This section is for you to find out if you sell clothes on Vinted.

Vendez-vous sur Vinted ? / Do you sell on Vinted? *

- Oui / Yes
- Non / No

Après la section 7 Accéder à la page 8 (Vente sur Vinted (...sories and shoes))

Rubrique 8 sur 13

Vente sur Vinted (hors accessoires et chaussures) / Selling on Vinted (excluding accessories and shoes)

Cette section est destinée aux personnes qui vendent des vêtements sur Vinted. / This section is for people who sell clothes on Vinted.

Avant de vendre un vêtement sur Vinted, combien de fois l'avez-vous porté en moyenne ? / Before selling a garment on Vinted, how many times did you wear it on average? *

- Je l'ai jamais porté / I've never worn it
- Je l'ai porté moins de 5 fois / I have worn it less than 5 times
- Je l'ai porté entre 5 et 10 fois / I have worn it between 5 and 10 times
- Je l'ai porté une dizaine de fois / I have worn it between 10 and 20 times
- Je l'ai porté une vingtaine de fois / I have worn it between 20 and 30 times
- Je l'ai porté une trentaine de fois / I have worn it between 30 and 40 times
- Je l'ai porté une cinquantaine de fois / I have worn it about 50 times
- Je l'ai porté plus de 50 fois / I have worn it more than 50 times

Quel est majoritairement l'état de votre vêtement lorsque vous le vendez sur Vinted? / What is the main condition of your garment when you sell it on Vinted? *

- ◯ Neuf / New
- ◯ Très bon état / Very good condition
- ◯ Bon état / Good condition
- ◯ Satisfaisant / Satisfactory

En général, comment lavez-vous vos vêtements ? / In general, how do you wash your clothes? *

- ◯ Machine à laver. / Washing machine.
- ◯ À la main. / By hand.
- ◯ Autre...

A quelle fréquence en moyenne lavez-vous vos vêtements? / On average, how often do you wash your clothes? *

- ◯ Après chaque usage / After each use
- ◯ Après 2 usages / After 2 uses
- ◯ Après 3 usages / After 3 uses
- ◯ Après 5 usages / After 5 uses
- ◯ Après plus de 5 usages / After more than 5 uses

En général, mettez-vous vos vêtements au séchoir ? / Do you usually put your clothes in the dryer ? *

- ◯ Yes
- ◯ No

En général, repassez-vous vos vêtements ? / Do you usually iron your clothes?? *

- Yes
- No

Après la section 8 Passer à la section suivante

Rubrique 9 sur 13

Achat et/ou vente sur Vinted

Cette section est destinée aux personnes ayant affirmé être acheteurs et /ou vendeurs sur Vinted dans les sections précédentes. / This section is intended for people who have declared to be buyers and/or sellers on Vinted in the previous sections.

As-tu affirmé être un acheteur et/ou un vendeur sur Vinted dans les sections précédentes ? / Did you declared being a buyer and/or seller on Vinted in the previous sections? *

- Yes
- No

Après la section 9 Passer à la section suivante

Rubrique 10 sur 13

Distance point relais (Mondial Relay) & maison / Distance from pick-up point (Mondial Relay) & home

Cette section s'intéresse à la distance entre votre maison et le point de collecte des colis le plus proche (que vous soyez vendeur/acheteur Vinted ou pas). / This section looks at the distance from your home to the nearest parcel collection point (whether you are a Vinted seller/buyer or not).

Quelle est la distance entre votre maison & le point relais (Mondial Relay) le plus proche ? / What is the distance between your home & the nearest Mondial Relay point? *

- ○ 0 - 2km
- ○ 2 - 4km
- ○ 4 - 6 km
- ○ 6 - 10km
- ○ + 10km

Quel moyen de transport utilisez-vous pour vous rendre au point relais ? / What means of transport do you use to get to the pick-up point? *

- ☐ En voiture / By car
- ☐ A pied or à vélo / On foot or by bike
- ☐ En transports en commun / By public transport
- ☐ Je ne m'y rends jamais car je ne vends/achète pas sur Vinted. / I never go there because I don't sell/bu...

Après la section 10 Passer à la section suivante

Rubrique 11 sur 13

Fin de vie d'un vêtement / End of life of a garment

Cette section s'intéresse à la fin de vie de vos vêtements. / This section looks at the end of life of your clothes.

Comment vous débarrassez-vous d'un vêtement invendable ? / How do you get rid of unsellable clothing? *

- [ ] A la décharge ou au parc à conteneur / At the landfill or container park
- [ ] Donation (Petits Riens, La Croix Rouge, etc.) / Donation (Petits Riens, La Croix Rouge, etc.)
- [ ] Dans les bennes à recycler / In the recycling bins
- [ ] Autre...

Après la section 11 Passer à la section suivante

Rubrique 12 sur 13

Impact environnemental des vêtements de seconde main / Environmental impact of second-hand clothes

Cette section s'intéresse à l'impact environnemental des vêtements de seconde main. / This section looks at the environmental impact of second-hand clothing.

Pensez-vous que les vêtements de seconde main achetés sur Vinted ont un impact positif sur l'environnement ? / Do you think that second-hand clothes bought on Vinted have a positive impact on the environment? *

- ( ) Oui / Yes
- ( ) Non / No
- ( ) Je ne sais pas / I don't know

S'il est confirmé que les vêtements de seconde main achetés sur Vinted ont un impact positif sur l'environnement, achèteriez-vous de préférence des vêtements sur cette plateforme ? / If it is confirmed that second-hand clothes bought on Vinted have a positive impact on the environment, would you buy clothes preferably on this platform? *

- ○ Oui / Yes
- ○ Non / No
- ○ Peut-être / Maybe

Après la section 12 Passer à la section suivante

Rubrique 13 sur 13

Conclusion

Merci beaucoup d'avoir participé à notre questionnaire ! Vos réponses nous sont très précieuses. / Thank you very much for participating in our questionnaire! Your answers are very valuable to us.

Souhaitez-vous ajouter quelque chose ? / Would you like to add something?

Réponse longue

Si vous souhaitez être mis au courant de notre recherche et lire les conclusions de notre mémoire, laissez-nous vos coordonnées. / If you would like to be kept up to date with our research and read the findings of our brief, please leave us your details.

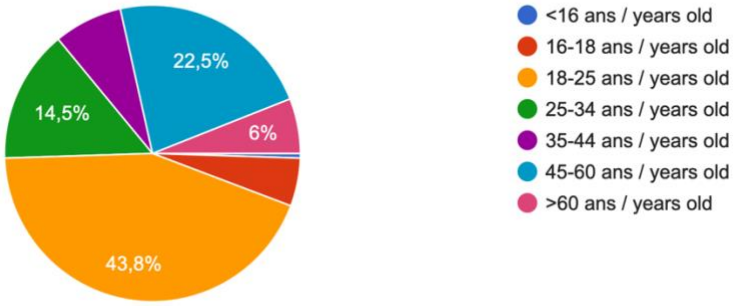
Réponse longue

15.Survey responses

Données démographiques / Demographic data

Quel âge avez-vous? / How old are you?

400 réponses



Dans quelle ville habitez-vous en Belgique ? / In which city do you live in Belgium?

400 réponses

Bruxelles

Arlon

Bruxelles

Jodoigne

Virton

Louvain-la-Neuve

Musson

Arlon

Jodoigne

L

Quel est votre code postal ? / What is your postcode?

400 réponses

6700

1370

6750

1348

1050

1040

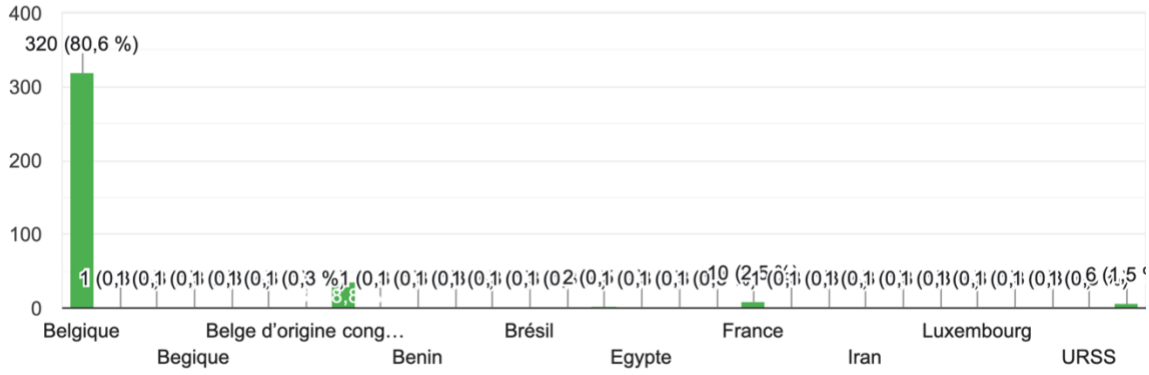
6760

1150

6880

Quel est votre pays d'origine ?/ What is your home country ?

397 réponses



Quelle est votre ville d'origine ? / What is your hometown ?

397 réponses

Arlon

Bruxelles

Jodoigne

Jodoigne

Bruxelles

Namur

Musson

Arlon

Virton

Quel est le code postal de votre ville d'origine?/ What is the postcode of your hometown ?

397 réponses

6700

1370

6750

6760

6880

1367

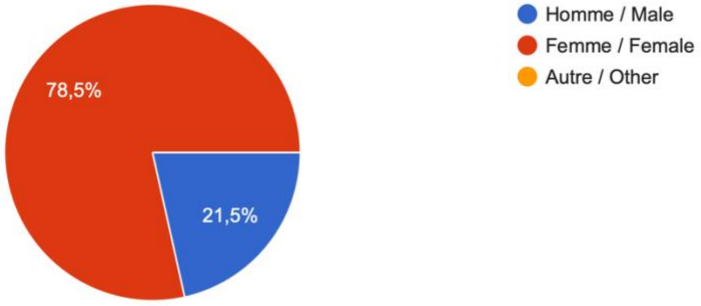
1180

1000

1040

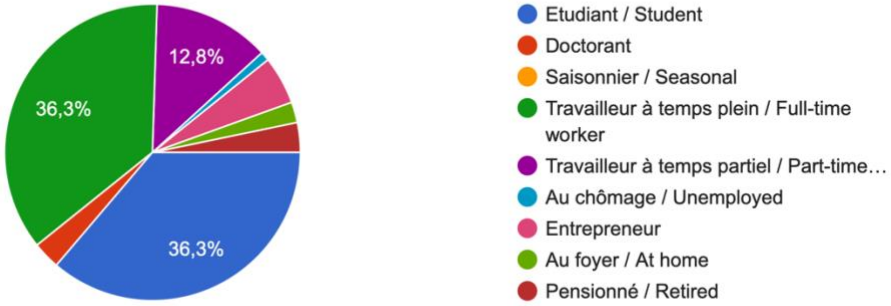
A quel genre vous identifiez-vous? / Which gender do you identify with?

400 réponses



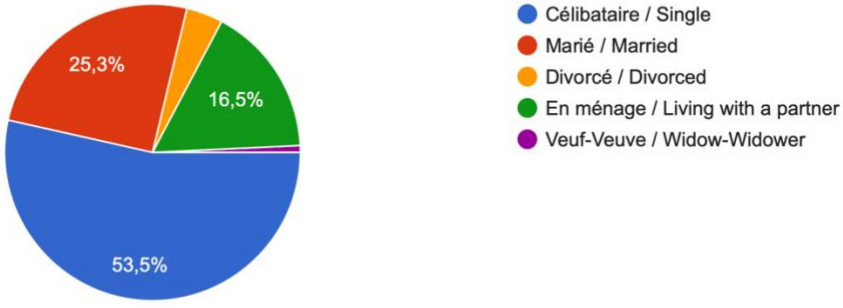
Quel est votre occupation? / What is your activity?

400 réponses



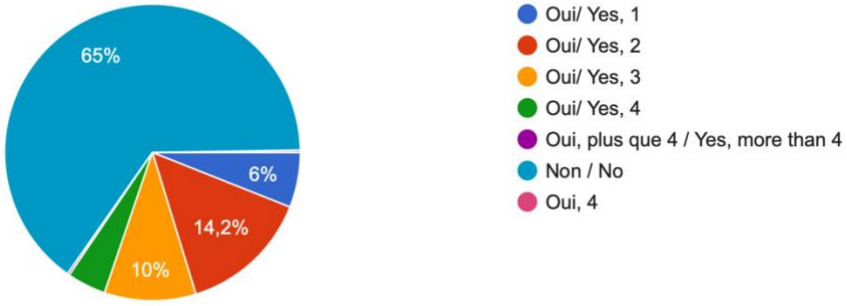
Quel est votre statut? / What is your status?

400 réponses



Avez vous des enfants? / Do you have children?

400 réponses



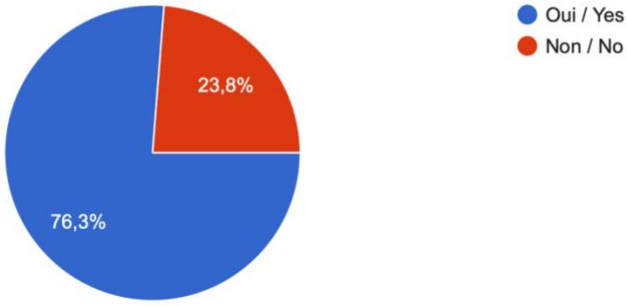
Quel est le budget mensuel moyen que vous allouez pour acheter vos vêtements (seconde main incluse) ? / What is the average monthly budget yo...ocate to buy your clothes (including second hand)?

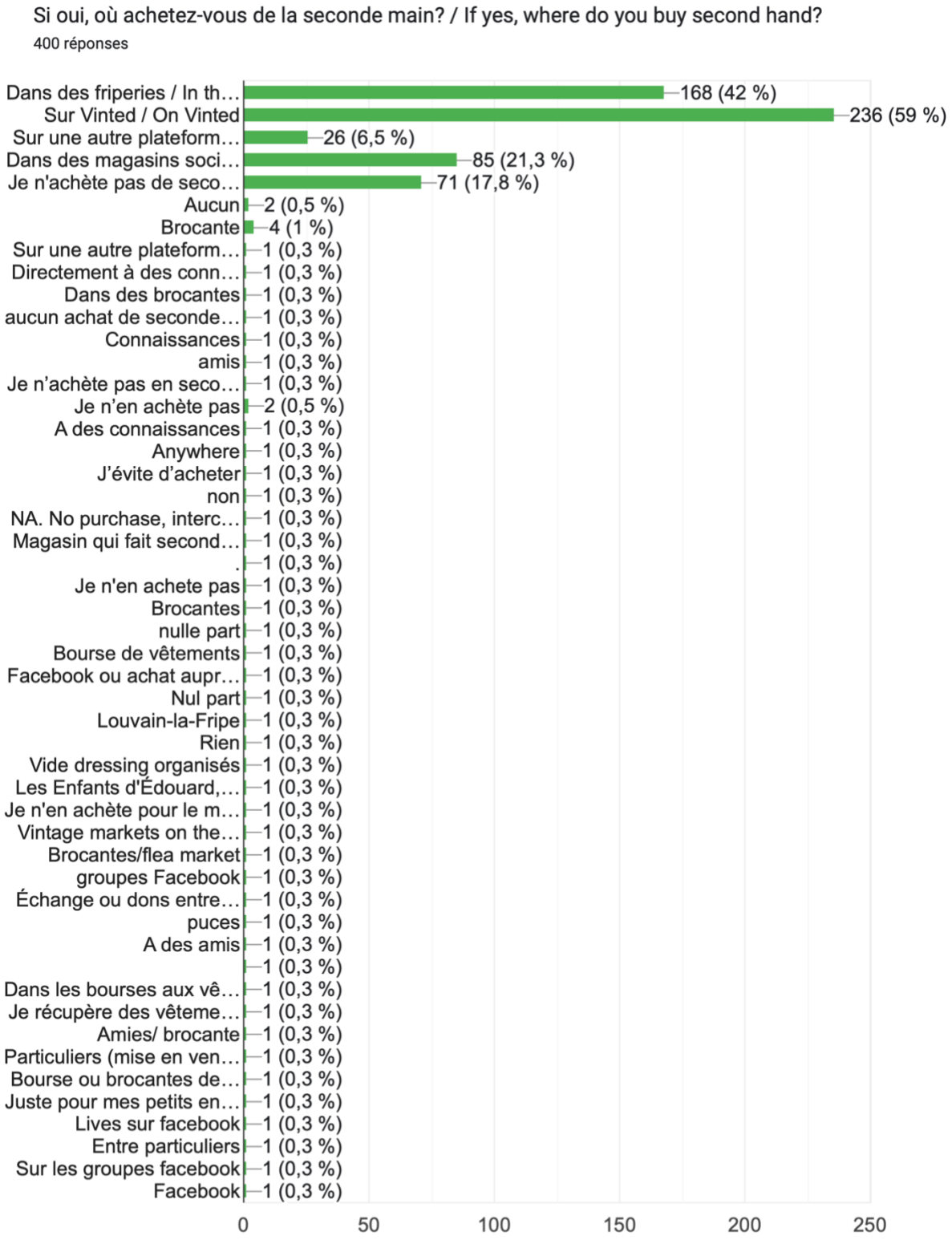
400 réponses

Utilisation des vêtements seconde main (hors accessoires et chaussures) / Use of second-hand clothing (excluding accessories and shoes)

Achetez-vous des vêtements de seconde main ? / Do you buy second-hand clothes?

400 réponses



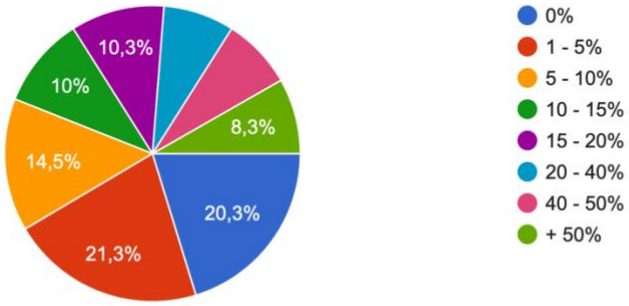

Si oui, où achetez-vous de la seconde main? / If yes, where do you buy second hand?
400 réponses
Dans des friperies / In th… 168 (42 %)
Sur Vinted / On Vinted 236 (59 %)
Sur une autre plateform… 26 (6,5 %)
Dans des magasins soci… 85 (21,3 %)
Je n'achète pas de seco… 71 (17,8 %)
Aucun 2 (0,5 %)
Brocante 4 (1 %)
Sur une autre plateform… 1 (0,3 %)
Directement à des conn… 1 (0,3 %)
Dans des brocantes 1 (0,3 %)
aucun achat de seconde… 1 (0,3 %)
Connaissances 1 (0,3 %)
amis 1 (0,3 %)
Je n'achète pas en seco… 1 (0,3 %)
Je n'en achète pas 2 (0,5 %)
A des connaissances 1 (0,3 %)
Anywhere 1 (0,3 %)
J'évite d'acheter 1 (0,3 %)
non 1 (0,3 %)
NA. No purchase, interc… 1 (0,3 %)
Magasin qui fait second… 1 (0,3 %)
. 1 (0,3 %)
Je n'en achete pas 1 (0,3 %)
Brocantes 1 (0,3 %)
nulle part 1 (0,3 %)
Bourse de vêtements 1 (0,3 %)
Facebook ou achat aupr… 1 (0,3 %)
Nul part 1 (0,3 %)
Louvain-la-Fripe 1 (0,3 %)
Rien 1 (0,3 %)
Vide dressing organisés 1 (0,3 %)
Les Enfants d'Édouard,… 1 (0,3 %)
Je n'en achète pour le m… 1 (0,3 %)
Vintage markets on the… 1 (0,3 %)
Brocantes/flea market 1 (0,3 %)
groupes Facebook 1 (0,3 %)
Échange ou dons entre… 1 (0,3 %)
puces 1 (0,3 %)
A des amis 1 (0,3 %)
1 (0,3 %)
Dans les bourses aux vê… 1 (0,3 %)
Je récupère des vêteme… 1 (0,3 %)
Amies/ brocante 1 (0,3 %)
Particuliers (mise en ven… 1 (0,3 %)
Bourse ou brocantes de… 1 (0,3 %)
Juste pour mes petits en… 1 (0,3 %)
Lives sur facebook 1 (0,3 %)
Entre particuliers 1 (0,3 %)
Sur les groupes facebook 1 (0,3 %)
Facebook 1 (0,3 %)
0
50
100
150
200
250

Quel est le budget moyen que vous allouez pour l'achat de vêtements de seconde main par mois? / What is the average budget you allocate to buying second-hand clothes per month?

370 réponses

Quel est le pourcentage approximatif de vêtements achetés en seconde main dans votre garde-robe? / What is the approximate percentage...second-hand clothing purchased in your wardrobe?

400 réponses



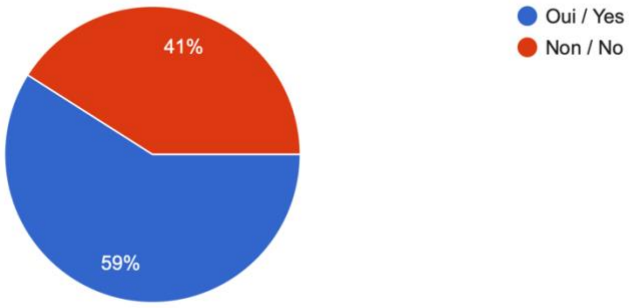
Combien de pièces en moyenne achetez-vous en seconde main par mois? / On average, how many used parts do you buy per month?

400 réponses

Achats sur Vinted / Shopping on Vinted

Achetez-vous sur Vinted ? / Do you buy on Vinted?

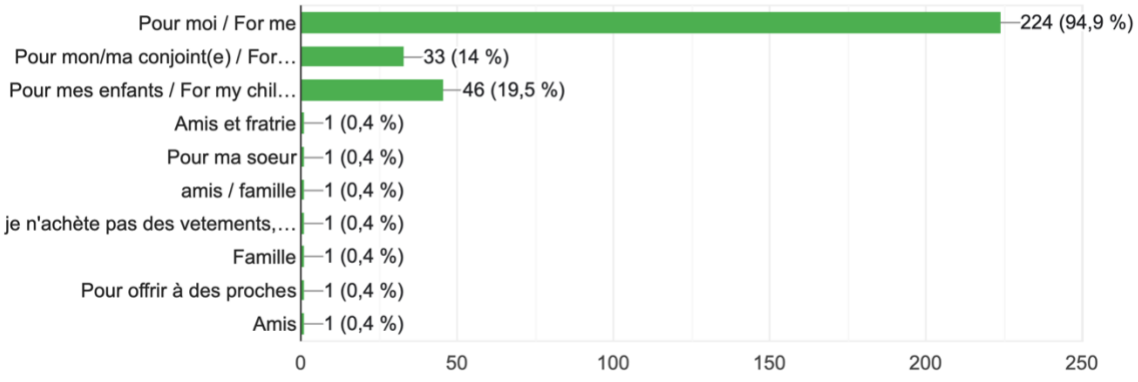
400 réponses



L'achat seconde main sur Vinted (hors accessoires et chaussures) / Second-hand purchases on Vinted (excluding accessories and shoes)

Pour qui achetez-vous des vêtements sur Vinted? / Who do you buy clothes for on Vinted?

236 réponses

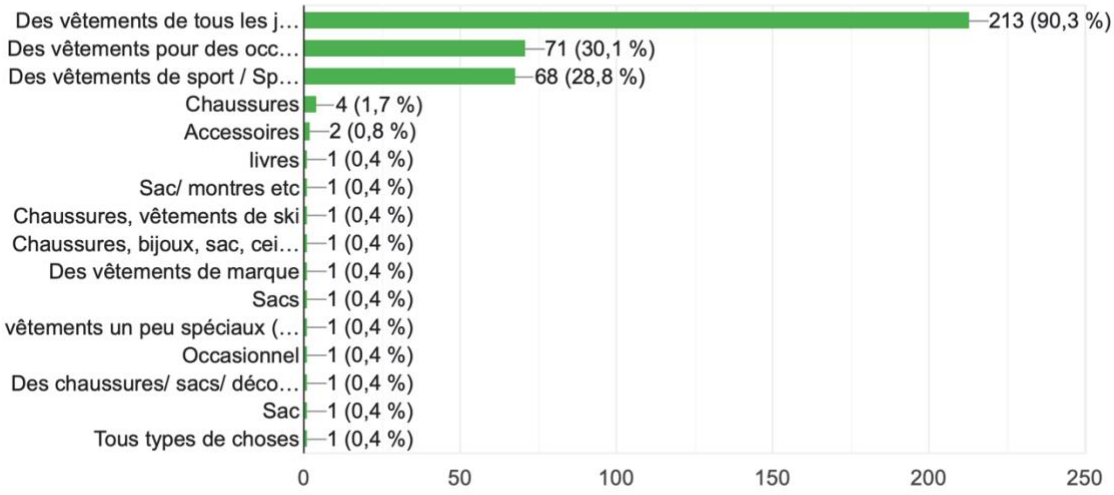


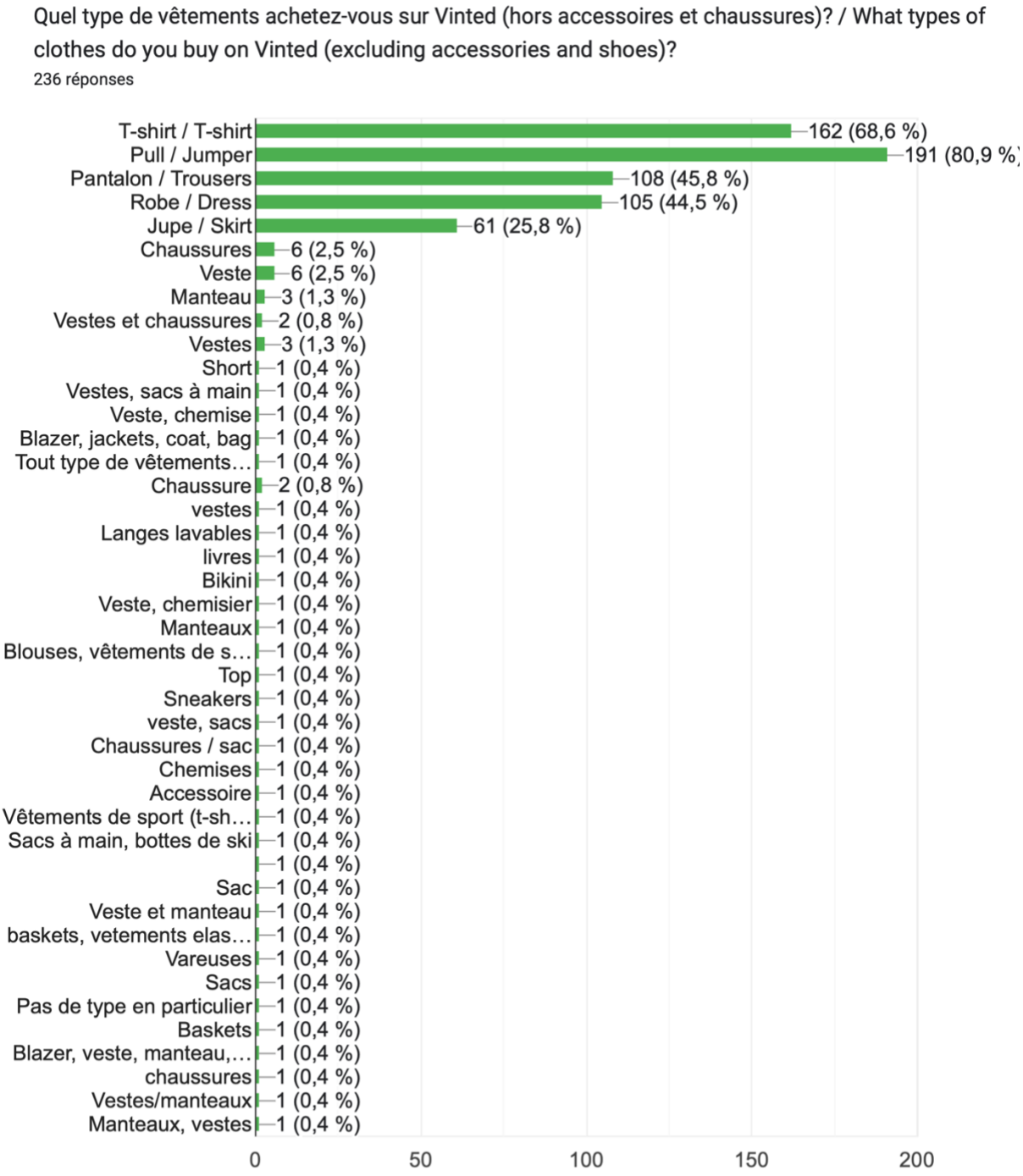
A quelle fréquence consultez-vous Vinted ? / How often do you go on Vinted?

236 réponses

Quel type de vêtements achetez-vous sur Vinted ?/ What is the type of clothes you buy on Vinted?

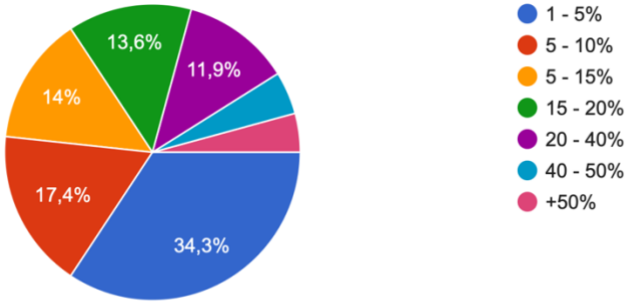
236 réponses




Quel type de vêtements achetez-vous sur Vinted (hors accessoires et chaussures)? / What types of clothes do you buy on Vinted (excluding accessories and shoes)?
236 réponses
T-shirt / T-shirt 162 (68,6 %)
Pull / Jumper 191 (80,9 %)
Pantalon / Trousers 108 (45,8 %)
Robe / Dress 105 (44,5 %)
Jupe / Skirt 61 (25,8 %)
Chaussures 6 (2,5 %)
Veste 6 (2,5 %)
Manteau 3 (1,3 %)
Vestes et chaussures 2 (0,8 %)
Vestes 3 (1,3 %)
Short 1 (0,4 %)
Vestes, sacs à main 1 (0,4 %)
Veste, chemise 1 (0,4 %)
Blazer, jackets, coat, bag 1 (0,4 %)
Tout type de vêtements… 1 (0,4 %)
Chaussure 2 (0,8 %)
vestes 1 (0,4 %)
Langes lavables 1 (0,4 %)
livres 1 (0,4 %)
Bikini 1 (0,4 %)
Veste, chemisier 1 (0,4 %)
Manteaux 1 (0,4 %)
Blouses, vêtements de s… 1 (0,4 %)
Top 1 (0,4 %)
Sneakers 1 (0,4 %)
veste, sacs 1 (0,4 %)
Chaussures / sac 1 (0,4 %)
Chemises 1 (0,4 %)
Accessoire 1 (0,4 %)
Vêtements de sport (t-sh… 1 (0,4 %)
Sacs à main, bottes de ski 1 (0,4 %)
1 (0,4 %)
Sac 1 (0,4 %)
Veste et manteau 1 (0,4 %)
baskets, vetements elas… 1 (0,4 %)
Vareuses 1 (0,4 %)
Sacs 1 (0,4 %)
Pas de type en particulier 1 (0,4 %)
Baskets 1 (0,4 %)
Blazer, veste, manteau,… 1 (0,4 %)
chaussures 1 (0,4 %)
Vestes/manteaux 1 (0,4 %)
Manteaux, vestes 1 (0,4 %)
0
50
100
150
200

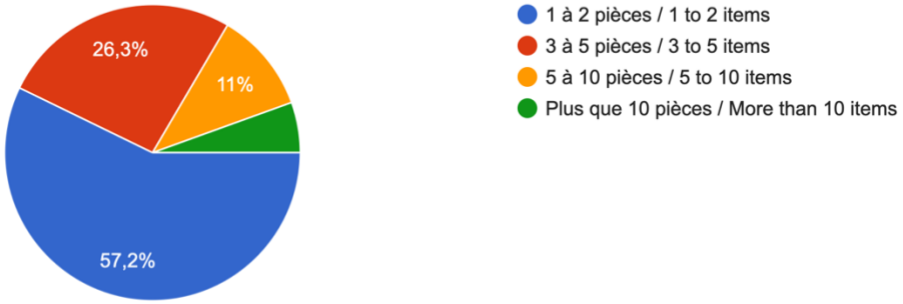
Quel est le pourcentage approximatif de vêtements dans votre garde-robe ayant été achetés en seconde main sur Vinted dans votre garde-robe...rdrobe were purchased in second-hand on Vinted?

236 réponses



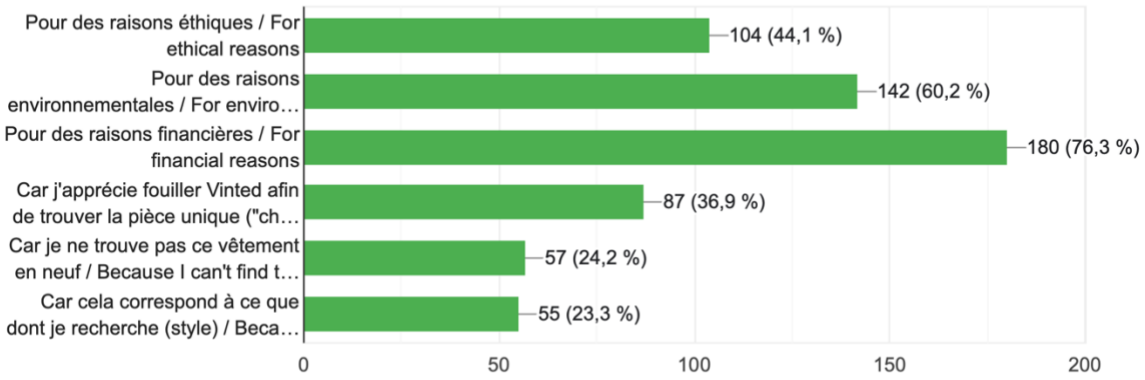
Combien de vêtements avez-vous acheté sur Vinted durant les 3 derniers mois? / How much clothing have you bought on Vinted in the last 3 months?

236 réponses



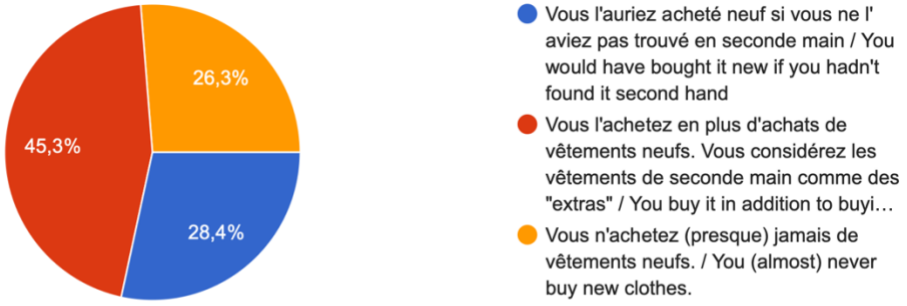
Pourquoi achetez-vous en seconde main sur Vinted? / Why do you buy second-hand on Vinted?

236 réponses



Quand vous achetez un vêtement en seconde main sur Vinted : / When you buy a second-hand garment on Vinted :

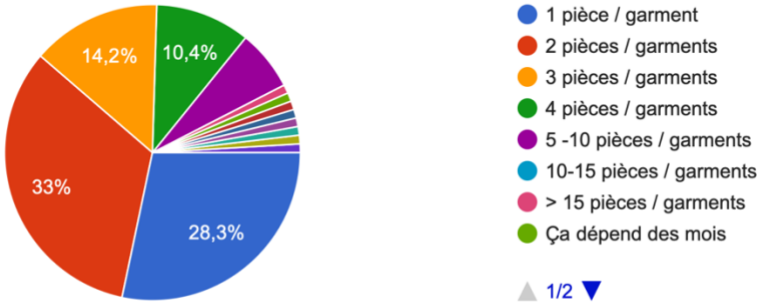
236 réponses



Achats de vêtement "extra" sur Vinted en plus d'achats de vêtements neufs / Purchases of "extra" clothing on Vinted in addition to new clothing purchases

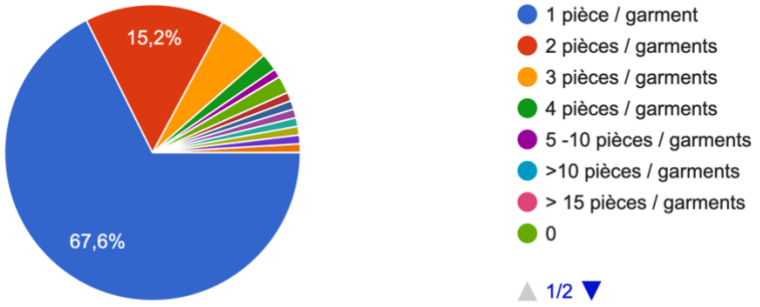
En moyenne, combien de vêtements neufs achètes-tu par mois ?/ On average, how many new clothes do you buy per month?

106 réponses



En moyenne, combien de vêtements "extra" (= vêtements achetés en plus de l'achat de vêtements neufs) achètes-tu par mois sur Vinted ?/ On avera...n to new clothes) do you buy per month on Vinted?

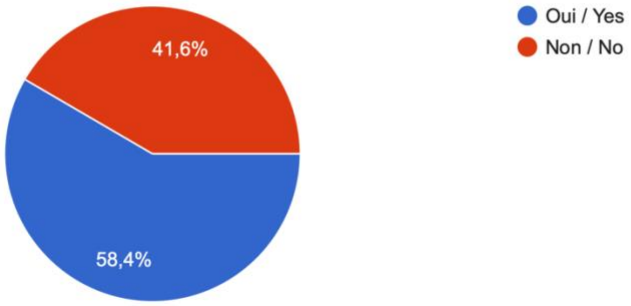
105 réponses



Vente sur Vinted / Selling on Vinted

Vendez-vous sur Vinted ? / Do you sell on Vinted?

399 réponses



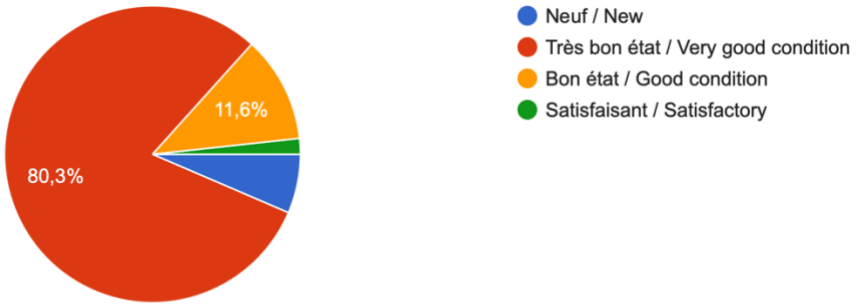
Vente sur Vinted (hors accessoires et chaussures) / Selling on Vinted (excluding accessories and shoes)

Avant de vendre un vêtement sur Vinted, combien de fois l'avez-vous porté en moyenne ? / Before selling a garment on Vinted, how many times did you wear it on average?

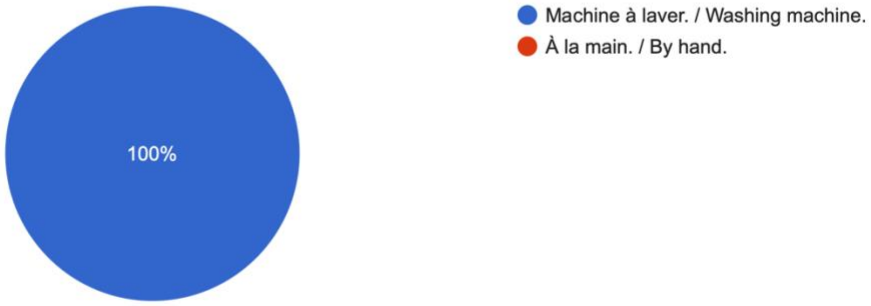
233 réponses

Quel est majoritairement l'état de votre vêtement lorsque vous le vendez sur Vinted? / What is the main condition of your garment when you sell it on Vinted?

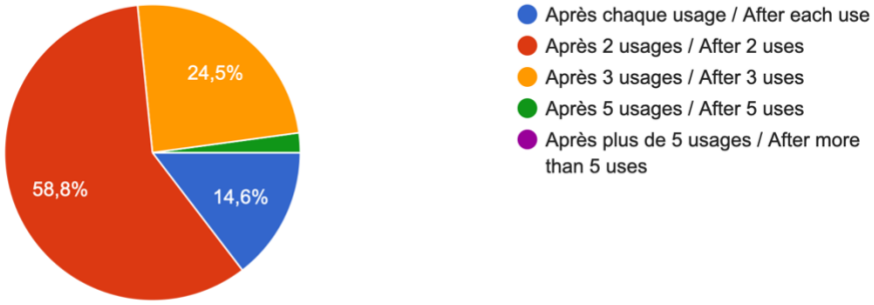
233 réponses



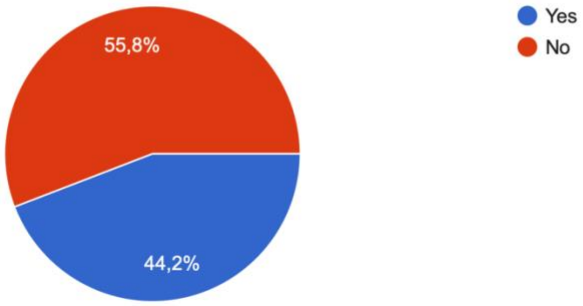
En général, comment lavez-vous vos vêtements ? / In general, how do you wash your clothes?
231 réponses



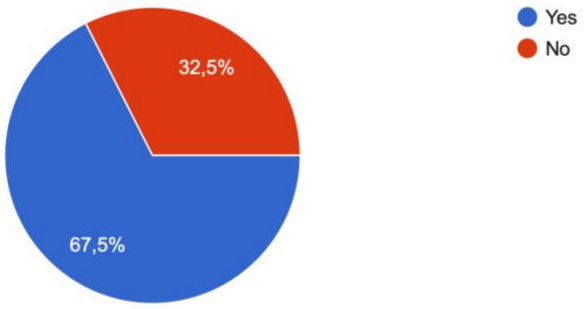
A quelle fréquence en moyenne lavez-vous vos vêtements? / On average, how often do you wash your clothes?
233 réponses



En général, mettez-vous vos vêtements au séchoir ? / Do you usually put your clothes in the dryer ?
231 réponses

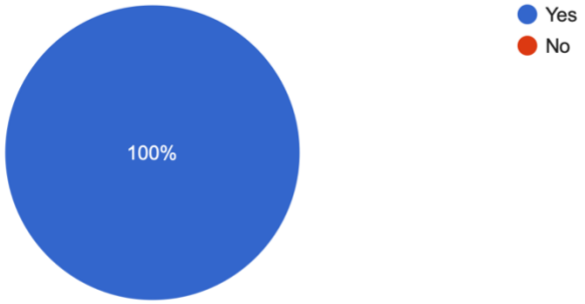


En général, repassez-vous vos vêtements ? / Do you usually iron your clothes??
231 réponses



Achat et/ou vente sur Vinted

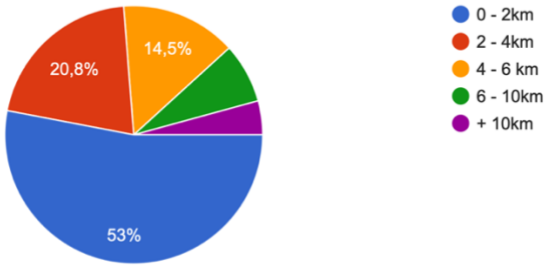
As-tu affirmé être un acheteur et/ou un vendeur sur Vinted dans les sections précédentes ? / Did you declared being a buyer and/or seller on Vinted in the previous sections?
231 réponses



Distance point relais (Mondial Relay) & maison / Distance from pick-up point (Mondial Relay) & home

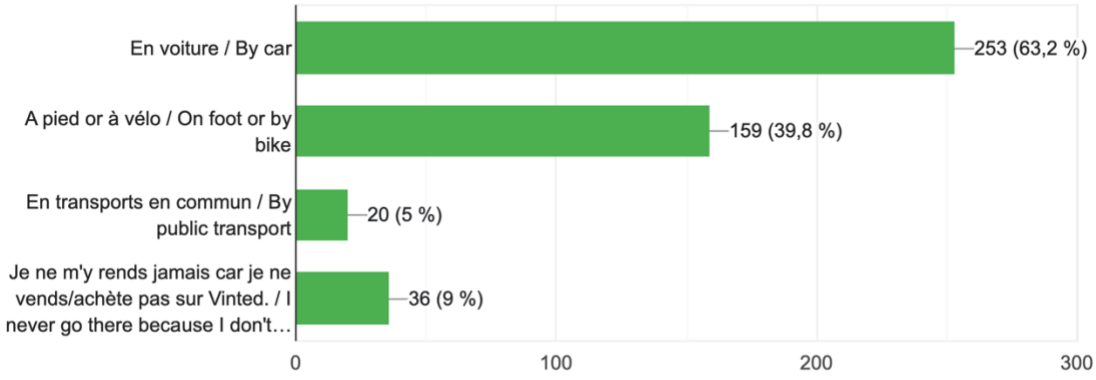
Quelle est la distance entre votre maison & le point relais (Mondial Relay) le plus proche ? / What is the distance between your home & the nearest Mondial Relay point?

400 réponses



Quel moyen de transport utilisez-vous pour vous rendre au point relais ? / What means of transport do you use to get to the pick-up point?

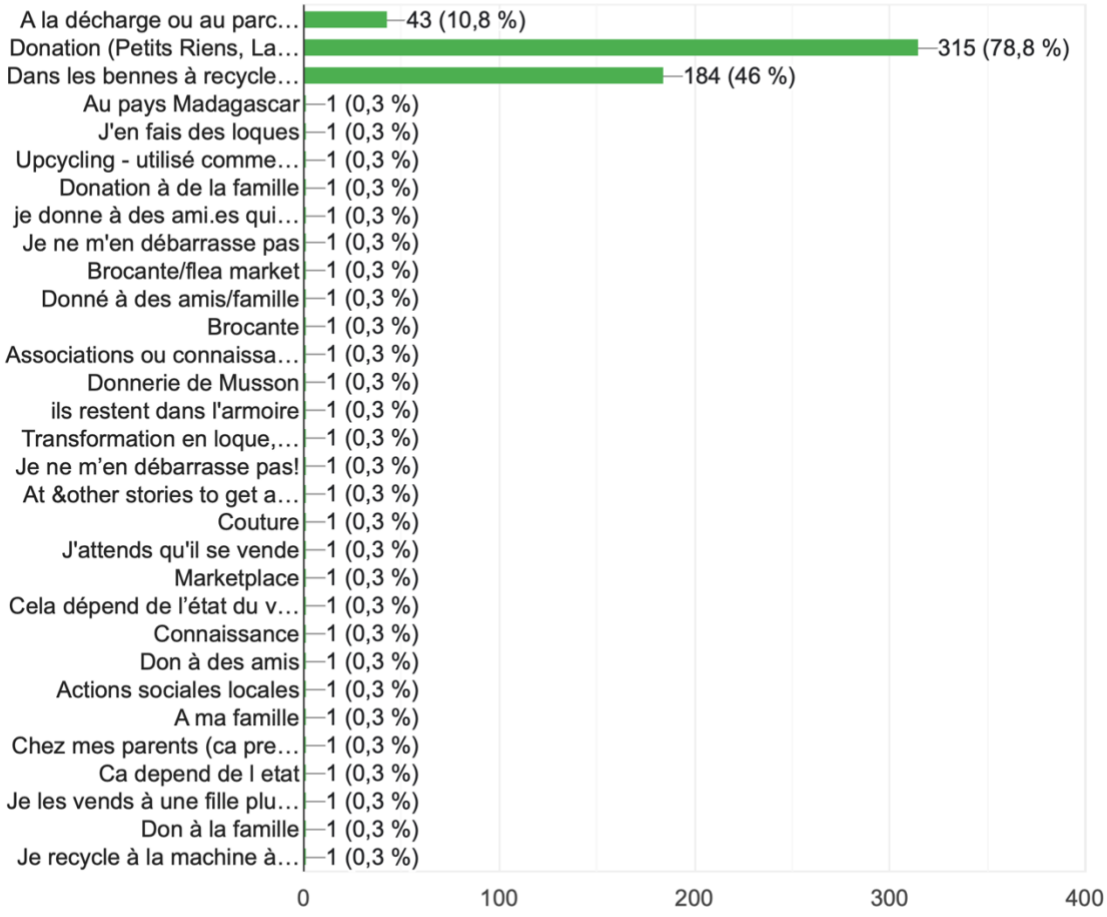
400 réponses



Fin de vie d'un vêtement / End of life of a garment

Comment vous débarrassez-vous d'un vêtement invendable ? / How do you get rid of unsellable clothing?

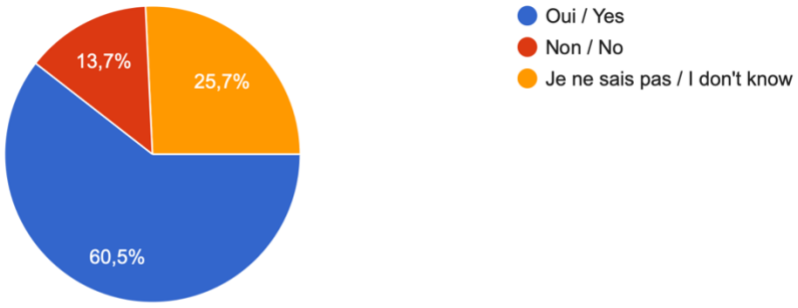
400 réponses



Impact environnemental des vêtements de seconde main / Environmental impact of second-hand clothes

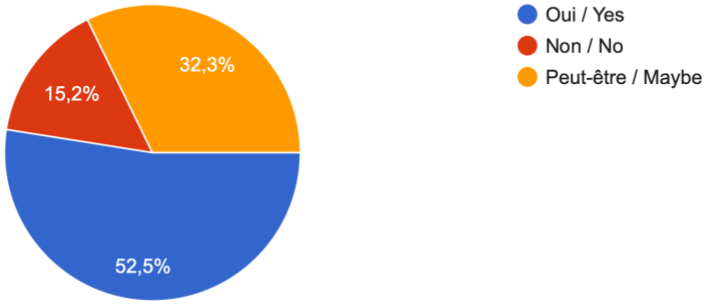
Pensez-vous que les vêtements de seconde main achetés sur Vinted ont un impact positif sur l'environnement ? / Do you think that second-hand ... Vinted have a positive impact on the environment?

400 réponses



S'il est confirmé que les vêtements de seconde main achetés sur Vinted ont un impact positif sur l'environnement, achèteriez-vous de préférence des...would you buy clothes preferably on this platform?

400 réponses



Conclusion

Souhaitez-vous ajouter quelque chose ? / Would you like to add something?

70 réponses

- Non
- No
- nail this master thesis, you got this !!
- Je n'achète que sur Vinted + je reçois beaucoup de vêtements de la part de mon entourage. Je n'aime pas - plus - faire du shopping
- Vinted est un très bon système pour les jeunes et pour les enfants qui grandissent vite
- I started just three months ago to buy on this platform and I really like it. I can buy high quality clothes with cheap price and most of them are in a very good status (almost new).
- À ce stade-ci mes achats Vinted représentent encore un faible pourcentage de mes vêtements parce que ma pratique est relativement récente et que je garde mes vêtements longtemps. Le nombre d'achats sur les 3 derniers mois est bcp plus élevé que la moyenne mensuelle sur une année parce qu'il comprenait mes achats de Noël. C'était une demande de certains de mes enfants de ne recevoir que des vêtements de

Si vous souhaitez être mis au courant de notre recherche et lire les conclusions de notre mémoire, laissez-nous vos coordonnées. / If you would like to be kept up to date with our research and read the findings of our brief, please leave us your details.

63 réponses

- Oui

16.Excel analysis

Figure 26: clothes first life impacts

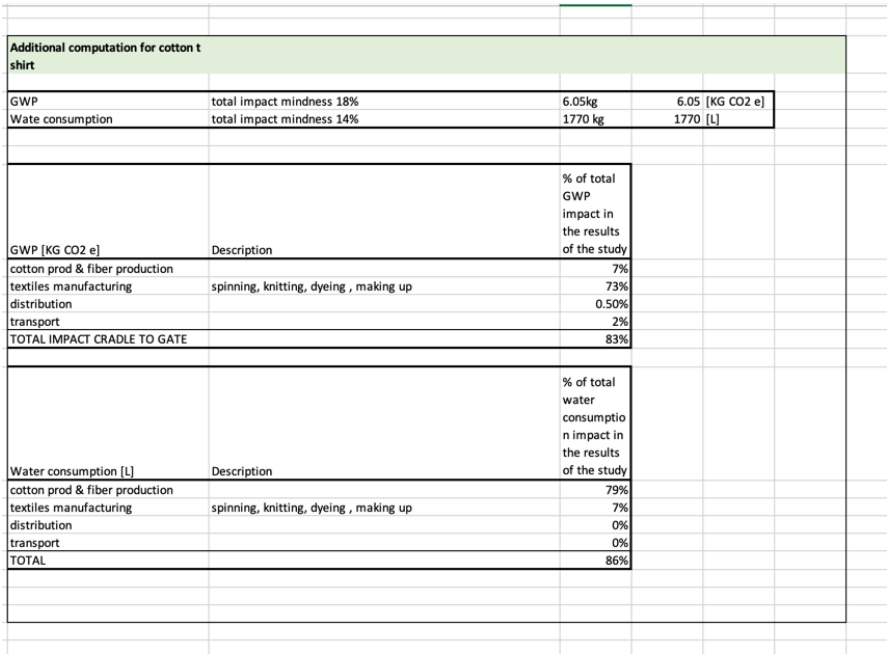
Jeans			
PHASES	PHASES DEFINITION	KG CO2 e	L H2O
Fiber cultivation & Harvest	The harvest and cultivation of raw materials	2.90	2565.00
Fabric Assembly	Yarn spinning, dyeing, weaving, and fabric finishing	9.00	236.00
Cut, Sew & Finish	Garment manufacture	4.30	111.00
Transport & Retail	Transportation between phases and distribution to retail stores	3.80	10.00
TOTAL	TOTAL	20.00	2922.00

T shirt			
PHASES	PHASES DEFINITION	KG CO2 e	L H2O
cotton cultivation		0.42	1398.30
textiles manufacturing	spinning, knitting, dyeing , making up	4.42	123.90
distribution		0.03	0.00
transport		0.12	0.00
TOTAL	**TOTAL**	4.99	1522.20

Sweater			
PHASES	PHASES DEFINITION	KG CO2 e	L H2O
Wool production	The harvest and cultivation of raw materials.	10.90	205.00
Processing	Yarn production & garment manufacturing	5.45	
Retail	in stores	1.10	50.00
TOTAL	**TOTAL**	17.45	255.00

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 27: Additional computations for cotton T-shirt



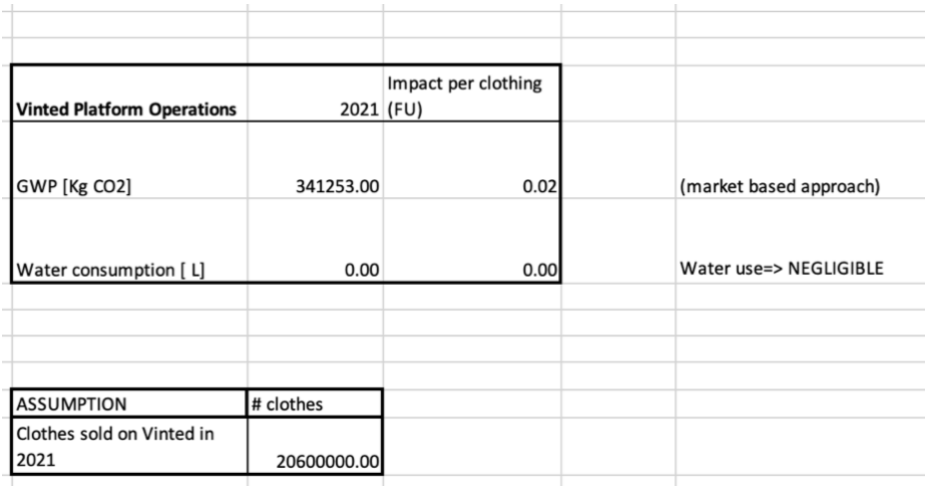
Additional computation for cotton t shirt				
GWP	total impact mindness 18%	6.05kg	6.05	[KG CO2 e]
Wate consumption	total impact mindness 14%	1770 kg	1770	[L]

GWP [KG CO2 e]	Description	% of total GWP impact in the results of the study
cotton prod & fiber production		7%
textiles manufacturing	spinning, knitting, dyeing , making up	73%
distribution		0.50%
transport		2%
TOTAL IMPACT CRADLE TO GATE		83%

Water consumption [L]	Description	% of total water consumption impact in the results of the study
cotton prod & fiber production		79%
textiles manufacturing	spinning, knitting, dyeing , making up	7%
distribution		0%
transport		0%
TOTAL		86%

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 28: Vinted impact

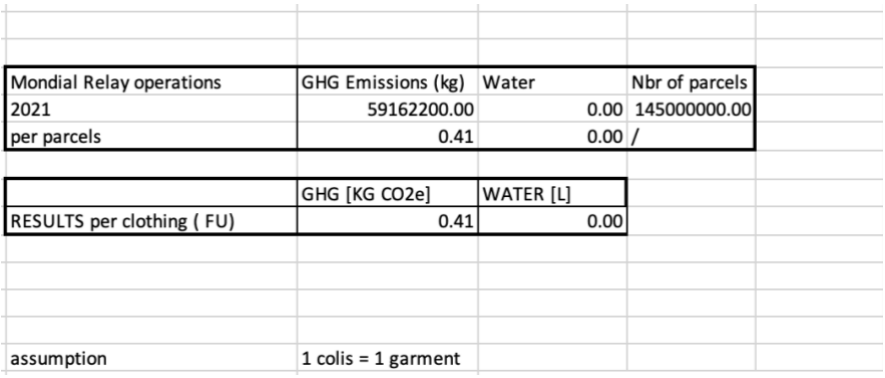


Vinted Platform Operations	2021	Impact per clothing (FU)	
GWP [Kg CO2]	341253.00	0.02	(market based approach)
Water consumption [L]	0.00	0.00	Water use=> NEGLIGIBLE

ASSUMPTION	# clothes
Clothes sold on Vinted in 2021	20600000.00

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 29: Mondial Relay impact



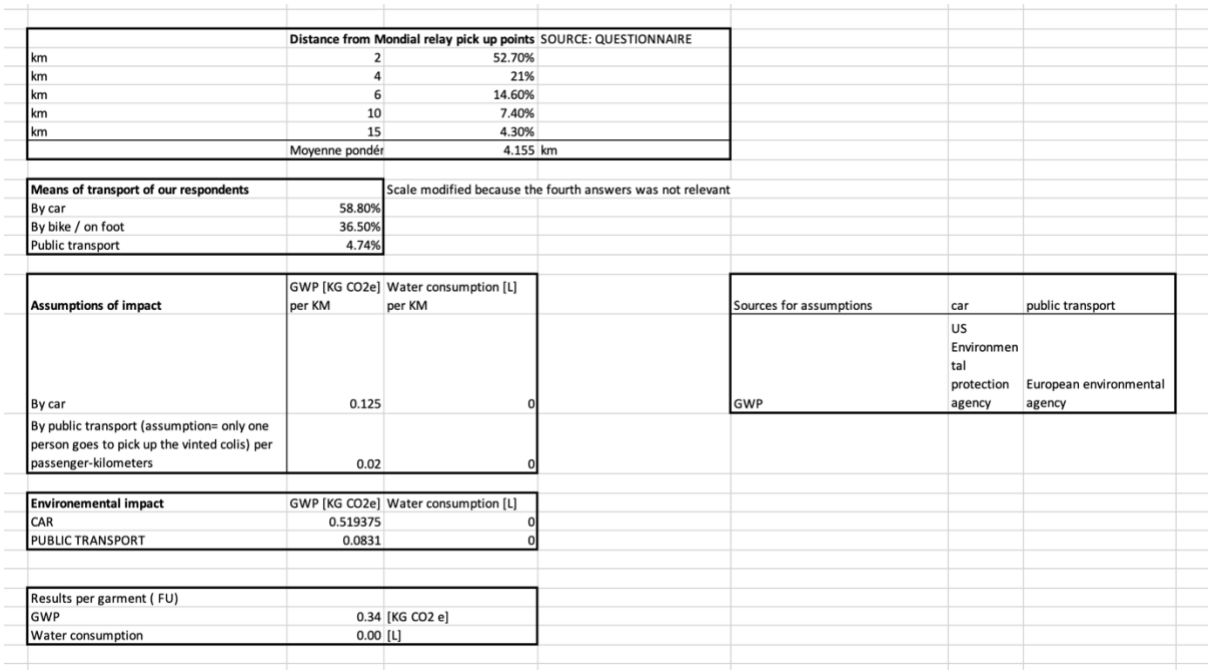
Mondial Relay operations	GHG Emissions (kg)	Water	Nbr of parcels
2021	59162200.00	0.00	145000000.00
per parcels	0.41	0.00	/

	GHG [KG CO2e]	WATER [L]
RESULTS per clothing (FU)	0.41	0.00

assumption	1 colis = 1 garment

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 30: Vinted user transportation impact to the collection point



	Distance from Mondial relay pick up points	SOURCE: QUESTIONNAIRE
km	2	52.70%
km	4	21%
km	6	14.60%
km	10	7.40%
km	15	4.30%
	Moyenne pondér	4.155 km

Means of transport of our respondents		Scale modified because the fourth answers was not relevant
By car	58.80%	
By bike / on foot	36.50%	
Public transport	4.74%	

Assumptions of impact	GWP [KG CO2e] per KM	Water consumption [L] per KM
By car	0.125	0
By public transport (assumption= only one person goes to pick up the vinted colis) per passenger-kilometers	0.02	0

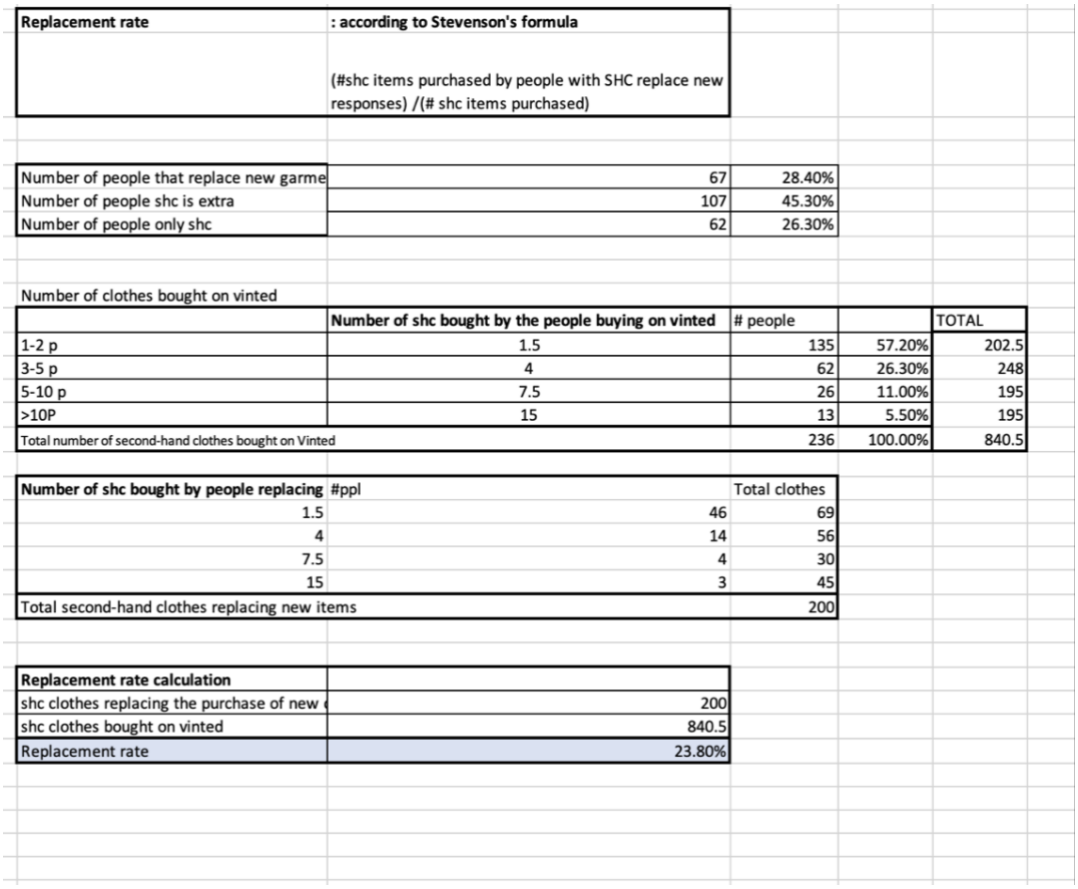
Sources for assumptions	car	public transport
GWP	US Environmental protection agency	European environmental agency

Environemental impact	GWP [KG CO2e]	Water consumption [L]
CAR	0.519375	0
PUBLIC TRANSPORT	0.0831	0

Results per garment (FU)		
GWP	0.34	[KG CO2 e]
Water consumption	0.00	[L]

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 31: Replacement rate calculations



Replacement rate	: according to Stevenson's formula
	(#shc items purchased by people with SHC replace new responses) /(# shc items purchased)

Number of people that replace new garme	67	28.40%
Number of people shc is extra	107	45.30%
Number of people only shc	62	26.30%

Number of clothes bought on vinted

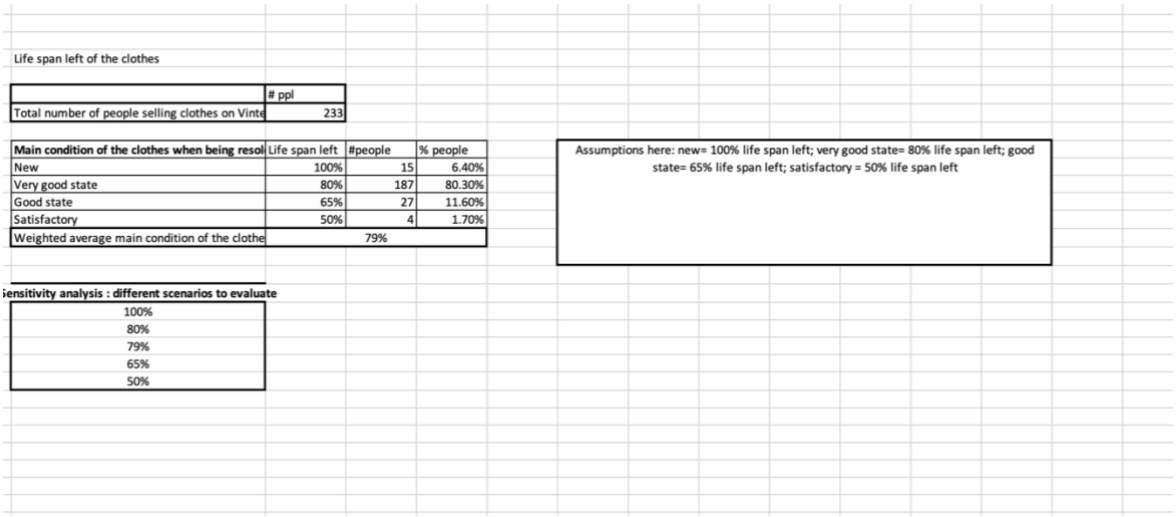
	Number of shc bought by the people buying on vinted	# people		TOTAL
1-2 p	1.5	135	57.20%	202.5
3-5 p	4	62	26.30%	248
5-10 p	7.5	26	11.00%	195
>10P	15	13	5.50%	195
Total number of second-hand clothes bought on Vinted		236	100.00%	840.5

Number of shc bought by people replacing	#ppl	Total clothes
1.5	46	69
4	14	56
7.5	4	30
15	3	45
Total second-hand clothes replacing new items		200

Replacement rate calculation	
shc clothes replacing the purchase of new	200
shc clothes bought on vinted	840.5
Replacement rate	23.80%

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 32: Life Span left calculations



Life span left of the clothes

	# ppl
Total number of people selling clothes on Vinte	233

Main condition of the clothes when being resol	Life span left	#people	% people
New	100%	15	6.40%
Very good state	80%	187	80.30%
Good state	65%	27	11.60%
Satisfactory	50%	4	1.70%
Weighted average main condition of the clothe	79%		

Assumptions here: new= 100% life span left; very good state= 80% life span left; good state= 65% life span left; satisfactory = 50% life span left

ensitivity analysis : different scenarios to evaluate

100%
80%
79%
65%
50%

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 33: Final LCA for 3 selected clothes

For one cotton t -shirt	GWP [KG CO2e]	Water consumption [L]
Manu prod	4.99	1522.20
VINTED	0.02	0.00
Packaging	0.00	0.00
Mondial Relay	0.41	0.00
Transport	0.34	0.00
Transport	0.34	0.00
TOTAL	6.09	1522.20

For one Levi's 501 jeans	GWP [KG CO2e]	Water consumption [L]
Manu prod	20.00	2922.00
VINTED	0.02	0.00
Packaging	0.00	0.00
Mondial Relay	0.41	0.00
Transport	0.34	0.00
Transport	0.34	0.00
TOTAL	21.10	2922.00

For one wool sweater	GWP	Water (l)
Manu prod	17.45	255.00
VINTED	0.02	0.00
Packaging	0.00	0.00
Mondial Relay	0.41	0.00
Transport	0.34	0.00
Transport	0.34	0.00
TOTAL	18.55	255.00

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 34: Avoided impact calculations for 3 selected clothes

T shirt	GWP (kg co2e)	Water (L)
Impact manufacturing (a shc replace manu of new clothes)	4.99	1522.20
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	**-0.16**	**286.20**

Basis scenario	
Replacement rate	24%
Lifetime left	79%
total	**18.8%**

jeans	GWP	Water (l)
Impact manufacturing (a shc replace manu of new clothes)	20.00	2922.00
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	**2.66**	**549.39**

Sweater	GWP	Water (l)
Impact manufacturing (a shc replace manu of new clothes)	17.45	255.00
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	**2.18**	**47.95**

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

Figure 35: Scenarios analysis

BASE SCENARIOS

T shirt	GWP [KG CO2e]	Water consumption [L]
Impact manufacturing (a shc replace manu of new clothes)	4.99	1522.20
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	-0.16	286.20

Hypothesis	
Replaceement rate	50%
Lifetime left	70%
total	35.0%

jeans	GWP [KG CO2e]	Water consumption [L]
Impact manufacturing (a shc replace manu of new clothes)	20.00	2922.00
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	2.66	549.39

Sweater	GWP [KG CO2e]	Water consumption [L]
Impact manufacturing (a shc replace manu of new clothes)	17.45	255.00
Vinted operations	1.10	0.00
Net avoided impact (by avoiding purchase of new clothes)	2.18	47.95

T SHIRT

Replacement rate	50%		24%	
Lifetime span	79%	70%	79%	70%
GWP [KG CO2e]	0.88	0.65	-0.16	-0.26
Water consumption [L]	601.27	532.77	286.20	253.60

JEANS

Replacement rate	50%		24%	
Lifetime span	79%	70%	79%	70%
GWP [KG CO2e]	6.80	5.90	2.66	2.24
Water consumption [L]	1154.19	1022.70	549.39	486.81

SWEATER

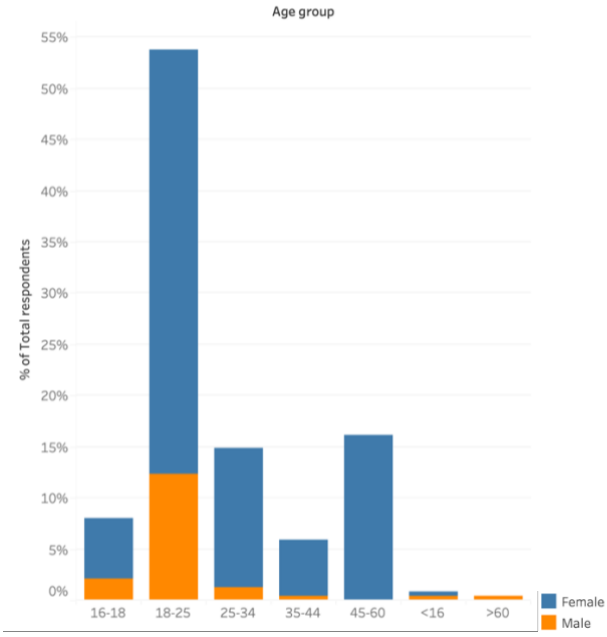
Replacement rate	50%		24%	
Lifetime span	79%	70%	79%	70%
GWP [KG CO2e]	5.80	5.01	2.18	1.81
Water consumption [L]	100.73	89.25	47.95	42.48

Note. Own elaboration (Clotuche, L.Hanon, C. 2023).

17.Tableau analysis

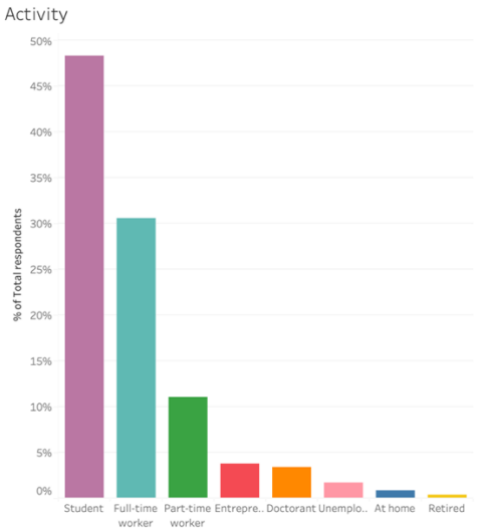
17.1. Vinted buyers analysis

Figure 36: Age group and Gender analysis of Vinted buyers of our sample



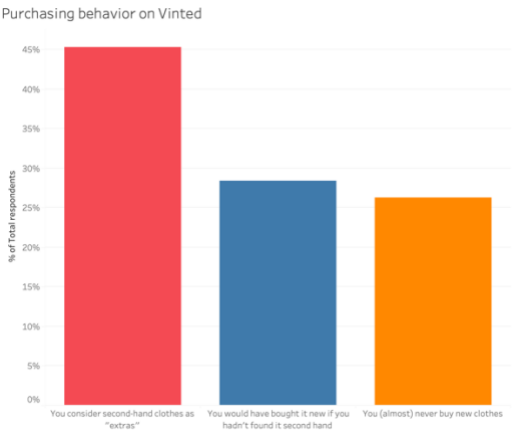
Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Figure 37: Activity of Vinted buyers of our sample



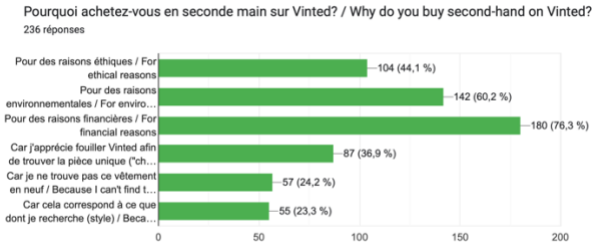
Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Figure 38: Purchasing behaviour of Vinted buyers of our sample



Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

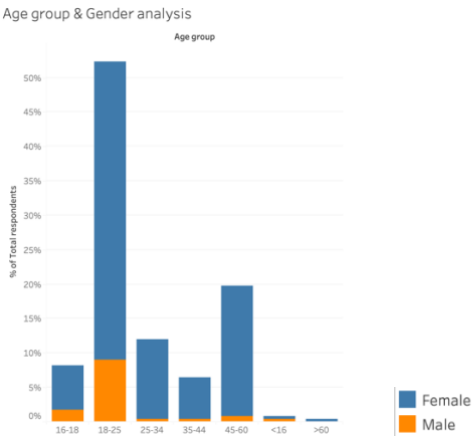
Figure 39: Reasons to purchase second-hand clothes on Vinted of Vinted buyers of our sample



Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

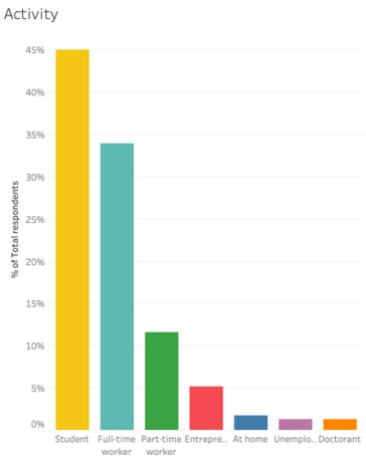
17.2. Vinted sellers analysis

Figure 40: Age group & Gender analysis of Vinted sellers of our sample



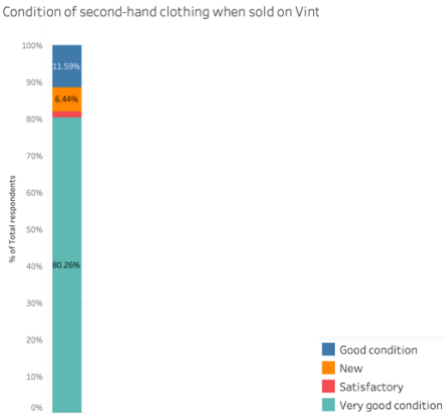
Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Figure 41: Activity of Vinted sellers of our sample



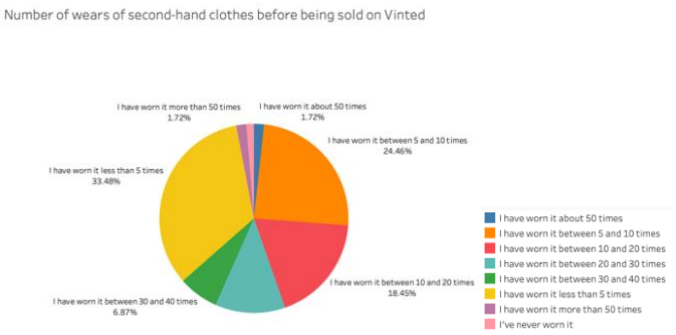
Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Figure 42: Condition of second-hand clothes according to Vinted sellers of our sample



Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

Figure 43: Number of wears of second-hand clothes before being sold on Vinted according to Vinted sellers of our sample



Note. Own elaboration (Clotuche, L.Hanon, C. 2023). Based on data from Excel Survey results. (2023).

ABSTRACT

The fashion industry is notorious for its severe ecological and social impact, making it one of the most polluting industries globally. This is primarily due to the traditional linear "take-make-waste" system, which fuels the fast fashion industry's growth, leading to overconsumption and environmental degradation. To counter this, the clothing industry has started to embrace circular models such as slow fashion, which prioritises quality over quantity and rejects overconsumption. Second-hand clothing is one of the most popular forms of slow fashion, with platforms like Vinted driving their growth. In Belgium, more and more people now turn to Vinted to purchase second-hand clothes in an attempt to lessen the fashion industry's environmental impact. However, it is unclear whether buying second-hand clothes on Vinted is undeniably better for the environment. Therefore, this thesis aims to determine the concrete environmental benefits of purchasing second-hand clothes on Vinted and identify influencing factors. Although existing literature has explored the environmental impacts of second-hand clothing and the factors that influence them, it is unclear whether these findings apply to the Belgian population when purchasing second-hand items on the Vinted platform. Therefore, this thesis adopts a quantitative approach, namely a life cycle analysis, which draws on existing life cycle analysis data, company reports and a survey of the Belgian population. The results confirm the high lifespan left of second-hand clothing on Vinted, refute the generally reported replacement rate, and demonstrate that environmental benefits vary by garment type, with a potential rebound effect observed for T-shirts. The results highlight the importance of responsible behaviour and use of the platform to maximise environmental benefits. Drawing on these findings, we have drafted recommendations for stakeholders and called for further research into recycling and sustainable production in the fashion industry.

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