Using life cycle assessment to quantify the environmental impacts of clothing consumption

Assessing environmental impacts of clothing consumption for three different lifestyles

Master's thesis in Industrial Ecology

Moa Aldén
Isak Nilsson

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF ENVIRONMENTAL SYSTEMS ANALYSIS

CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2025
www.chalmers.se

Using life cycle assessment to quantify the environmental impacts of clothing consumption

Assessing environmental impacts of clothing consumption depending on three different lifestyles

Moa Aldén

Isak Nilsson

Department of Technology Management and Economics
Division of Environmental Systems Analysis
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden 2025

Using life cycle assessment to quantify the environmental impacts of clothing consumption
Assessing environmental impacts of clothing consumption depending on three different lifestyles

Moa Aldén
Isak Nilsson

© Moa Aldén, 2025.
© Isak Nilsson, 2025.

Supervisor: Matilda Lidfeldt, IVL Swedish Environmental Institute
Examiner: Gregory Peters, Department of Technology Management and Economics

Department of Technology Management and Economics
Division of Environmental Systems Analysis
Chalmers University of Technology
SE-412 96 Gothenburg
Telephone +46 31 772 1000

Gothenburg, Sweden 2025

Using life cycle assessment to quantify the environmental impacts of clothing consumption
Assessing environmental impacts of clothing consumption depending on three different lifestyles

Moa Aldén
Isak Nilsson

Department of Technology Management and Economics
Chalmers University of Technology

Abstract

This master's thesis assessed the environmental impacts of clothing consumption and how these varied depending on lifestyle, with the aim of identifying environmental hotspots in the clothing value chain. The study applied a life cycle assessment (LCA) methodology to compare three different lifestyles: a slow fashion lifestyle, a modern Swedish lifestyle, and an ultra-fast fashion lifestyle. Environmental impacts were calculated for four selected garments and combined to represent total lifestyle impacts. The selected impact categories were climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use.

The results showed that the ultra-fast fashion lifestyle generated more than twice the environmental impact compared to the slow fashion lifestyle across all categories, due to higher consumption of new garments. The production phase was identified as the major contributor to all environmental impacts in the lifestyles, followed by the use phase, particularly user transport. A sensitivity analysis showed that shifting to second-hand clothing significantly reduced environmental impacts across all categories. In contrast, shifting to electric transport reduced climate change impacts but had no effect in other impact categories.

Several methodological challenges were identified, particular related to data availability and the complexity of the online shopping value chains. Initiatives by the EU such as the Digital Product Passport may help to adress these challenges. The study highlighted the importance of consumer behaviour in reducing environmental impacts, such as reducing consumption and extending garment lifespans, and provided future recommendations for research.

Keywords: Clothing, consumer behaviour, environmental impact, life cycle assessment, LCA, lifestyles, second-hand clothing.

Acknowledgements

We would like to sincerely thank our supervisor Matilda Lidfeldt at IVL Swedish Environmental Institute and our examiner Gregory Peters at Chalmers University of Technology, for their contributions and support to the continuous work throughout the thesis. This work would not have been possible without their guidance and valuable insights.

We would also like to give our gratitude to the LCM team at IVL Swedish Environmental Institute who gave valuable insights into how the LCA methodology works and how to gather data related to the project.

We express our utmost gratitude to both IVL Swedish Environmental Institute and Chalmers University of Technology for this valuable opportunity to deep dive into the world of LCA and have given valuable knowledge in both the technical area as well as preparing us for what is to come in the future.

Finally we would like to thank our families for their unending support throughout the work, this would not have been possible without you.

Isak Nilsson & Moa Aldén, Gothenburg, June 2025

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

CARE	Circular consumption Activities to tRansform households towards material Efficiency
CEAP	Circular Economy Action Plan
DPP	Digital Product Passport
EE-IOA	Environmentally Extended Input-Output Analysis
EOL	End-of-life
EPR	Extended Producer Responsibility
FEP	Freshwater Eutrophication Potential
FETP	Freshwater Ecotoxicity Potential
GWP	Global Warming Potential
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LDPE	Low density polyethylene
LOP	Agricultural Land Occupation
PET	Polyethylene terepthalate
PP	Polypropylene
SDG	Sustainable Development Goals
WCP	Water Consumption Potential

Contents

List of Figures

List of Tables

1

Introduction

Over recent decades, the global fashion industry has experienced rapid growth, largely driven by the expansion of the fast fashion business model. This model, characterised by low prices and quickly changing trends, has accelerated clothing consumption and shortened the lifespan of garments (Niinimäki et al., 2020). As a consequence, the industry now causes significant environmental impacts across the entire life cycle of garments, from raw material extraction and manufacturing to distribution, use, and disposal.

Historically, the clothing industry operated at a considerably slower pace, with production aligned to consumer demand through seasonal forecasting. A major shift occurred in the 1980s, when fast fashion began to gain dominance and dramatically increased market speed (Dzhengiz et al., 2023). In recent years, a new business model named ultra-fast fashion has further intensified these unsustainable aspects. Ultra-fast fashion brands can bring products from design to sale in just a few days. They focus on responding instantly to consumer demand for fashionable innovation, using online engagement, abundant style options, and highly efficient operations without physical stores (Dzhengiz et al., 2023). Companies such as Shein rely on digital technologies to collect data on consumer behaviour, personalise shopping experiences, and influence consumers through social media. These strategies intensify unsustainable consumption patterns and exacerbate the environmental footprint of the fashion industry.

The environmental impacts associated with the textile value chain stem from material use, water consumption, hazardous chemicals, and energy demand at each stage of production (Niinimäki et al., 2020). The increased production volumes and the rise of fast and ultra-fast fashion have increased these impacts by encouraging unsustainable consumption habits. These impacts have also generated reactions in different parts of the industry and among consumers, with the consequence that while some parts of the industry are becoming less sustainable, others are increasingly pro-sustainability (Dzhengiz et al., 2023). The growing popularity of second-hand markets represents a pro-sustainability response, offering a more sustainable alternative by extending the life cycle of garments (Yang et al., 2024). Driven by shifting consumer attitudes towards sustainability, environmental concerns, and growing interest in sustainable fashion practices, the second-hand market has experienced significant growth in recent years. Over the past decade, the sales of second-hand clothing has constantly increased, highlighting the potential to promote a more sustainable approach to clothing consumption (Yang et al., 2024).

Addressing the environmental burden of the fashion industry requires fundamental systemic change. Key strategies include deceleration of production, implementing sustainability measures across supply chains, and shifting consumer behaviour toward slow fashion and extended garment use (Niinimäki et al., 2020). Today's consumption patterns generate large amounts of textile waste, much of which is incinerated, landfilled, or exported to other countries. Garments fall out of fashion quickly and may not be disposed of properly, further contributing to the sector's environmental impacts (Zamani et al., 2017).

The fast- and ultra-fast fashion business models contribute to this issue by promoting cheap and low-quality garments that are often discarded before they are worn out. Clothing repair becomes unnecessary, uneconomical, or even impossible due to poor quality (Peters et al., 2021). As a result, barely used garments are either thrown away or left unused in consumers' wardrobes. In addition, clothing production requires labour-intensive processes typically concentrated in developing countries, far removed from the end consumer. This geographic and informational distance reduces consumer awareness of labour and environmental conditions within global supply chains, where transparency and traceability are frequently lacking (Dzhengiz et al., 2023).

These patterns of production and consumption are incompatible with international sustainability targets such as the European Circular Economy Action Plan (CEAP) and the United Nations Sustainable Development Goals (SDGs) (European Commission, 2020). In particular, Goal 12 promotes responsible consumption and production (The Global Goals, n.d.). Both initiatives call for resource-efficient systems and sustainable lifestyles. Despite growing public awareness of fashion's social and environmental consequences, global consumption continues to rise. This highlights the urgent need for more effective policy interventions, corporate responsibility, and better data to gain insight into the environmental impacts of clothing.

As part of the European Green Deal and CEAP, the European Union (EU) has proposed several concrete measures to reduce the environmental impact of textiles. One of the key initiatives is Extended Producer Responsibility (EPR) which aims to make producers responsible for the entire life cycle of textile products and to support the sustainable management of textile waste (European Commission, 2023). This includes ensuring that producers finance textile collection, sorting, reuse, and recycling systems, which will promote incentives to reduce waste and increase the circularity of textile products. Another key initiative is the upcoming Digital Product Passport (DPP), which aims to improve traceability, circularity, and transparency throughout the entire life cycle of fashion products. DPP could promote circularity and sustainability practices by providing detailed information on products such as material composition, supply chain, transport, and environmental impact. Together, these measures reflect a growing political awareness of the need for systemic change in the fashion industry (European Parliament, 2024).

1.1 CARE Project

This master thesis was performed in collaboration with IVL Swedish Environmental Institute and is part of the EU-funded project CARE *(Circular consumption Activities to tRansform households toward material Efficiency)*, which is running from 2024 to 2027 (CARE, 2025). As a Horizon Europe project, CARE aligns with the United Nations Sustainable Development Goal (SDG) 12 and the EU Circular Economy Action Plan. The project supports the transition toward more sustainable consumption patterns and the mitigation of climate change.

The CARE project aims to empower 100 households across Finland, Norway, Sweden, Germany, and Estonia to reduce food waste and extend the lifespan of their clothing. Starting in summer 2025, participating households from these regions will adopt new daily habits and explore how small lifestyle changes can lead to environmental benefits.

By implementing interventions related to food and clothing consumption, the project seeks to transform consumption practices and demonstrate how behavioural changes can reduce environmental impact. To reduce these impacts, there are three interventions related to clothing: "detox", washing, and repairing. The first intervention, "detox", focuses on reducing the purchase of new garments. The second intervention, washing, aims to reduce environmental impacts by promoting sustainable laundry practices, such as washing less frequently and avoiding tumble drying. The third intervention, repairing, seeks to extend the lifespan of clothing by encouraging households to maintain garments rather than discarding them, and thereby reducing the need for new production.

To assess how the environmental impacts vary across different lifestyles and to identify key environmental hotspots, this thesis applied life cycle assessment (LCA). As part of the CARE project, this master's thesis focused on the environmental impacts of clothing consumption and identified environmental hotspots for different lifestyles. This thesis also aimed to provide insights into effective interventions within the CARE project. These findings will support the project's goal of promoting sustainable consumption habits and reducing the environmental impact of households.

1.2 Aim of the Study

This master's thesis aimed to assess the environmental impacts of clothing consumption and how this differs depending on lifestyle. The study was conducted in order to locate hotspots for environmental impact in the value chain of clothing.

The environmental impacts were assessed by conducting a life cycle assessment (LCA). In addition, the report aimed to further develop the LCA methodology by identifying challenges related to assessing the environmental impacts of clothing and attempting to address them. During the study, the main methodological challenges were identified and the study aimed to find ways to address them. Further, this master's thesis aimed to give recommendations and consumer guidance for transitioning toward more sustainable fashion systems, particularly within the CARE project.

1.3 Research Questions

In order to investigate the aims, the thesis aimed to answer the following research questions:

1. What are the main methodological challenges with assessing the impact of clothing consumption using LCA?
2. How can one address the main methodological challenges with assessing the impact of clothing consumption using LCA?
3. How does the total environmental impact of clothing consumption vary depending on lifestyle?
4. What are the main environmental hotspots in the clothing life cycle for different lifestyles?

1.4 Limitations of the Study

As with any life cycle assessment or research project, this master's thesis comes with certain limitations. While the study aimed to provide insights into the environmental impacts of clothing consumption across different lifestyles, it did not capture all possible variables or garment types.

The assessment was based on a selection of four commonly used garments, which are jeans, T-shirts, dresses, and jackets. The garments were chosen for their popularity, relevance to everyday clothing consumption. In addition, Sandin et al. (2019) claim that the fibre, weaving method and use pattern of these garments are similar to other garments, meaning they can represent 84% of clothing consumption. This selection does not cover the full variety of clothing items, which also may differ in material composition, production processes, and consumption patterns. The four garment categories are used to represent garments with similar fibres, production chains and use patterns.

This study focused on key factors affecting the environmental impact, such as the type of transport for households, garment type, frequency of use, washing habits, and type of purchase, for example, second-hand or shopping of new clothes. Some lifestyle-related aspects, such as cultural differences in clothing use were not included due to scope constraints.

Finally, while the data for the modern lifestyle was based on available statistics, the two other lifestyles were constructed using assumptions informed by literature. All three lifestyles were modelled based on a Swedish context. Consequently, the majority of the data used in this study is gathered from Sweden or Europe, in line with the scope of the EU-funded CARE project.

2

Literature Review

The literature review aimed to address the first two research questions. This chapter includes the main methodological challenges with assessing the environmental impacts of clothing consumption, including data availability, assessing toxicity, and the use of LCA to assess consumption patterns. Together, these themes provide a basis for interpreting LCA results and identifying limitations and opportunities for sustainable transformation in the clothing industry.

2.1 LCI Data Availability

Previous research highlights several challenges in assessing the environmental impact of clothing consumption using life cycle assessment (LCA). One of the key issues is the lack of available and reliable life cycle inventory (LCI) data. Accurate assessments require detailed information about both the value chain of clothing and consumer behaviour throughout the use phase, including purchasing patterns, laundering, and disposal.

2.1.1 Use Phase Behaviour

A central challenge in current life cycle assessments is the reliance of assumptions about consumer behaviour due to the lack of data. Gwozdz et al. (2017) highlight the need for more detailed data on clothing acquisition and use, and attempt to reduce this gap by conducting a survey on clothing consumption in Western countries. However, Gwozdz et al. (2017) acknowledges the fact that the study may not be applicable when studying clothing consumption in non-western contexts.

Similarly, Daystar et al. (2019) identify the lack of data for the use phase as a significant research gap, which is a limiting factor when conducting LCAs due to the importance of this phase. Their study includes a survey assessing the clothing use and consumption patterns from six countries, including non-Western countries such as China and Japan. Despite this broader scope, both studies are limited in the types of garments they assess. For example, Gwozdz et al. (2017) group garments into jeans, T-shirts, and other items, while Daystar et al. (2019) focus on woven pants, knit collared shirts, and T-shirts. A more holistic inclusion of multiple garment types could strengthen the environmental assessment of clothing use.

Another aspect to consider beyond data availability for assessing the environmental impacts of clothing, is the quality and accuracy of use phase data. A study by Klint et al. (2023) indicates that the survey results reported regarding use phase behaviour of clothing, such as washing and drying practices, may not reflect the observed use phase behaviour. For example, survey respondents overestimated the loading rate of their washing machines compared to observed usage. Although, according to Peters (2025), this could be influenced by the fact that the washing machines used in the study were larger than average washing machines, which may be more difficult for small households to fill. Nonetheless, this raises the question of how the reported surveys differ with the observed user behaviour.

Another indicator of potential inaccuracy in self-reported data is the variation in estimates of annual clothing purchases. For instance, Gwozdz et al. (2017) report an average of 22.44 items purchased per year based on survey data. However, others sometimes suggest higher numbers. This deviation may indicate that survey participants under-report their acquisition, possibly due to social desirability bias, as discussed by Klint et al. (2023). Social desirability bias occurs when respondents answer in ways they believe are socially acceptable or desirable, rather than providing accurate answers of their behaviour. This further illustrates the challenge of relying on self-reported data for the use phase in LCA studies.

Additionally, some relevant data, such as the total time that consumers iron their clothes, was not found during this project. This further underscores the limitations of current data available. In addition to gaps in consumer behaviour data, there are challenges relating to the availability of data along the value chain of clothing. One specific area where this is apparent is online shopping. Sandin et al. (2019) describe that due to limited data availability, the environmental impact of online shopping was not included in their analysis on clothing consumption. As online shopping is a growing business model, more data on its logistics and associated impacts are necessary for reliable assessments.

2.1.2 Addressing the Data Gaps

Addressing issues with data availability and quality would improve the accuracy and usefulness of LCA results in this area. Future research should therefore prioritise gathering detailed and reliable data on consumer behaviour, both in terms of clothing consumption and during the use phase, such as washing and maintenance patterns. These behaviours have influence on the total environmental impact, yet they are often difficult to measure accurately.

Policy initiatives such as Extended Producer Responsibility (EPR) and the proposed Digital Product Passport (DPP) by the EU could have the potential to improve transparency and data availability across the textile value chain and address that data gap. For example, the DPP could enable the tracing of material flows and production processes and improve transparency (European Parliament, 2024).

However, while DPP may support data gathering on purchase behaviour, it does not capture information related to user behaviour in the use phase, such as washing frequency or drying methods.

To address this gap in data regarding user behaviour, there are a few potential solutions. For instance, Klint et al. (2023) studied self-reported laundry behaviour in surveys and compared this with observed laundry habits recorded through tags attached to garments. Gathering data regarding the use phase by using this method has the potential to produce more accurate results. In addition, even without tagging, it is now possible to gather household-level laundry use data over time, as modern washing machines have onboard computers that calculate loading rates and can be used to log program uses and wash temperatures.

2.2 Comprehensive Assessment of Toxicity Impacts

Many methodological challenges in applying LCA to the textile consumption of different lifestyles are relevant in many other applications of LCA. One such challenge is the comprehensive assessment of toxicity impacts.

The clothing value chain includes several steps that involve chemical treatments. In the case of cotton cultivation, there is the use of a variety of pesticides (Zhang et al., 2023). As a result, it is important to evaluate the ecotoxicity impacts to gain a comprehensive understanding of the environmental impacts. This aspect remains underrepresented in many LCA studies of textiles.

Roos et al. (2019) say that few LCAs of textiles cover toxicity for two primarily reasons. The first reason is that there is a lack of LCI data capturing the emissions of chemicals throughout the value chain of textiles. The second reason is that there is a lack of LCIA data regarding converting the LCI data and characterisation factors into toxicity-related quantitative indicators of environmental impacts. Sandin and Peters (2018) highlight this concern, and discuss that while climate change is assessed in nearly all textile LCAs, human toxicity is included in approximately 25% of the studies. The difficulties in assessing toxicity can manifest in uncertainties in the results regarding toxicity. Roos and Peters (2015) demonstrate how three different methods of toxicity assessment provide different results. Since different toxicity assessment methods can yield varying results, there is an apparent need for standardisation.

This methodological uncertainty presents a risk that toxicity may be excluded from LCAs, which in turn limits their usefulness in making informed decisions on chemicals to assess this problem. Despite these challenges, Roos and Peters (2015) argue that including toxicity impacts into LCA still adds value by providing at least a fragmented understanding of an important environmental issue.

To address challenges related to data, Roos et al. (2019) suggest structuring LCI data according to the function of each chemical to simplify and improve the LCI process for textiles. Roos et al. (2019) states that the LCI process for textiles is often complicated due to the large number of chemicals used throughout the life cycle of textiles, and her approach could improve transparency and help prioritise data collection.

In addition to chemical ecotoxicity, the literature highlights growing concerns about microplastics. Nihart et al. (2025) report increasing levels of microplastics in both the environment and the human body. Despite this, microplastic impacts are often excluded from LCAs (Schwarz et al., 2024). To address this gap, Schwarz et al. (2024) further developed a methodology to assess microplastic impacts in a case study by comparing two types of plastic packaging films, including PET, PP and LDPE plastics. The findings showed that microplastics contributed significantly to both marine and freshwater ecotoxicity. Therefore, Schwarz et al. (2024) found that applying this methodology to broader range of plastic types is necessary to more accurately capture the impacts of microplastic pollution.

2.3 Using LCA to Assess Lifestyles

There are challenges with conventional LCA that several authors have suggested different approaches to adressing, including rebound effects, functional units, drivers of clothing consumption, and limitations of eco-efficiency for clothing production.

2.3.1 LCA and the Rebound Effects

Life cycle assessment (LCA) is a powerful tool used to assess the environmental impacts of a product or service throughout its life cycle (Baumann and Tillman, 2004). While LCA has emerged as an effective tool to analyse the environmental impacts throughout the value chain of a product, several studies argue that the current approach to conventional LCA is insufficient to achieve the systemic change needed to address sustainability challenges. For example, Suski et al. (2024) argue that with the limited progress towards environmental sustainability through technical change, a more holistic and systemic approach is needed. Suski et al. (2024) outline how measures to increase the efficiency of technical systems have generally not resulted in decreased resource use. In fact, increases in efficiency often lead to an overall increase in the use of that product.

One critical issue is that improvements in efficiency do not lead to decreased resource use. Instead, they can result in increased overall consumption, a phenomenon known as the rebound effect, or Jevons paradox, originally discovered by Jevons (1865). He first discovered that improvements in efficiency for coal use led to the use of more coal overall, not less. For example, despite significant increase in laundry machine efficiency in recent decades, overall energy use per capita for laundry has increased. Klint (2024) applies this partly due to the rebound effect and emphasises that it is often not included in conventional LCAs. Klint (2024) also focuses on the importance of identifying the behavioural and psychological reasons behind such effects.

The rebound effect might be assessed through analytical frameworks that go beyond traditional LCA boundaries. The additional mechanisms that need assessment were initially described by Sandén and Karlström (2007), and later reworked by Sandin and Roos (2019), who describe a typology of consequences which categorises consequences into four orders. The 0th order effects are direct physical effects, first order effects are linear systemic responses, second order effects are effects governed by economic mechanisms with negative feedback, and third order effects are systemic responses governed by positive feedback. Applied to the installation of more efficient laundry machines, a 0th order effect would be less electricity used per cycle. Whereas a third order effect could involve shifting social norms around cleanliness, causing more frequent washing, as discussed by Klint (2024) in relation to shifts in laundry behaviour.

Shifting cultural norms and third order effects complicate the environmental assessment of lifestyles. Gutowski (2018) criticises LCA for not accurately capturing the actual behaviour of people in the scenarios analysed. Gutowski (2018) claims that the effects of a product analysed with LCA often differs from the actual outcome. For example, efficient light bulbs may be assumed to reduce energy use, but the actual outcome may instead be increased usage or installation of additional devices using more energy than before, which is an example of the rebound effect.

In addition, Gutowski (2018) describes other third order effects that can make the results of an LCA less reliable in predicting future outcomes, such as the possibility that improved football helmets created to reduce head trauma may encourage more people to play football and that younger people may be allowed to play football. In the context of clothing, third order effects may emerge through online shopping. While emissions from online compared to in-store shopping vary depending on factors such as logistics and transport modes, the third order effects are less easy to predict. Online shopping becoming more prominent may generate cultural shifts regarding the attitude towards consumption, such as normalizing high consumption of low quality items. The user behaviour may also shift in ways that are not foreseen and are not seen with conventional shopping, such as customers ordering multiples of one item of different sizes, and returning the garments that do not fit.

These insights suggest that identifying environmental hotspots in the clothing value chain, though important, is insufficient if current trends in overconsumption continue. Fast fashion and ultra-fast fashion business models worsen these issues within the clothing industry. While conventional LCA highlights the environmental hotspots in the value chain of a product or service, it does not account for behavioural change and rebound effects. Klint (2024) therefore underscores the need to understand the environmental impacts from behavioural drivers and underlying psychological reasons.

This critique is highlighted by several studies. The sentiment expressed by Suski et al. (2024), relating to the inability for efficiency to address the issues relating to sustainability, is echoed by others. André (2024) introduces the concept of sufficiency as a complement to efficiency. While efficiency reduces the environmental impact per function, sufficiency measures focus on altering or reducing the function itself. For example, instead of only improving the impact per garment washed, sufficiency would include washing less or owning fewer garments. André (2024) outlines "Sufficiency LCA" as a concept with potential to be of use, since efficiency measures are not expected to be enough to achieve environmental sustainability. Sufficiency LCA would allow for functional non-equivalence, meaning the comparison of alternatives where the functional unit is not equivalent in terms of how much, how long, or how well the function is performed (André, 2024).

Another attempt to use LCA in a more holistic approach towards sustainability is through "Absolute LCA". The concept of an absolute LCA connects LCA outcomes to the planetary boundaries defined by Rockström (2009). The planetary boundaries describe the safe and just operating space when it comes to several environmental categories. Bjørn et al. (2015) argue that while products may become more environmentally efficient, human impacts are still growing. For example, to limit global warming to 2°C by 2100, global eco-efficiency must improve by 6.2% per year, yet current improvements are only 0.9%. In an absolute LCA, the results of an LCA are compared to the carrying capacity of the planetary boundaries. Using absolute LCA, one could see the share of the personal assigned environmental carrying capacity taken up by consumption categories such as clothing. Bjørn et al. (2015) describes that this method requires normative decisions regarding how much of the environmental carrying capacity is allocated to each sector, but that the absolute LCA perspective is useful nonetheless as it addresses the underlying issues and acknowledges that the relying on eco-efficiency is insufficient.

However, Guinée et al. (2022) have raised criticism against the absolute LCA framework, arguing that the term "absolute" LCA is misleading and that the methodology is relative. Guinée et al. (2022) argue that while the planetary boundaries have a time dimension, the results of many absolute LCAs do not.

Earlier critiques of LCAs highlight limitations in capturing broader system-level impacts. For instance, Hertwich (2005) argued that traditional LCAs do not integrate rebound effects when assessing the impacts of consumption patterns and that LCA should be more comprehensive than traditional LCAs of a product. Hertwich (2005) suggested that life cycle assessments should be complemented with methods such as environmentally extended input-output analysis (EE-IOA) should be used. Input-output analysis is an economic tool used to trace product flows across the entire economy, allowing for a top-down rather than bottom-up assessment. EE-IOA enables the inclusion of second-order effects, such as economic effects governed by negative feedback driven by aspects such as supply and demand, although the extent to which it can address third-order effects such as cultural or behavioural shifts remains debated. While LCA methodologies have developed since this critique, the discussion underscores the importance of system boundaries when assessing environmental impacts of lifestyles.

An additional effort to assess the environmental impact of a lifestyle rather than products include life LCA and lifestyle LCA developed by Bossek et al. (2021) and Bossek et al. (2023). However, the usefulness of these approaches is uncertain. For instance, it seemingly assumes a direct correlation between an identity as being eco-conscious and environmental impact, and reductions of environmental impact between a non-sustainable and a sustainable consumer are assigned arbitrarily to consumption categories without clear behavioural evidence.

2.3.2 Utility and Functional Units

In LCA, the functional unit is defined based on the function of a product system. Rydh et al. (2002) defines the function as something that fulfills a need. Klint (2024) argues that LCAs should go further in investigating the underlying reason for behaviours driving environmental impact. For example, many LCAs on laundry use the functional unit *1 kg of laundry washed*, Klint (2024) argues that while this is the output of the technical system, it does not accurately represent the function of the system. Klint (2024) argues that such functional units overlook the underlying psychological drivers behind the behaviour. Instead, Klint (2024) suggests that some of the rebound effects and compensatory behaviours are better understood if one considers the function of laundry as feeling confident in social situations. Klint (2024) argues that behaviour should be regarded as system components in LCAs and not unchanging background information.

Klint (2024) explores how shame, disgust sensitivity, and social norms such as the fear of appearing unclean if one washes less frequently than others, could be primary psychological drivers of laundry behaviour. Since LCA aims to assess the environmental impacts required to fulfil a certain function, it may be useful to consider the underlying motivations, and the need that function aims to fulfil. Klint (2024) proposes that integrating these underlying psychological and social reasons into the functional unit could provide a more holistic and accurate reflection way to address this.

Increased efficiency of washing machines has not resulted in reduced energy consumption from laundry. Instead, it has led to increased washing frequency and a shift in social norms toward washing clothes more often. This represents a rebound effect that conventional LCA methods may fail to capture, as they typically do not account for such system dynamics. LCAs often assume that doubling the efficiency of a product will reduce its environmental impact, while it may instead increase in practice. Defining the functional unit based on the social norms, such as cleanliness norms, helps explain the compensatory rebound effect.

In this sense, the approach aligns with the tradition of the functional unit in conventional LCA, where the functional unit is intended to describe the function of the system. However, as Klint (2024) argues, only considering the output of the technical system does not accurately represent the function of the system. Instead, the functional unit should reflect the need or motivation that the system serves.

One perspective that could be useful when considering the functional units described by Klint (2024) is the concept of means, ends, intermediate ends and intermediate means described by Daly (1971) and later developed by Meadows (1998). Applying this to laundry, the 1 kg of laundry can be seen as means used to achieve an end, which is confidence in social situations. Furthermore, confidence in social situations can then be seen as an intermediate means used to achieve some other need, such as creating an identity or generating wellbeing, which could be seen as an ultimate end.

Research into human needs done by Max-Neef (1991) suggests that wellbeing is associated with nine basic needs: subsistence, protection, affection, understanding, participation, idleness, creation, identity and freedom. Max-Neef (1991) claims that these needs are equally important, and one need is not substitutable by another. Such a belief is referred to as axiological pluralism, while the belief that all value can be reduced to a single type of value is axiological monism. Connecting these concepts to the conclusions of Klint (2024) suggests that it may be prove insightful to analyse which of these needs are the primary drivers of clothing consumption. Understanding how human needs can be met while minimising the environmental impact is an important topic to consider, as it could provide insights for designing more effective interventions for consumer behaviour.

An aggregation of the concepts described by Klint (2023), Meadows (1998), and Max-Neef (1991), applied to clothing consumption can be seen in Figure 2.1. Connecting these aspects, one could perhaps describe the categories described by Max-Neef (1991) as being more of midpoint indicators indicators of wellbeing, and wellbeing is the endpoint indicator. While classical economics is primarily concerned with the endpoint indicator, analysing the midpoint indicators driving behaviours and integrating this into the functional unit as suggested by Klint 2024) may prove insightful into understanding the primary motivations driving environmental impacts. This framework attempts to create needs-based functional units, where the underlying psychological drivers for behaviour are considered.

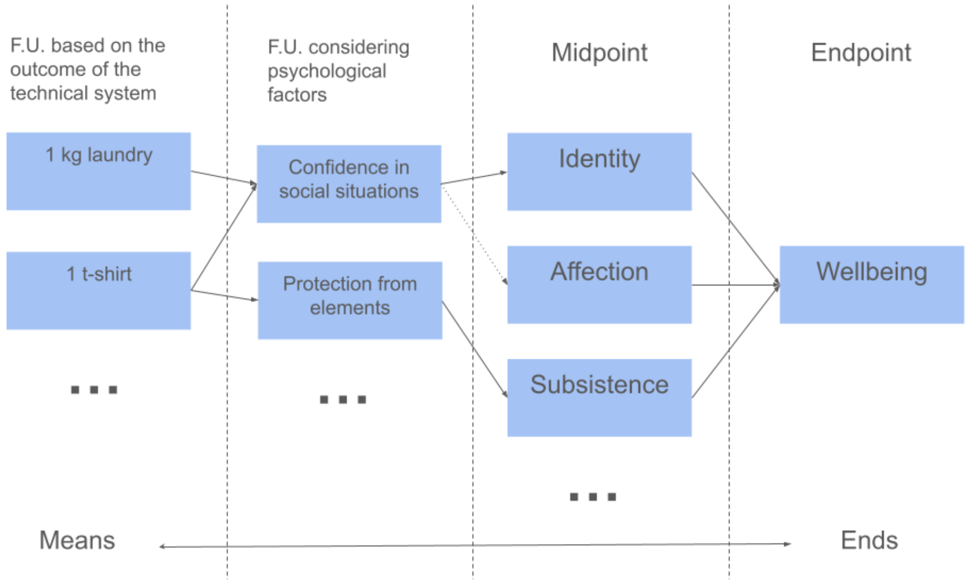

Figure 2.1: Framework for analysing the underlying motivations behind behaviour driving consumption and environmental impact, that expands upon the functional units considering psychological aspects described by Klint (2024), connecting functional units to the human need fulfilled by that function.

If one were to apply this framework to the functional units described by Klint 2024), one could say that the functional unit 1 kg of laundry washed is a means to achieve "confidence in social situation", which is closer to an end than 1 kg of laundry washed. It might then be useful to reflect upon what need is fulfilled by such a functional unit. Shifting the functional unit in LCA closer to the ultimate ends may provide insights into the underlying motivations behind the behaviours driving environmental impact.

2.3.3 Drivers of Clothing Consumption

As Klint (2024) argues for the integration of psychological factors into designing the functional unit of LCA studies, it is therefore prudent to understand the factors driving clothing consumption.

A study by Joanes et al. (2020) found a strong relation between social and personal norms with the intention to reduce clothing consumption. Furthermore, Nielsen et al. (2023) found that clothing, in addition to protecting the body from physical elements, serves the psychological functions of communicating personality, taste, and identity to others. In addition, the study by Nielsen et al. (2023) differentiates between two categories of consumers when it comes to clothing, fashion- and style oriented consumers. Nielsen et al. (2023) explains the difference between the consumer types as being the following: fashion orientation is related to wanting to follow the latest trends while style oriented consumers have a more personal sense of style that reflects their personal identity.

Nielsen et al. (2023) found that while both fashion- and style-oriented consumers had a positive correlation with materialism, the correlation was significantly stronger for fashion-oriented consumers. The study outlines that materialism is characterised by three factors: placing high importance on possessions, believing that acquiring more possessions will lead to greater wellbeing, and evaluating success based on material possessions.

Importantly, materialism also showed a strong negative correlation with personal wellbeing. Nielsen et al. (2023) suggests that this could be attributed to the fact that materialistic individuals tend to be more affected by advertising, which will cause them to feel inadequate with their possessions. Connecting this to the fulfillment of needs, while clothing serves the basic need for subsistence, it also contributes to an individual's sense of personal identity. However, fast fashion seems to instead undermine the person's sense of identity by promoting comparison to the newest trends and others, which ultimately undermines wellbeing and promotes increased consumption of fast fashion products. Hence, the fast fashion business model uses increasing amounts of resources, while simultaneously achieving worse outcomes than slow fashion when it comes to fulfilling the needs of people and generating wellbeing.

2.3.4 The Limitations of Eco-Efficiency

The amount of textiles produced per capita per year was 5.9 kg in 1975 (Peters et al., 2019). By 2023, this number had increased to 11.4 kg (Naturvårdsverket, 2024). While the eco-efficiency of clothing production has increased in terms of environmental impact per garment, the overall environmental impact of the system per capita has also increased (Peters et al., 2021). This is because the use time for one garment has decreased by 36% in first-world countries during that same time period (Niinimäki et al., 2020). Hence, conducting an LCA of a garment of clothing using a functional unit of 1 garment will find that the efficiency of a garment is better today than it was in 1975; yet, the overall sustainability of the system as a whole has decreased. One could keep the perspective of Klint et al. (2023) in mind and consider the function of clothing, taking one step closer towards ultimate ends. Nielsen et al. (2023) found that clothing serves social functions, such as communicating identity and personality. Considering these social functions to be the functional unit, an important question emerges: does the fashion business model today perform better or worse in terms of fulfilling these social functions in 2025 compared to 1975?

One could perhaps assume that the social functions of clothing were fulfilled roughly to the same extent in 1975 compared to today. Since Nielsen et al. (2023) found that materialism and fashion orientation to be correlated with worse wellbeing, it could very well be the case that the overall satisfaction with clothing has decreased during 1975, but if the satisfaction with clothing for the average consumer is the same, more environmental impact is created to fulfill that need in 2023 than it was in 1975. Hence, with a more holistic level, the eco-efficiency of the system would be lower in 2023 than it was in 1975, despite the eco-efficiency of the production of one garment increasing.

Niinimäki et al. (2020) highlight how a shift away from these business models are important in order to achieve sustainability. Fast- and ultra fast fashion relies on quick shifts in trends in order to promote consumers to purchase more clothing (Dzhengiz et al., 2023). Hence, a materialistic, fashion-oriented mindset benefits the fast-fashion businesses, while simultaneously driving more environmental impact and potentially reducing wellbeing. Nielsen et al. (2023) found a materialistic mindset to be correlated with worse outcomes for wellbeing. While it is unknown how the wellbeing created by the fast fashion model has changed it is nonetheless an important issue to reflect upon. One could consider the clothing consumption system to be dysfunctional if increased amounts of resources are used in order to produce worse outcomes. Based on the arguments described previously, one could conclude that the fast fashion model does not work towards producing better outcomes in terms of wellbeing.

2.4 Conclusions of the Literature Review

It is clear that many authors have raised concerns with LCA being insufficient in order to address issues relating to sustainability. In the academic literature, some studies indicate the need for LCA to be more holistic, by either allowing functional non-equivalence of the functional unit (André, 2024), relating the results to the planetary boundaries (Suski et al., 2024), combining LCA with economic and sociological tools and using environmentally extended input-output analysis to assess sustainability (Hertwich, 2005), or integrating more aspects than the output of the technical system in the functional unit, such as the underlying psychological factors for behaviour (Klint, 2024).

Therefore, this study will assess the environmental impacts of clothing consumption using the functional unit: *the clothing needs of one person for one year*. This approach allows for the consumer behaviour to be a parameter in the LCA that can be optimized, rather than only optimizing the technical system. This project is primarily concerned with examining the effects of behavioural change rather than changes in the value chain of the technical systems. The purpose of assessing an entire lifestyle is to gain a more holistic understanding of the effects of behavioural change on the overall sustainability of the consumption of an individual. The study will assess the environmental impacts associated with the lifestyle of an average Swedish person in 2025 and compare these impacts to those of a typical Swedish lifestyle before fast fashion was established, and one potential future lifestyle. Further, by using this as a functional unit, the study aims to explore how various behavioural choices affect the environmental impact, rather than changes in the technical system. This is opposed to a conventional LCA, which often examines how a technical change in a value chain changes the impact, but the behavioural patterns are assumed to be the same. Examining the environmental impact of an average Swedish person in 1995 compared with 2025 will allow for the assessment of how the fast fashion business model has affected the environmental impact for an average person in Sweden.

In addition, the methodology used in this study can be used to assess the environmental impacts of any lifestyle, given data for the consumption patterns. Data from LCAs concerning the impact of any product can be used as input combined with data concerning behaviour in order to calculate the environmental impact for lifestyles. Hence, this serves as an alternative way of assessing the environmental impact of a lifestyle compared with Bossek et al. (2023). In addition, this methodology can be combined with the absolute LCA framework, as the environmental impact of a certain lifestyle can be compared with the allocated environmental impact for clothing that is allowed while still remaining within the planetary boundaries.

3

Method

In order to assess the environmental impacts of clothing consumption across three different lifestyles, the life cycle assessment (LCA) methodology was applied. The approach is based on calculating the environmental impacts of individual garments, which are then aggregated to represent total lifestyle impacts. Laundry, drying, and ironing activities were modelled separately from the garments.

3.1 LCA Framework

The life cycle assessment (LCA) will be conducted according to the European Standard ISO 14044 (Swedish Standards Institute, 2006). The framework consists of four main steps, including goal and scope definition, life cycle inventory analysis (LCI), life cycle impact assessment (LCIA), and life cycle interpretation. In the goal and scope definition, a functional unit is included. The functional unit should be measurable and clearly defined since the purpose is to provide a reference to which the input and output data are normalised (Swedish Standards Institute, 2006). Another factor in the goal and scope definition is the system boundary, which determines which unit processes that are included in the LCA. This includes defining geographical, temporal, natural, and technical boundaries, often illustrated using a flowchart.

The life cycle inventory analysis (LCI) step involves collecting data for each process that is included within the defined system boundary (Swedish Standards Institute, 2006). Data may be obtained through measurement, calculation, or estimation, and includes inputs such as energy and raw materials, as well as outputs such as products, waste, and emissions to air, water, and soil. If multiple products are involved, inputs and outputs should be allocated through system expansion or subdivision of processes, although ISO 14044 recommends avoiding allocation (Swedish Standards Institute, 2006). The third step, life cycle impact assessment (LCIA), includes the selection of impact categories, category indicators, and characterisation models. Further, it involves classification by assessing inventory results to impact categories, and characterisation by quantifying potential impacts. A sensitivity analysis may also be conducted to evaluate how sensitive the results are to changes in parameters (Swedish Standards Institute, 2006). The fourth and final step is life cycle interpretation, where significant issues are identified based on the results of the LCI and LCIA. This phase includes evaluating data quality, limitations, and drawing conclusions and recommendations (Swedish Standards Institute, 2006).

3.1.1 Goal and Scope

In this section, the goal and scope of the study were defined. The goal and scope definition helps performing the assessment and identifies key assumptions, system boundaries, limitations and other factors that affect the results.

The goal of this LCA was to evaluate the environmental impacts associated with clothing consumption, and how these impacts differ depending on lifestyle. The purpose was to identify environmental hotspots along the clothing value chain, from production and manufacturing, to distribution, use, and end-of-life, to recommend interventions for more sustainable lifestyles. Additionally, the goal was to contribute to further development of the LCA methodology by addressing key methodological challenges, such as representing social drivers of consumption, rebound effects, and definition of functional units.

The results are intended to support the transition toward more sustainable clothing use, and guide analysts and participants within the CARE project. This includes recommendations for consumers and stakeholders to reduce environmental impacts associated with clothing consumption.

3.1.1.1 Functional Unit

The functional unit for this study is defined as *the clothing needs of one person for one year*. This unit was chosen to enable the comparison of three different lifestyle scenarios with varying clothing consumption. While the environmental impacts of the value chain for each garment was assessed, the results were included as part of a broader model to represent the total clothing consumption for each lifestyle over one year. Defining the functional unit at lifestyle level ensures that the environmental impacts include consumption behaviours such as purchasing frequency, use, laundry habits, transport, and use of second-hand clothing.

3.1.1.2 System Boundaries

To define the scope of the LCA, four types of system boundaries are described: geographical, temporal, natural, and technical. The study is based on Swedish consumption patterns, which reflects the environmental impacts of an average Swedish consumer. While the use phase is situated in Sweden, the model includes global supply chains, meaning that production processes such as raw material extraction, manufacturing, and international transportation, that are located outside of Sweden, are also included in the assessment.

The temporal boundaries of this study are defined by the assessment of the clothing needs of one person over the time period of one year. The study has prioritised the most recent available data to reflect current consumption patterns, while also using historical data from before the widespread establishment of fast fashion. The recent data represents modern consumption habits, while the historical data provides insight into clothing consumption prior to the rise of fast fashion in society.

The natural system boundaries of the study include the environmental processes associated with the life cycle of garments. These include raw material extraction, water consumption, energy use, waste generation, and land use. The environmental impacts are considered from resource extraction to the end-of-life phase of the garment. Technical system boundaries include all stages of the life cycle, from material extraction and production to end-of-life, including distribution, use, and waste disposal. Processes related to infrastructure construction and maintenance of machines were excluded from the study.

To clarify the system boundaries and the different life cycle phases, five flowcharts have been developed. These flowcharts illustrate the main life cycle phases for the individual garments as well as for one second-hand garment. Each product system consists of four phases: production, distribution and retail, use, and end-of-life (EOL).

Figure 3.1 shows the different phases of a cotton T-shirt's life cycle, which include cotton production, distribution and retail, use, and the EOL phase. The production phase involves cotton production, yarn production (e.g., spinning), fabric production (e.g., knitting), wet treatment (e.g., bleaching), and confectioning. The finished T-shirt is then transported by transoceanic shipping to domestic distribution and sold in stores. After purchase, the T-shirt is transported by the user, used, washed, dried, and ironed. Finally, the T-shirt is disposed of and transported to incineration.

While the T-shirt represents a specific type of material, other garments follow the same phases but differ in the materials used. For instance, Figure 3.3 shows the life cycle of a dress made of polyester, while Figure 3.2 shows jeans which are composed of cotton and elastane and also involve production of metal components such as buttons. Similarly, a jacket is shown in Figure 3.4 which includes multiple material processes such as cotton, elastane, polyamide, and polyester fibres, with additional fabric production for both woven and nonwoven types.

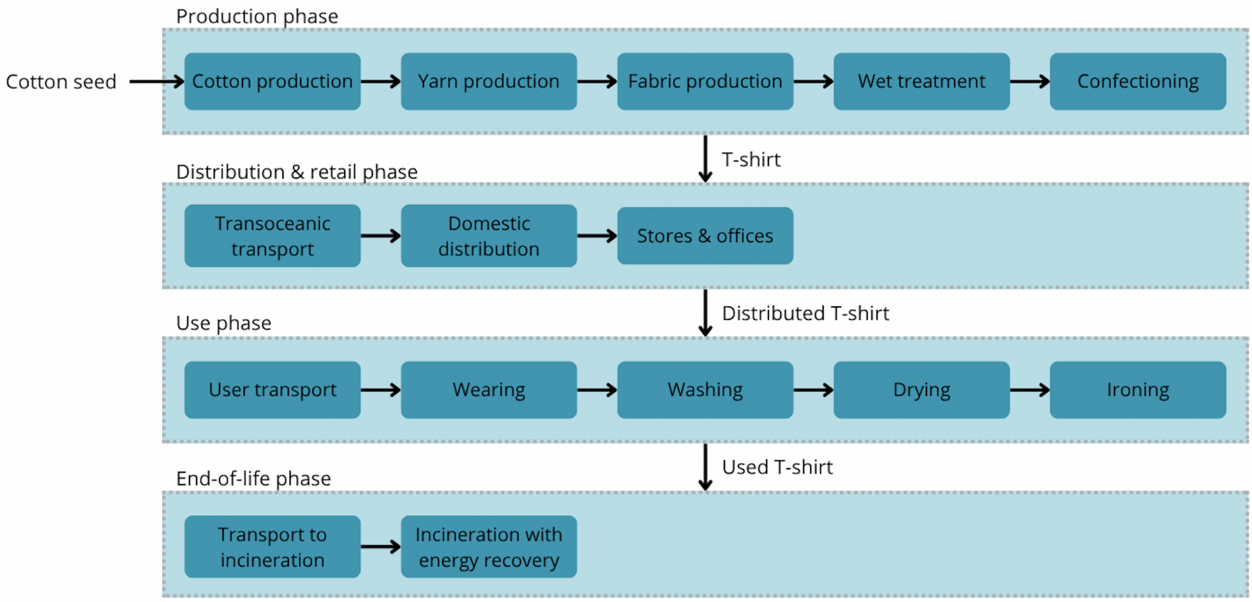

Figure 3.1: Flowchart for a T-shirt.

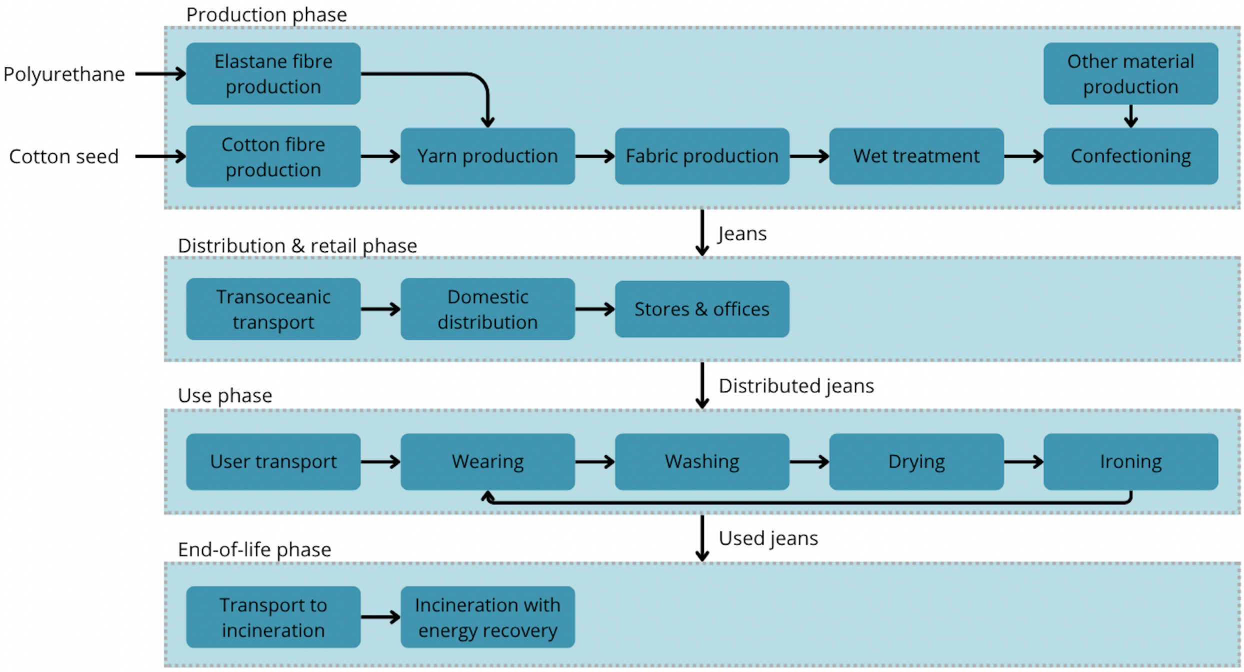

Figure 3.2: Flowchart for a pair of jeans.

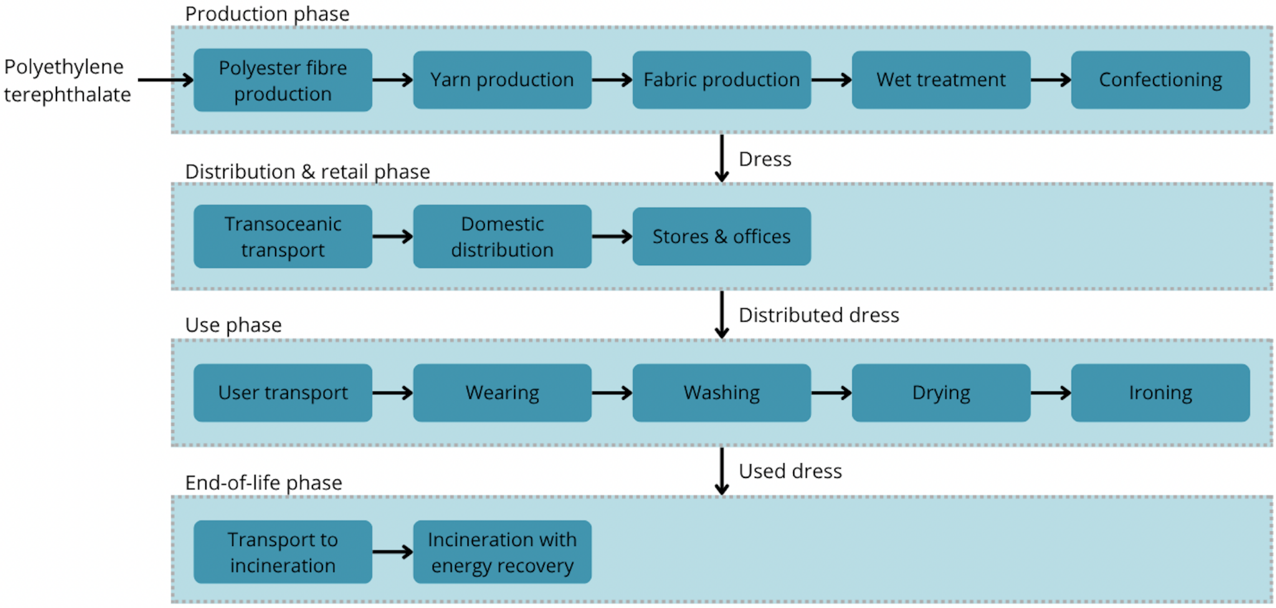

Figure 3.3: Flowchart for a dress.

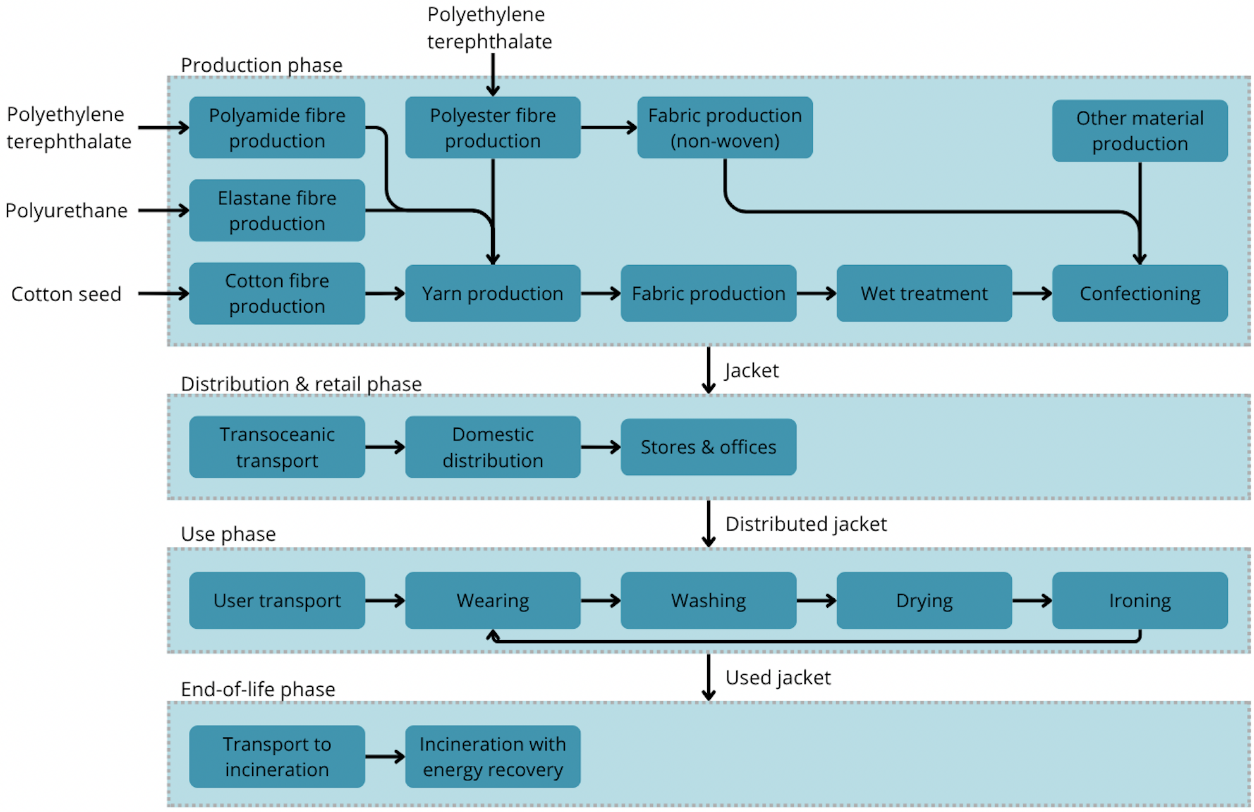

Figure 3.4: Flowchart for a jacket.

The final flowchart is shown in Figure 3.5, which illustrates the life cycle of a second-hand garment. Once the garment has been used, it enters the pre-sorting phase, where it is evaluated for condition and suitability for resale. The pre-sorting is assumed to take place in Sweden, after which the garment is transported to Lithuania for manual sorting. During this phase, garments are categorised based on their potential for reuse or recycling (Nellström et al., 2025). After sorting, the garment is sent to distribution and retail, and following purchase, it goes through the same use phase as new clothing, where it is worn, washed, dried, and ironed by the consumer. Finally, the garment reaches the EOL phase, where it is disposed of.

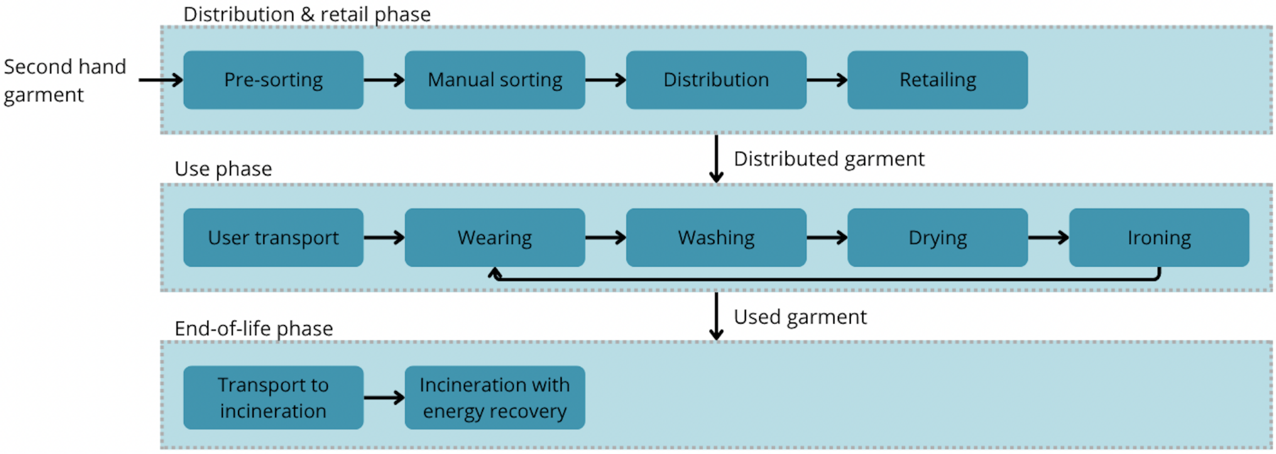

Figure 3.5: Flowchart for a second-hand garment.

3.1.1.3 Allocation Methods

When assessing the second-hand garments, a cut-off allocation methodology will be used, meaning the environmental impacts from the original production phase of what ultimately becomes a second-hand garment will not be allocated to that second hand garment. Hence, the environmental impacts from the second-hand garment will be from the collection- and end-of-life phase.

3.1.1.4 Impact Categories

The Life Cycle Impact Assessment (LCIA) evaluated the environmental impacts associated with the three lifestyles, in accordance with the ISO 14044 standards (Swedish Standards Institute, 2006). The LCIA translates data from the LCI into relevant environmental impact categories. The impact categories were selected based on their relevance to the clothing industry, according to Zamani et al. (2017). These include climate change, water use, freshwater eutrophication, freshwater ecotoxicity and land use.

Climate change was assessed using the midpoint indicator global warming potential over a 100-year period (GWP100), expressed in kg CO_2-eq. Water use was measured using the water consumption potential (WCP), expressed in m^3. Freshwater eutrophication was measured as freshwater eutrophication potential (FEP), in kg P-eq. Freshwater ecotoxicity was measured using freshwater ecotoxicity potential (FETP), in kg 1.4-DCB-eq. Land use was measured using agricultural land occupation (LOP), expressed in $m^2 \cdot$ a crop-eq.

The life cycle impact model used in this study is the ReCiPe 2016 (version 1.06) midpoint (H) method developed by Huijbregts et al. (2016). The life cycle impact model is the characterisation method that translates LCI data into comparable units for each impact category. The midpoint level focuses on specific environmental issues along the cause-effect chain, such as climate change or freshwater eutrophication. The ReCiPe (2016) methodology presents three perspectives, the individualist (I), hierarchist (H) and egalitarian (E), with each perspective making different normative choices regarding aspects such as time horizon (Huijbregts et al., 2016). The hierarchist (H) perspective was selected due to it being the most supported by scientific consensus.

3.1.1.5 Assumptions and Limitations

This study relies on several assumptions to enable modelling of clothing consumption and life cycle impacts within the scope and available data. These assumptions were necessary due to limitations in data availability and methodological feasibility.

This study modelled three lifestyles based in Sweden. Therefore, the Swedish electricity production mix is used when electricity use was modelled in the use phase, for example, for laundry and drying. This has implications for the results. For example, the low carbon intensity of the Swedish electricity mix will lead to lower climate impact from electricity production than if the electricity mix of another country was used. Similarly, the electric car transport in the sensitivity analysis is based on Swedish electricity, which may not represent the electric car transport in other regions.

Regarding consumer laundry behaviour, data from Klint et al. (2023) was used. According to this data, approximately 90% of all laundry is washed at either 40°C or 60°C. Due to limited availability of detailed data on wash cycles at other temperatures, all laundry temperatures below 40°C have been rounded up to 40°C, and those above 60°C have been rounded down to 60°C. Data regarding volume of laundry per day are obtained from European Commission (n.d.).

Initially, three types of clothing purchases were modelled: conventional (in-store), online, and second-hand. Online shopping was modelled as a separate system which included additional packaging materials such as kraft paper and packaging film, 8.5 km of lorry transport from the retailer to a pick-up point, and reduced user transport, which was assumed to be half the distance of conventional shopping, to represent delivery to a pick-up point rather than a consumer trip. It was further assumed that the consumer bicycled 1 km to and from the pick-up point to collect the parcel. The production and end-of-life phases were modelled identically for both the online and conventional retail shopping scenarios. Additionally, for conventional shopping, a distance of 17 km to and from a physical store was assumed.

However, the results from the online shopping were ultimately excluded from the final results. This was due to the reasons that the environmental impacts were found to be highly similar to those of conventional shopping, and it was limited data available regarding the processes in the online shopping value chain, which made the modelling uncertain and dependent on several assumptions. Due to this uncertainty and similarity in results, the online shopping was excluded from the final results presented in the report and only conventional and second-hand shopping were included. While online shopping was initially modelled, it is not included in the results or figures presented in the report. Nontheless, the environmental impacts of online shopping remain an area for future research.

A key assumption in this study for second-hand modelling is that when new clothes are acquired, an equal amount of clothing is discarded. This effectively models the consumption patterns as a steady-state wardrobe. This was considered reasonable, as all garments will eventually be discarded, making the assumption valid over a longer time scale. Moreover, it was deemed infeasible in the scope of this project to assume an steady-state wardrobe, as it would have required additional data and assumptions. It was also assumed that garments are discarded by the consumer at the end of use phase and sent to incineration with energy recovery, rather than being donated to second-hand markets or sent to recycling.

Transport was modelled at several stages of the clothing life cycle. For transport between production phases, a distance of 750 km was assumed between fibre production and subsequent manufacturing stages, for all three scenarios. This assumption was based on modelling done by Sandin et al. (2019).

In the distribution phase, garments were assumed to be transported through $18800km$ transoceanic shipping from China to Sweden, followed by domestic transport by truck to retail stores, both transport being based on Sandin et al. 2019. China was selected as the assumed production location, as it is the world's leading textile producer according to Nellström et al. (2025). In the use phase, consumer transport was modelled as an average distance of 17 km, divided equally between fossil-fuel car (50%) and bus (50%), based on Sandin et al. (2019). The EOL transport from use phase was set to 30 km per garment, also based on the same source.

It should be noted that all garments were assumed to follow the same transport distances and modes, except for the T-shirt, where an additional transport of 750 km was included between yarn and fabric production, based on differences in data regarding the transportation for the t-shirt between Nellström et al. (2025) and Sandin et al. (2019). Hence, a value in between the two was assumed. Finally, it is important to acknowledge that transport assumptions comes with a degree of uncertainty since they are generalised. In reality, transport modes and distances vary depending on location, supply chains, and consumer behaviour.

3.2 Assessment of Lifestyles

The lifestyles included in this study were selected based on the goals of the CARE project, which aims to promote sustainable living and encourage households to extend the lifespan of their clothing. By implementing behavioural interventions, the project seeks to transform consumption practices and reduce environmental impacts. To identify environmental hotspots and understand how these impacts vary across different lifestyles, LCA was conducted on selected garments and compared across three distinct lifestyle profiles.

The selected garments in the LCI consist of a T-shirt, jeans, a dress, and a jacket, which represent common clothing items with varying material and use frequencies. For each lifestyle, the total number of clothes purchased both new and second-hand was distributed proportionally across the different types of garments based on data from Sandin et al. (2019) and Gwozdz et al. (2017). Second-hand garments were included separately, assuming similar use phase and washing frequencies as new garments. By combining clothing consumption with use phase activities, this LCI provides a dataset for assessing the environmental impacts of each lifestyle, enabling comparison across different consumption behaviours.

3.2.1 Definition of the Three Lifestyles

To evaluate the environmental impacts associated with clothing consumption, three lifestyles were developed in this study: a historical slow fashion lifestyle, a modern Swedish consumer lifestyle, and a future ultra-fast fashion scenario. These lifestyles represent distinct patterns in consumer behaviour, including clothing purchases, use, washing frequency, and transportation, see Table 3.2.

The aim of creating these lifestyles was to illustrate how changes in consumer behaviour over time can influence the environmental impacts. The slow fashion lifestyle is based on conditions before the rise of fast fashion, including data from 1975 to 1995. This scenario is intended to represent a more sustainable, yet realistic, consumption pattern that has a historical basis. The modern lifestyle reflects the average Swedish consumer, including data from 2023 to 2025, where both fast fashion and second-hand shopping are prevalent and washing habits are more frequent. The ultra-fast fashion lifestyle is a prospective scenario representing a consumer who purchases significantly more clothing and frequent washing routines. This scenario is based on current trends and assumptions about future consumption.

The three lifestyles mainly differ in type and number of garments purchased, both new and second-hand, and washing, drying, and ironing frequencies, see Table 3.1. To maintain consistency, the transport distance to and from store (17 km in total) was assumed based on Sandin et al. (2019), allowing other factors to be compared. Data on household size was obtained from SCB Statistical Database (2025). Since data was only available for the years 2012 to 2024, and the average remained consistently at 1.8 persons per household during this time period, it was assumed that the same household size applies to both the slow fashion and ultra-fast fashion lifestyles.

Table 3.1: Clothing purchases per lifestyle scenario

Information	**Slow Fashion**	**Modern**	**Ultra-Fast Fashion**
New clothes purchased (kg/year)	5.19	8.3	11.62
New garments (%)	95%	87%	87%
T-shirts (pcs)	11.53	18.42	25.79
Jeans (pcs)	2.78	4.45	6.23
Dresses (pcs)	2.15	3.43	4.81
Jackets (pcs)	3.54	5.65	7.91
Second-hand garments (%)	5%	13%	13%
T-shirts (pcs)	0.61	2.81	3.94
Jeans (pcs)	0.15	0.68	0.95
Dresses (pcs)	0.11	0.52	0.73
Jackets (pcs)	0.19	0.86	1.21

Table 3.2: Use phase parameters per lifestyle scenario

Information	**Slow Fashion**	**Modern**	**Ultra-Fast Fashion**
User transport (km/store trip)	17	17	17
Laundry/day per household (kg)	1.0	1.7	2.0
Household size (avg)	1.8	1.8	1.8
Washes at 40°C	66%	66%	66%
Washes at 60°C	35%	35%	35%
Laundry/year/person (kg)	202.8	344.7	405.6
Drying cycles/year	160	107	107
Dryer load (kg/cycle)	2.75	4.4	4.4
Laundry dried/year/person (kg)	200.0	261.6	261.6
Ironing (min/year)	260	780	780

3.2.1.1 Slow Fashion Consumer

The first lifestyle scenario represents a slow fashion consumer, based on historical data from before the emergence of fast fashion in society. This lifestyle reflects lower clothing consumption and less frequent washing, drying, and ironing. It is developed using data from the 1970s to 1990s, chosen to illustrate a more sustainable, yet realistic, consumer behaviour. This lifestyle is not idealised, but instead rooted in a lifestyle that has been practised in the past. The motivation for including this lifestyle is to show that more sustainable consumption habits are feasible, since in 1995, the average consumer in Sweden was able to meet their clothing needs without the fast fashion consumption behaviour seen today.

In this scenario, the consumer purchases fewer garments per year, both new and second-hand. The second-hand market was not well established during this period, resulting in less second-hand purchases compared to modern consumers. Since no data could be found on the second-hand market from 1990 and back in history, an assumption of 5% second-hand garments was made.

Data on new garment purchases for the slow fashion lifestyle are based on historical statistics from 1975, which report an average of 5.9 kg of textiles produced per capita per year, according to Peters et al. (2019). The 5.9 kg of textiles include garments as well as home textiles. Due to this report only examining clothes, home textiles was not considered. In data from Naturvårdsverket (2024) regarding textile consumption, a trend that the share of home textiles is increasing is apparent. As data for 1975 was not available, linear regression was applied to estimate the share of home textiles in the year 1975. Data from 2000 to 2023 to determine the average share of home textiles in total textile consumption during that period. The regression results were then used to estimate the corresponding share for 1975. Subtracting the share of home textiles gave an estimation of 5.19 kg of garments purchased per capita, as presented in Table 3.1. The share of new garments is based on Sandin et al. (2019), further explained in Section 3.3.1 in Table 3.3.

Data on washing and drying, such as laundry per day per household, were obtained from 1990 according to European Commission (n.d.). However, as no data was available regarding the average ironing time per household or per person, an assumption was made of 5 minutes per week, corresponding to 260 minutes per year.

3.2.1.2 Modern Consumer

The second lifestyle scenario represents the modern Swedish consumer of today, with data primarily from the years 2023 and 2025. This lifestyle reflects current consumption behaviour influenced by the fast fashion industry, as well as the increasing accessibility and popularity of second-hand clothing.

In this lifestyle, consumers purchase more garments per year compared to the slow fashion lifestyle. According to the study by Gwozdz et al. (2017), 86.76% of clothing purchases consist of new garments, and therefore only 13.24% are second-hand items. Both fast fashion and second-hand shopping are a part of the modern consumer's behaviour, and the high availability and low prices has contributed to an increase in garment purchases. The laundry habits in this scenario are more intensive compared to the past. The washing is more frequent, and while the number of drying cycles may be lower than in 1995 due to larger washing machine capacities, the total amount of clothing dried and ironed per person is higher. This increase is due to larger washing capacity of the washing machines (European Commission, 2024).

The data for developing this modern lifestyle are obtained from recent studies and statistics that capture both purchasing behaviour and washing practices. They provide a realistic perspective of the modern consumer, and could be a reference point for comparison with both the historical and the future scenario. Data on new garment purchases for the modern lifestyle are based on statistics from 2023, which report an average of 8.3 kg of new clothes purchased per year, according to Naturvårdsverket (2024). The share of new garments is based on Sandin et al. (2019), further explained in Section 3.3.1 in Table 3.3.

Data on washing and drying, such as laundry per day per household, were obtained from 2020 according to European Commission (n.d.). However, as no data was available regarding the average ironing time per household or per person, an assumption was made of 15 minutes per week, corresponding to 780 minutes per year. The assumed ironing time was higher for the modern lifestyle compared to the slow fashion lifestyle. This was based on the reasoning that the amount of laundry per household per day is larger today than in 1990, resulting in more clothes requiring ironing.

3.2.1.3 Ultra-Fast Fashion Consumer

The third lifestyle scenario represents a potential future consumer characterised by ultra-fast fashion consumption, which is a behaviour already existing among extreme consumers. This pattern of consumption already exists today for some consumers, but could be the average behaviour of the future consumer if current trends continue. This scenario is speculative but based on current trends, aiming to illustrate how continued increase of clothing consumption could affect environmental impact if no significant systemic or behavioural changes occur.

In this future scenario, the consumer purchases 40% more clothing than the modern consumer. This scenario is based on statistics from (Nordic Council of Ministers 2023), claiming that clothing consumption has increased by 40% over the last 20 years. Therefore, the future scenario explores how the environmental impact would be affected if the trends regarding clothing consumption continues, and the consumption increases by another 40% in the future. The ratio of new garments to second hand is assumed to be the same as for the modern consumer. The same assumption as for the modern lifestyle was applied, according to the study by Gwozdz et al. (2017), 86.76% of clothing purchases consist of new garments, and therefore only 13.24% are second-hand items. The share of new garments are based on Sandin et al. (2019), further explained in Section 3.3.1 in Table 3.3.

The washing frequency is expected to increase due to higher garment use, and the laundry per day per household is assumed to double compared to the slow fashion lifestyle. However, for other laundry-related factors such as drying and ironing, the values were assumed to remain the same as in the modern lifestyle. This assumption is based on European Commission (2024), which states that the capacities of laundry washed per cycle are expected to remain the same after 2020.

As with both the historical and modern lifestyles, the same transport distance is assumed to and from the store.

3.2.2 LCI for Lifestyles

To enable a LCA of three lifestyles, a Life Cycle Inventory (LCI) was developed for each. The LCI includes data on garment types, quantities, and use phase such as washing, drying, and ironing, as well as transport to and from store. These parameters were combined to model the environmental impact of each lifestyle over a defined functional unit.

3.3 Modelling of Individual Garments

The modelling details of the processes associated with the individual garments are presented in Appendix A, including inputs and outputs, datasets from Ecoinvent 3.11 used in the model, and corresponding quantities.

The environmental impacts associated with the selected garments were primarily modelled based on data from the Mistra Future Fashion report by Sandin et al. (2019). The modelling of second-hand garments was based on the report by Nellström et al. (2025). In addition, energy-related data has been updated to reflect current conditions in Sweden based on statistics from Swedenergy (2024).

3.3.1 Garment Selection and General Information

It was not feasible to model every individual garment that might appear in a typical Swedish wardrobe. Therefore, the scope of this study was limited to a selection of four garments. The garments were selected based on their material composition, function, and popularity in Swedish consumption patterns. The selected garments were chosen to represent a significant share of clothing use, and also cover a broad range of textile materials and garment types.

Due to these limitations of the modelling, some assumptions had to be made. The proportions of each garment were determined using data from Sandin et al. (2019), which suggest that T-shirts can represent 21% of clothing consumption, jeans account for 22%, dresses account for 17%, and jackets account for 26%. Together, these four garments can be used to represent 84% of clothing consumption in Sweden. Since the garments include commonly used textile fibres, typical fabric processes, and patterns of use, they can serve as representative garments for a large share of the total wardrobe. This 84% share was scaled up to represent 100% of total clothing consumption, while maintaining the same original ratio between the four different garment categories. The final distribution of clothing consumption used for modelling can be seen in Table 3.3.

	T-shirt	**Jeans**	**Dress**	**Jacket**
Weight	110 g	477 g	478 g	444 g
Proportion of clothing consumption	24%	26%	20%	30%
Material	100% cotton	98% cotton 2% elastane	100% polyester	43.6% polyamide 37.6% polyester 18.8% cotton/ elastane mix
User transport	50% car 50% bus 17 km distance	50% car 50% bus 17 km distance	50% car 50% bus 17 km distance	50% car 50% bus 17 km distance
Intercontinental transport	100% ship	100% ship	100% ship	100% ship

Table 3.3: Information about the modelling of the garments, based on Sandin et al. (2019).

3.3.1.1 Modelling of T-shirt

The modelling of the T-shirt encompassed all life cycle phases, including production, distribution and retail, use, and end-of-life (EOL). The production phase covered the full textile manufacturing process, including cotton cultivation, yarn production, fabric manufacturing, wet treatments such as bleaching and drying, followed by confectioning. These stages were modelled according to tables in Appendix A.

The distribution and retail phase included transoceanic transport from China to Sweden, followed by domestic transportation to retail stores within the country. The use phase was modelled to include user transport, assumed to be a total of 17 km, with a split of 50% car and 50% bus. Laundry related practices were considered as part of the lifestyle assumptions, but the specific processes of washing, drying, and ironing were modelled separately from the garments. Finally, the EOL was modelled as transportation to incineration, followed by incineration with energy recovery.

3.3.1.2 Modelling of Jeans

The modelling of the jeans encompassed all life cycle phases, including production, distribution and retail, use, and EOL. The production phase included the complete textile manufacturing process, beginning with the dry spinning of elastane fibres, followed by yarn spinning to produce cotton and elastane yarn. The next step was circular knitting to form cotton and elastane tricot, then weaving, and wet treatments such as bleaching and dyeing, followed by confectioning of the jeans. These stages were modelled according to tables in Appendix A.

The distribution and retail phase included transoceanic transport from China to Sweden, followed by domestic transportation to retail stores within the country. The use phase was modelled to include user transport, assumed to be a total of 17 km, with a split of 50% car and 50% bus. Laundry related practices were considered as part of the lifestyle assumptions, but the specific processes of washing, drying, and ironing were modelled separately from the garments. Finally, the EOL was modelled as transportation to incineration, followed by incineration with energy recovery.

3.3.1.3 Modelling of Dress

The modelling of the dress encompassed all life cycle phases, including production, distribution and retail, use, and EOL. The production phase included the complete textile manufacturing process, beginning with the melt spinning of polyester fibres, followed by yarn spinning to produce polyester staple yarn. This was followed by circular knitting to form polyester tricot and weaving to produce polyester weave for the dress.

The next processes included pre-treatment prior to printing the polyester weave, disperse printing of the polyester weave, and wet treatments such as dyeing and drying of both knitted and woven polyester fabrics using a stenter frame. The final step in production was the confectioning of the dress. These stages were modelled according to tables in Appendix A.

The distribution and retail phase included transoceanic transport from China to Sweden, followed by domestic transportation to retail stores within the country. The use phase was modelled to include user transport, assumed to be a total of 17 km, with a split of 50% car and 50% bus. Laundry related practices were considered as part of the lifestyle assumptions, but the specific processes of washing, drying, and ironing were modelled separately from the garments. Finally, the EOL was modelled as transportation to incineration, followed by incineration with energy recovery.

3.3.1.4 Modelling of Jacket

The modelling of the jacket encompassed all life cycle phases, including production, distribution and retail, use, and EOL. The production phase involved a diverse number of processes due to the use of multiple material types. It began with the production of fibres, including cotton, elastane, polyamide, and polyester. This was followed by yarn production through both spinning and non-woven processes, depending of the fibre type.

Fabric production included both knitting and weaving to create the required textile structures. The next steps involved wet treatments such as dyeing and drying. In addition, the production of other materials such as metals for buttons and zippers was also modelled. The final step in the production phase was the confectioning of the jacket. All stages were modelled according to tables in Appendix A.

The distribution and retail phase included transoceanic transport from China to Sweden, followed by domestic transportation to retail stores within the country. The use phase was modelled to include user transport, assumed to be a total of 17 km, with a split of 50% car and 50% bus. Laundry related practices were considered as part of the lifestyle assumptions, but the specific processes of washing, drying, and ironing were modelled separately from the garments. Finally, the EOL was modelled as transportation to incineration, followed by incineration with energy recovery.

3.3.2 Modelling of Second-hand Garments

The modelling of the environmental impacts of a second-hand garment is based on Nellström et al. (2025). Nellström et al. (2025) determined the processes involved in the value chain of a second-hand garment to be the following: *pre-sorting, manual sorting, distribution, retailing, use and end-of-life.* In this project, the purchase, use phase, and end-of-life phase is determined to be the same for both second-hand and new garments.

In addition, another assumption made when modelling second-hand garments compared to Nellström et al. (2025), was that they calculate that 10% of second-hand garments gathered in Europe will be sold outside of Europe. However, as the focus of this project is on the environmental impacts of a consumer in Sweden, it was deemed more accurate to exclude the garments sold outside of Europe and assume that 10% was assumed to go where the other 90% goes. Hence, the calculation of second-hand garments assumes that the second-hand garment value chain remains within Europe. Distribution and retail of the garments are modelled according to Table A.53 in Appendix A, excluding the transportation to the retailer. The transportation to the retailer is modelled after Case A in Nellström et al. (2025).

In this report, the rate of consumption of second-hand clothes has been based on survey data from Gwozdz et al. (2017). This data has been combined with data from Naturvårdsverket (2024) to produce results regarding the total consumption of second-hand clothes. The share of both second-hand and new clothes purchased are based on Table 3.3.

3.4 Sensitivity Analysis

A sensitivity analysis was conducted to evaluate how changes in key assumptions affect the environmental impact of the lifestyles. Two parameters were varied in this analysis: the mode of user transport and the assumption that 100% of clothing purchases are second-hand for all three lifestyles. The first parameter examined the effect of changing user transport, and the second explored the potential reduction in environmental impact of reusing garments instead of producing new ones through a 100% second-hand scenario.

The first parameter investigated the effect of varying the mode of user transport. In the base case, user transport for garment acquisition was assumed to be 50% by fossil fuel car and 50% by bus, based on average consumer travel patterns according to Sandin et al. (2019). In the sensitivity analysis, the user transport was changed to 100% electric car to reflect a shift toward electric vehicles instead of fossil fuel cars. This choice was made instead of assuming walking or bicycling, which would have resulted in zero environmental impacts, since electric cars are becoming more widely adapted in society and provide a more realistic transport alternative for many consumers. The second parameter tested the influence of assuming that all clothing purchases are second-hand. This 100% second-hand was included to assess the potential reduction in environmental impacts. These two analyses were selected to reflect behavioural changes that could influence the garments' environmental impact. The results of the sensitivity analysis are presented and discussed in Section 4.3.

4

Results

The results were first calculated for individual garments before being aggregated into the different lifestyles. These results can be seen in Appendix B: Figure B.1 shows climate change impact, Figure B.2 illustrates water use, Figure B.3 presents freshwater eutrophication, Figure B.4 shows freshwater ecotoxicity, and Figure B.5 presents land use. As the primary focus of this study was to analyse the total environmental impacts and identify hotspots for different lifestyles, the results for the individual garments were placed in Appendix B.

The LCA of clothing consumption based on three defined lifestyles are presented: slow fashion, modern, and ultra-fast fashion consumer. These lifestyles differ depending on garment purchase frequency, the share of second-hand items, and washing practices. For full details regarding parameter values used to model these lifestyles, see Table 3.1 and Table 3.2 in Section 3.2.1.

The results show the total environmental impacts associated with each lifestyle across several impact categories, including climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use. Further, environmental hotspots in the clothing life cycle for the lifestyles were identified. To explore the influence of second-hand clothing rates and the mode of user transport, the results also include a sensitivity analysis.

4.1 Total Environmental Impacts of Lifestyles

In this section, the third research question is addressed by identifying how the total environmental impact of clothing consumption vary depending on lifestyle. The impact assessment results for garments were combined with the behavioural patterns defined for each lifestyle. The outcomes cover five environmental impact categories, expressed per consumer and per year.

Table 4.1 presents the total climate change impact for each lifestyle, divided by life cycle phase. These values include emissions from production, distribution and retail, second-hand purchases, use phase activities such as washing, drying, ironing, and user transport, as well as the end-of-life phase.

The following tables summarise the results for the remaining impact categories: Table 4.2 shows total water use, Table 4.3 details freshwater eutrophication, Table 4.4 presents freshwater ecotoxicity, and Table 4.5 reports land use impact.

As shown in Table 4.1, the ultra-fast fashion lifestyle generates more than 2.5 times the climate impact compared to the slow fashion lifestyle, primarily due to a higher consumption of new clothes. Table 4.1 shows that the total climate change impact is 425 kg CO_2-eq for the ultra-fast fashion lifestyle, and 191 kg CO_2-eq for the slow fashion lifestyle.

Table 4.1: Climate Change impact (kg CO_2-eq) by lifestyle and garment

Phase / Garment	**Slow Fashion**	**Modern**	**Ultra-Fast Fashion**	**Unit**
Production phase				
T-shirts	27.76	44.37	62.12	kg CO_2-eq
Jeans	25.77	41.20	57.68	kg CO_2-eq
Dresses	37.15	59.39	83.15	kg CO_2-eq
Jackets	46.14	73.76	103.26	kg CO_2-eq
Distribution & retail phase for new clothes				
T-shirts	1.29	2.06	2.88	kg CO_2-eq
Jeans	1.55	2.48	3.48	kg CO_2-eq
Dresses	1.20	1.92	2.68	kg CO_2-eq
Jackets	1.61	2.58	3.61	kg CO_2-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.08	0.37	0.51	kg CO_2-eq
Jeans	0.08	0.39	0.54	kg CO_2-eq
Dresses	0.06	0.30	0.42	kg CO_2-eq
Jackets	0.10	0.46	0.64	kg CO_2-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport (second-hand garments)	2.85	5.83	8.16	kg CO_2-eq
User transport (new garments)	23.90	38.21	54.61	kg CO_2-eq
Washing 40°C	4.71	8.01	9.42	kg CO_2-eq
Washing 60°C	3.05	5.19	6.11	kg CO_2-eq
Drying	5.84	7.63	7.63	kg CO_2-eq
Ironing	0.31	0.92	0.92	kg CO_2-eq
End-of-Life phase				
T-shirts	1.02	1.63	2.28	kg CO_2-eq
Jeans	1.05	1.68	2.35	kg CO_2-eq
Dresses	2.13	3.41	4.77	kg CO_2-eq
Jackets	3.52	5.63	7.88	kg CO_2-eq
TOTAL IMPACT	**191.20**	**247.80**	**425.10**	**kg CO_2-eq**

Table 4.2 shows that the total water use per consumer per year is approximately 42 m^3 for the ultra-fast fashion lifestyle, 30 m^3 for the moder lifestyle, and 19 m^3 for the slow fashion lifestyle.

Table 4.2: Water Use (m^3) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	7.93	12.68	17.75	m^3
Jeans	7.86	12.56	17.59	m^3
Dresses	0.14	0.23	0.32	m^3
Jackets	1.88	3.01	4.22	m^3
Distribution & retail phase for new clothes				
T-shirts	0.01	0.02	0.03	m^3
Jeans	0.01	0.02	0.03	m^3
Dresses	0.01	0.02	0.03	m^3
Jackets	0.02	0.03	0.04	m^3
Distribution & retail phase for second-hand clothes				
T-shirts	0.0008	0.004	0.008	m^3
Jeans	0.0009	0.004	0.006	m^3
Dresses	0.0007	0.003	0.004	m^3
Jackets	0.001	0.005	0.007	m^3
Use phase (incl. transport, washing, drying, ironing)				
User transport (second-hand garments)	0.003	0.012	0.017	m^3
User transport (new garments)	0.049	0.079	0.224	m^3
Washing 40°C	0.316	0.538	0.633	m^3
Washing 60°C	0.232	0.395	0.465	m^3
Drying	0.679	0.889	0.889	m^3
Ironing	0.036	0.107	0.107	m^3
End-of-Life phase				
T-shirts	0.003	0.004	0.006	m^3
Jeans	0.003	0.004	0.006	m^3
Dresses	0.001	0.001	0.002	m^3
Jackets	0.004	0.007	0.010	m^3
TOTAL IMPACT	**19.20**	**30.44**	**42.39**	$\mathbf{m^3}$

Table 4.3 shows that the total eutrophication impact is 0.139 kg P-eq, while it is 0.064 kg P-eq for the slow fashion lifestyle.

Table 4.3: Freshwater Eutrophication (kg P-eq) by lifestyle and garment

Phase / Garment	**Slow Fashion**	**Modern**	**Ultra-Fast Fashion**	**Unit**
Production phase				
T-shirts	0.01	0.01	0.03	kg P-eq
Jeans	0.01	0.02	0.03	kg P-eq
Dresses	0.01	0.02	0.02	kg P-eq
Jackets	0.01	0.02	0.03	kg P-eq
Distribution & retail phase for new clothes				
T-shirts	0.0001	0.0002	0.0003	kg P-eq
Jeans	0.0002	0.0003	0.0004	kg P-eq
Dresses	0.0002	0.0002	0.0003	kg P-eq
Jackets	0.0002	0.0003	0.0004	kg P-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.000006	0.00003	0.00004	kg P-eq
Jeans	0.000007	0.00003	0.00004	kg P-eq
Dresses	0.000005	0.00002	0.00003	kg P-eq
Jackets	0.000008	0.00004	0.00005	kg P-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport (second-hand garments)	0.0001	0.0007	0.0010	kg P-eq
User transport (new garments)	0.0028	0.0045	0.0069	kg P-eq
Washing 40°C	0.0033	0.0055	0.0065	kg P-eq
Washing 60°C	0.0022	0.0037	0.0043	kg P-eq
Drying	0.0044	0.0057	0.0058	kg P-eq
Ironing	0.0002	0.0007	0.0007	kg P-eq
End-of-Life phase				
T-shirts	0.00002	0.00004	0.00005	kg P-eq
Jeans	0.00002	0.00004	0.00005	kg P-eq
Dresses	0.000004	0.000007	0.00001	kg P-eq
Jackets	0.00002	0.00003	0.00004	kg P-eq
TOTAL IMPACT	**0.064**	**0.97**	**0.139**	**kg PO$_4$-eq**

Table 4.4 shows that the total freshwater ecotoxicity impact is 33 kg 1.4-DCB-eq, while it is 16 kg 1.4-DCB-eq for the slow fashion lifestyle. These results indicate that the ultra-fast fashion consumer accounts for almost twice the impact compared to the slow fashion consumer, although these results are uncertain due to limited emissions data.

Table 4.4: Freshwater Ecotoxicity (kg 1.4-DCB-eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	1.22	1.96	2.74	kg 1.4-DCB-eq
Jeans	1.96	3.13	4.38	kg 1.4-DCB-eq
Dresses	1.00	1.60	2.24	kg 1.4-DCB-eq
Jackets	2.01	3.22	4.51	kg 1.4-DCB-eq
Distribution & retail phase for new clothes				
T-shirts	0.13	0.19	0.27	kg 1.4-DCB-eq
Jeans	0.14	0.21	0.30	kg 1.4-DCB-eq
Dresses	0.11	0.16	0.23	kg 1.4-DCB-eq
Jackets	0.16	0.24	0.34	kg 1.4-DCB-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.006	0.029	0.041	kg 1.4-DCB-eq
Jeans	0.007	0.031	0.043	kg 1.4-DCB-eq
Dresses	0.005	0.024	0.033	kg 1.4-DCB-eq
Jackets	0.008	0.036	0.051	kg 1.4-DCB-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport (second-hand garments)	0.08	0.35	0.50	kg 1.4-DCB-eq
User transport (new garments)	1.45	2.32	4.11	kg 1.4-DCB-eq
Washing 40°C	1.36	2.31	2.72	kg 1.4-DCB-eq
Washing 60°C	1.19	2.03	2.39	kg 1.4-DCB-eq
Drying	4.94	6.47	6.47	kg 1.4-DCB-eq
Ironing	0.26	0.78	0.78	kg 1.4-DCB-eq
End-of-Life phase				
T-shirts	0.02	0.03	0.05	kg 1.4-DCB-eq
Jeans	0.02	0.03	0.05	kg 1.4-DCB-eq
Dresses	0.17	0.28	0.39	kg 1.4-DCB-eq
Jackets	0.21	0.33	0.46	kg 1.4-DCB-eq
TOTAL IMPACT	**16.43**	**21.97**	**33.08**	**kg 1.4-DCB-eq**

Table 4.5 shows that the total land use impact is approximately 30 m^2 · a crop-eq for the slow fashion lifestyle, 47 m^2 · a crop-eq for modern consumer, and 65 m^2 · a crop-eq for the ultra-fast fashion lifestyle. Land use impacts were highest in the production phase, but the use phase also contributed, primarily through heat and power co-generation of wood chips for drying and through detergent production together with heat and power co-generation of wood chips for washing.

Table 4.5: Land Use (m^2 · a crop-eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	10.30	16.46	23.05	m^2 · a crop-eq
Jeans	10.54	16.84	23.58	m^2 · a crop-eq
Dresses	0.53	0.85	1.19	m^2 · a crop-eq
Jackets	3.03	4.92	6.89	m^2 · a crop-eq
Distribution & retail phase for new clothes				
T-shirts	0.06	0.09	0.13	m^2 · a crop-eq
Jeans	0.07	0.11	0.15	m^2 · a crop-eq
Dresses	0.05	0.09	0.12	m^2 · a crop-eq
Jackets	0.07	0.12	0.16	m^2 · a crop-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.002	0.009	0.013	m^2 · a crop-eq
Jeans	0.002	0.010	0.014	m^2 · a crop-eq
Dresses	0.002	0.008	0.011	m^2 · a crop-eq
Jackets	0.002	0.012	0.016	m^2 · a crop-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport (second-hand garments)	0.03	0.13	0.19	m^2 · a crop-eq
User transport (new garments)	0.55	0.87	1.46	m^2 · a crop-eq
Washing 40°C	1.85	3.15	3.71	m^2 · a crop-eq
Washing 60°C	1.13	1.93	2.27	m^2 · a crop-eq
Drying	1.57	2.05	2.05	m^2 · a crop-eq
Ironing	0.08	0.25	0.25	m^2 · a crop-eq
End-of-Life phase				
T-shirts	0.002	0.003	0.004	m^2 · a crop-eq
Jeans	0.002	0.003	0.004	m^2 · a crop-eq
Dresses	0.001	0.001	0.001	m^2 · a crop-eq
Jackets	0.002	0.003	0.004	m^2 · a crop-eq
TOTAL IMPACT	**29.92**	**46.62**	**65.26**	**m^2 · a crop-eq**

Furthermore, Table 4.2, Table 4.3, Table 4.4, and Table 4.5, indicate that the ultra-fast fashion lifestyle results in at least twice the environmental impact of the slow fashion lifestyle in each category respectively.

4.2 Environmental Hotspots in the Clothing Life Cycle for Lifestyles

This section addressed the fourth research question by identifying the main environmental hotspots in the clothing life cycle for different lifestyles. In this context, environmental hotspots refer to the phases, processes, or garment types that contribute the most to the overall environmental impacts. The results are presented for all impact categories included in the study: climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use. In addition, the environmental impacts and hotspots associated with the production phase of each lifestyle were assessed.

4.2.1 Climate Change

Figure 4.1 presents the total climate change impact (in kg CO_2-eq) per lifestyle, divided by life cycle phases. The ultra-fast fashion lifestyle shows the highest total impact at approximately 425 kg CO_2-eq per year, followed by the average consumer at around 248 kg CO_2-eq, and the slow fashion lifestyle at 191 kg CO_2-eq.

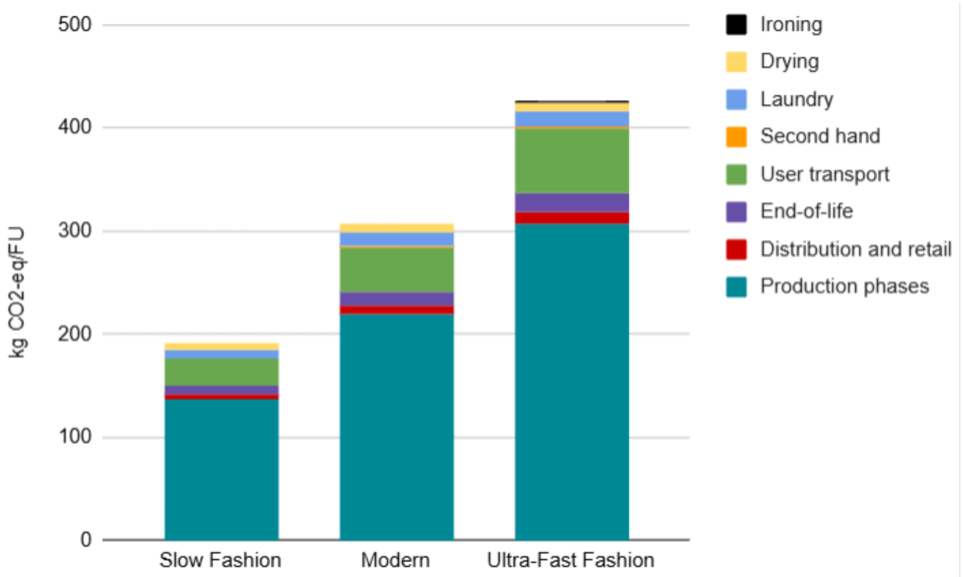

Figure 4.1: The climate change impact for the lifestyles during one year [kg CO_2-eq].

Across all lifestyles, the production phase contributes to the largest share of emissions. This is followed by the use phase, which includes user transport, washing, drying, and ironing. In particular, user transport contributes to a significant part of the use phase impact. The use phase impacts are dependent on a number of factors such as mode of transport, transport distance, the amount of products purchased during a single trip, and if the consumer did any other errands during that trip. Since user transport assumes that 1 kg of textiles are purchased in one trip, varying this factor would affect the results. In addition, if the user also purchased other non-clothing items, the environmental impact from the travel could be allocated upon all items purchased.

The contribution from distribution and retail, second-hand purchases, and the end-of-life phase is comparatively lower across all lifestyles but still increases with higher levels of consumption. Second-hand garments still contribute some emissions although their overall impact remains minor compared to new clothing.

Overall, the result in Figure 4.1 indicates a correlation between increased clothing consumption and climate impact, with the ultra-fast fashion consumer accounting for more than two times the emissions of the slow fashion consumer. Based on this, it is clear that the production of new garments is the major driver of environmental impact in a Swedish context, while other processes such as laundry contribute to a lesser extent.

4.2.2 Water Use

Figure 4.2 shows the total water use (in m^3) per consumer for each lifestyle. The ultra-fast fashion lifestyle has the highest water consumption at approximately 42 m^3 per year, followed by the modern average lifestyle with 30 m^3, and the slow fashion lifestyle 19 m^3.

Similar to climate change impacts, the production phase accounts for the majority of water use across all lifestyles. This is particularly apparent in the ultra-fast fashion lifestyle, where high volumes of new clothing purchases intensify the water use impact. This is dominated by the use of water for cotton irrigation but also the energy supplies for spinning, weaving, and other processes. The second largest contributor is the use phase, particularly laundry (at both 40 °C and 60 °C), and drying. Although these activities contribute less than production, their combined impact remains essential. Other phases such as user transport, second-hand purchases, distribution and retail, and end-of-life, contribute marginally to the total impact, but their influence increases with higher consumption. Overall, the results show a correlation between increased clothing consumption and higher water use.

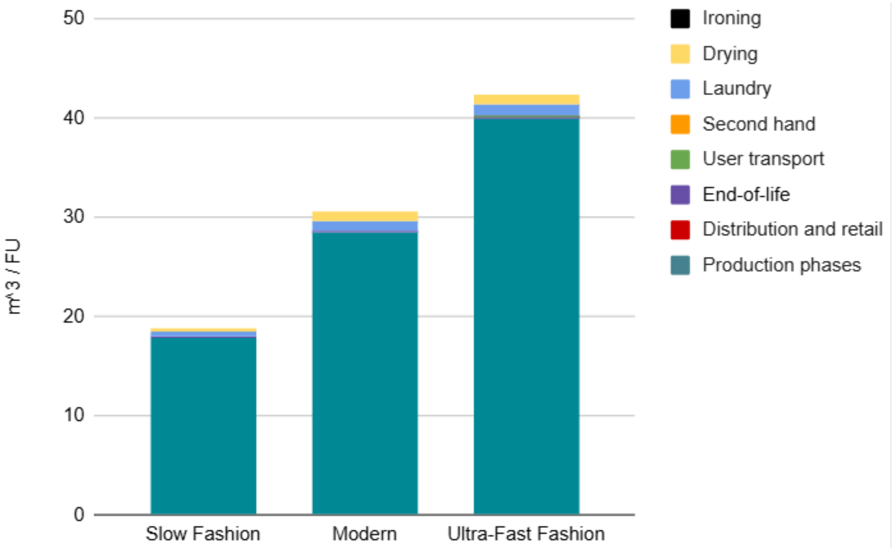

Figure 4.2: The water use impact for the lifestyles during one year [m^3 water].

4.2.3 Freshwater Eutrophication

Freshwater eutrophication is an important environmental impact of clothing production and consumption. As shown in Figure 4.3, the total impact of freshwater eutrophication increases with higher clothing consumption. The ultra-fast fashion consumer has a total impact of approximately 0.140 kg PO_4-eq, which is more than twice the impact of the slow fashion consumer at 0.064 kg PO_4-eq.

The production phase contributes significantly to freshwater eutrophication across all lifestyles. The ultra-fast fashion lifestyle, characterised by frequent purchases of new clothing, increases the eutrophication impact in this phase.

The use phase also contributes to eutrophication, particularly due to laundry, where detergent chemicals are released into water systems. It can also be seen in Figure 4.3 that drying and user transport cause an impact, especially in the ultra-fast fashion scenario. The distribution and retail phase, as well as the end-of-life phase contribute marginally to eutrophication compared to the production and use phases. In conclusion, as with the other impact categories, higher consumption correlates with significant larger eutrophication impact, with the production and use phases being the main contributors.

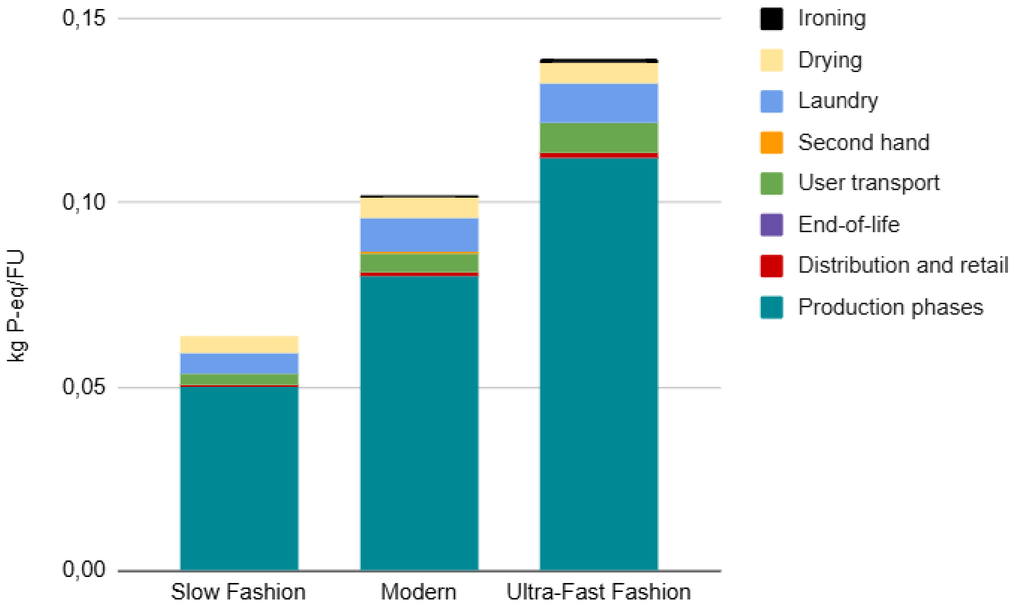

Figure 4.3: The freshwater eutrophication impact for the lifestyles during one year [kg PO_4-eq].

4.2.4 Freshwater Ecotoxicity

Figure 4.4 shows the total freshwater ecotoxicity impact for each lifestyle, covering all life cycle phases. The ultra-fast fashion lifestyle contributes to the highest environmental impact, with a total of approximately 33 kg 1.4-DCB-eq per consumer per year. The lowest result was for the slow fashion lifestyle, with a total of approximately 16 kg 1.4-DCB-eq per consumer per year. However, the results for freshwater ecotoxicity impacts are uncertain due to limited data on chemicals and emissions.

The production phase is the largest contributor to freshwater ecotoxicity for all lifestyles. The use phase also accounts for a substantial share of the total impact, particularly due to laundry, drying, and user transport. While the distribution and retail, and end-of-life phases contribute comparatively less, their impact becomes more notable in the ultra-fast fashion lifestyle since higher consumption of garments is consumed and disposed of each year.

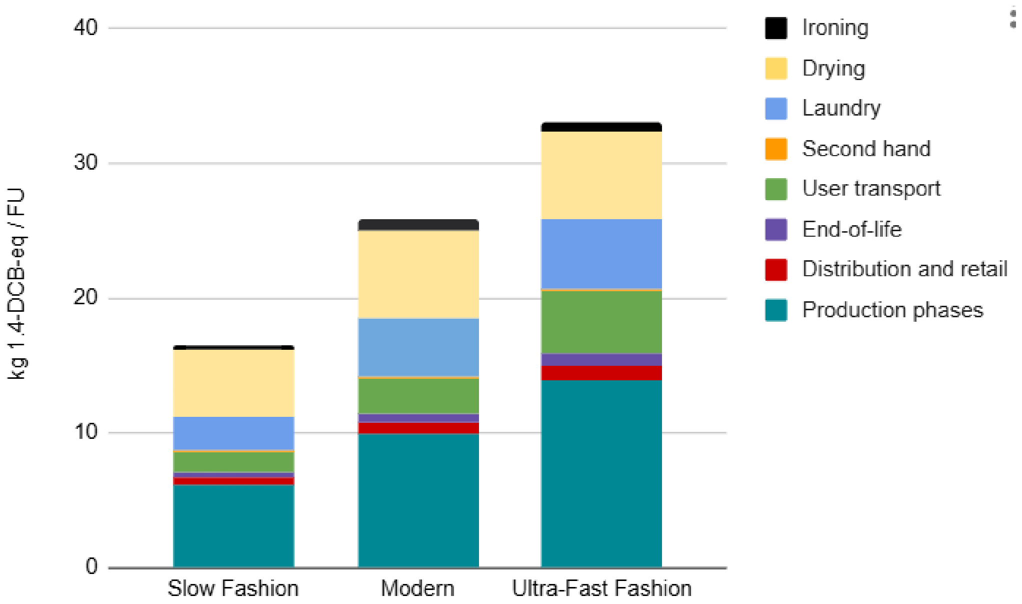

Figure 4.4: The freshwater ecotoxicity impact for the lifestyles during one year [kg 1.4-DCB-eq].

4.2.5 Land Use

Figure 4.5 presents the total impact for land use across all life cycle phases for each lifestyle. The ultra-fast fashion lifestyle has the highest impact, with approximately 65 m^2*a crop-eq per consumer. This is more than twice the impact of the slow fashion lifestyle.

The production phase is the greatest contributor to land use across all lifestyles, showing the agricultural demands during production. The use phase also contributes significantly, specifically through laundry, drying, and user transport. Land use impacts in the use phase were mainly associated with combined heat and power generation from wood chips for drying, as well as with detergent production and the combined heat and power generation from wood chips for washing. In contrast, the distribution and retail phase, second-hand purchases, and end-of-life phase have marginal contributions to the total impact. Overall, the results for land use follow the trend observed across all impact categories, that higher garment consumption leads to a higher environmental impact.

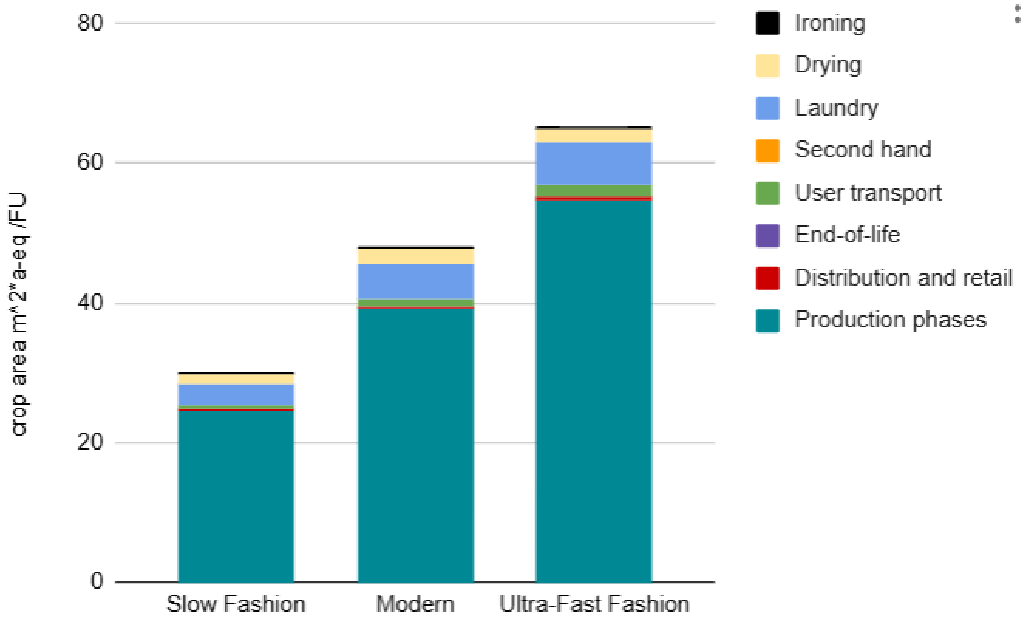

Figure 4.5: The land use impact for the lifestyles during one year [m^2*a crop-eq].

4.2.6 Production Phase Impacts and Hotspots

The most important phase for the environmental impacts of all lifestyles and all impact categories is the production phase. This section provides further analysis of where in the value chain the production phase impacts come from.

The life cycle impact assessment results are presented below, comparing four different garment types. Figure 4.6 illustrates the distribution of environmental impacts across jackets, dresses, jeans, and T-shirts. The impacts are compared to each garment type's share of the wardrobe by weight.

Water use is particularly high for jeans and T-shirts, which is due to cotton cultivation in the production process. Dresses, although representing a smaller share of the wardrobe, still contribute significantly to climate impact and freshwater eutrophication. Jackets show relatively high impacts in terms of freshwater ecotoxicity, which can be due to the use of specific materials and chemical treatments in production.

The results highlight the importance of both considering the quantity and material of garments when assessing environmental impacts of lifestyles. Jeans and T-shirts appear as environmental hotspots, indicating potential for reduction through changes in material choices or consumer behaviour.

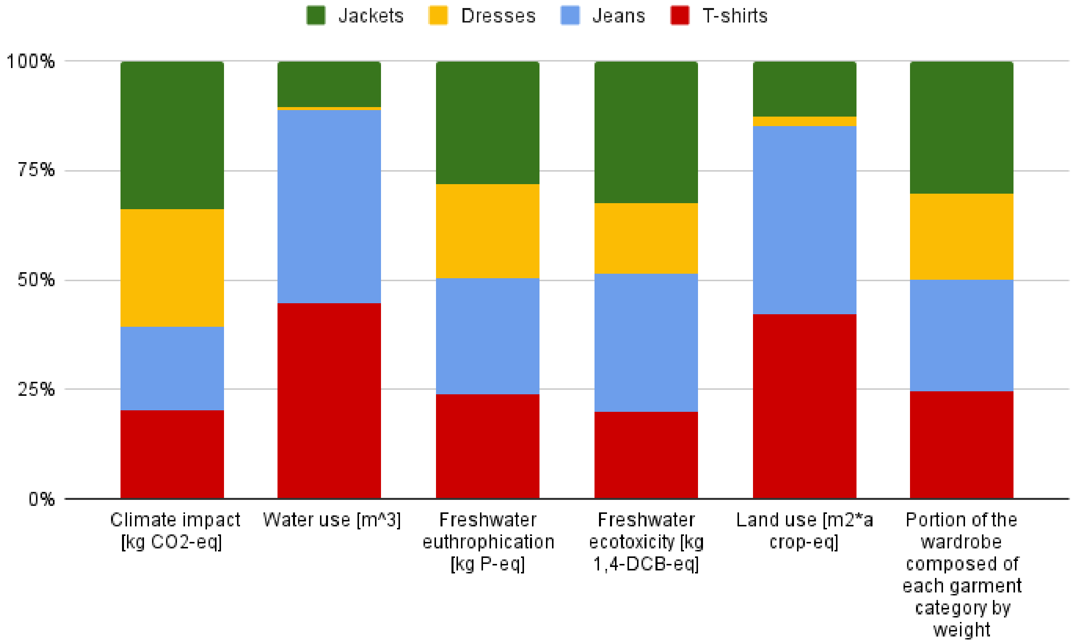

Figure 4.6: Environmental impacts generated during the production phase for each garment category, normalised by the garment category's share of wardrobe consumption by weight.

Looking further into the environmental impacts of the production phase by assessing the environmental impact for each garment, we derive the results seen in 4.7, displaying the results for climate impact.

The results for the T-shirt in Figure 4.7 show which section of the production chain that contributes with the most CO_2-eq emissions for a T-shirt. The major contributor is the wet treatment, but fibre production, yarn weaving and confectioning also contribute. The transportation that is included in the production chain as well as the production of fabric contribute with minor impact. It is important to note that while the T-shirt emits less than the jeans per garment, it is not certain that it is the case per use, as the lifespan of the garments differ.

For all garments, the wet treatment is a significant contributor to the climate impact, as it is an energy intensive process. All of the production steps displayed here are conducted using the production country energy mix, meaning that the energy intensive processes in the production phase will emit significant emissions.

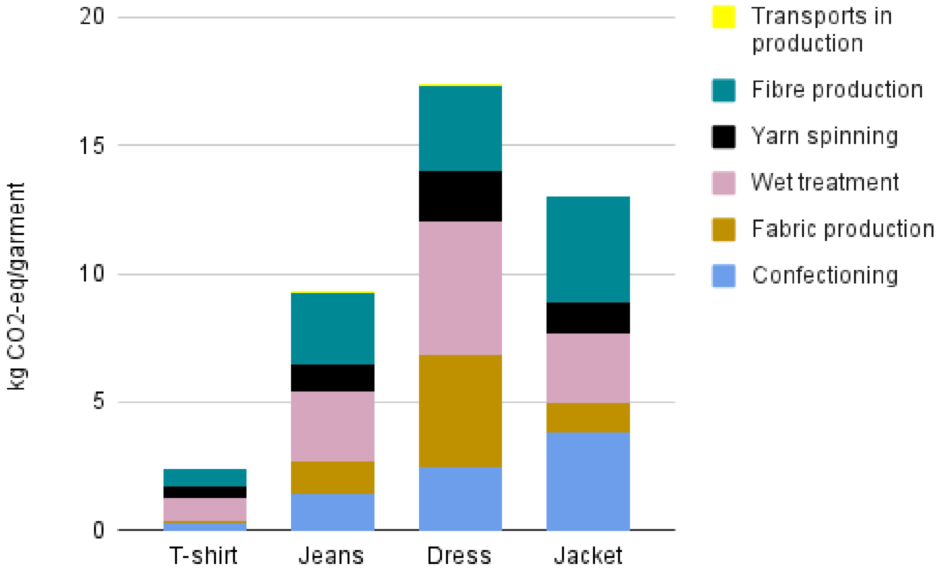

Figure 4.7: Climate impact for the production phase of each garment [kg CO_2-eq]

4.3 Sensitivity Analysis

The sensitivity analysis explored how variations in key assumptions affect the overall environmental impact. Two parameters were tested in particular. The first was the user transport mode, which evaluated how both shifting from the original assumption of 50% fossil-fuel car and 50% bus, as well as from a petrol car, to 100% electric car affects the environmental impacts associated with travelling to and from the store. This was chosen due to relatively high contribution of user transport to the environmental impacts in the results. The second parameter, the second-hand usage rate, assessed the environmental impact of consumers purchasing 100% second-hand garments instead of new clothes. Both variables were explored to investigate their potential for reducing environmental footprints in several impact categories.

4.3.1 User Transport Mode

The sensitivity analysis for the user transport mode examined the impact of using an electric car instead of fossil-based transport consisting of 50% car and 50% bus as well as a petrol car transport, across several impact categories. As shown in Table C.1 in Appendix C, the analysis compared the impact of electric transport per garment type. The sensitivity analysis for the user transport mode also compared the impact of using an electric car instead of a petrol car, across several impact categories.

Figure 4.8 illustrates the climate change impact of user transport, comparing fossil-based and electric alternatives. The results indicate that fossil transport contributes to more than twice the climate impact compared to electric car transport. In contrast, Figure 4.9 demonstrates that electric car transport accounts for significantly higher water use than fossil transport, primarily due to the use of hydropower, which accounts for over 40% of the impact.

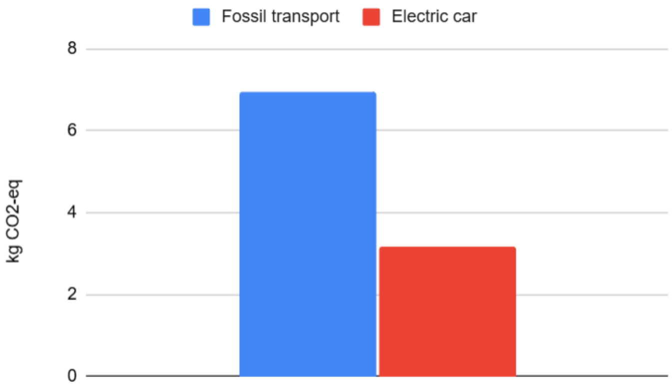

Figure 4.8: Sensitivity analysis of climate change impacts from user transport, comparing fossil-based and electric transport alternatives.

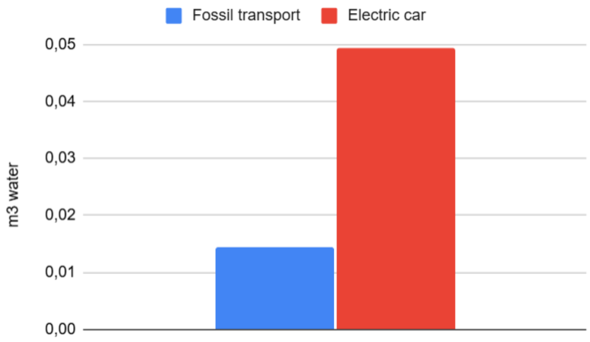

Figure 4.9: Sensitivity analysis of water use impacts from user transport, comparing fossil-based and electric transport alternatives.

Regarding freshwater eutrophication, Figure 4.10 indicates that the electric car causes nearly 2.5 times greater impact than fossil alternatives. Similarly, Figure 4.11 shows that freshwater ecotoxicity is approximately three times higher for the electric car, largely due to the production of the car and its battery, which together account for 82% of the impact.

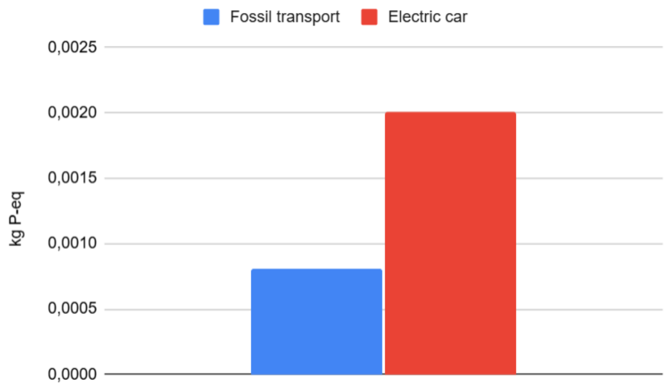

Figure 4.10: Sensitivity analysis of freshwater eutrophication impacts from user transport, comparing fossil-based and electric transport alternatives.

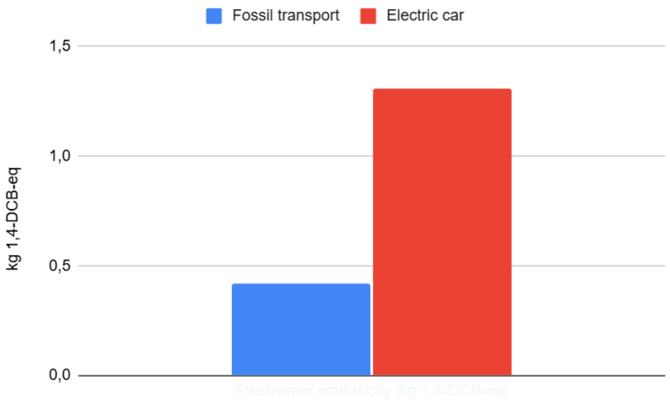

Figure 4.11: Sensitivity analysis of freshwater ecotoxicity impacts from user transport, comparing fossil-based and electric transport alternatives.

For land use, the difference between the two alternatives is smaller, although the electric car still shows a slightly higher impact according to Figure 4.12. A substantial part of the land use impact of comes from road construction (approximately 38%) and electricity production using wet wood ships measured as dry mass (approximately 25%). For fossil-based transport, the land use impact is also mainly attributed to road construction.

It is important to note that the fossil transport scenario includes a split of 50% car and 50% bus, while the electric transport scenario assumes 100% electric car. The travel distance is assumed to be 17 km in both cases.

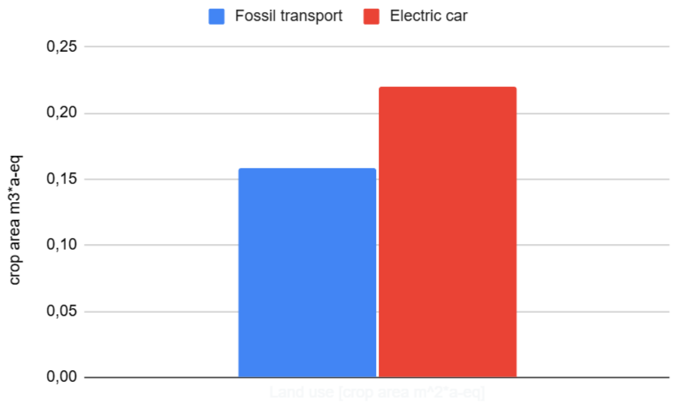

Figure 4.12: Sensitivity analysis of land use impacts from user transport, comparing fossil-based and electric transport alternatives

The second scenario compares the environmental impacts of an electric car to those of a petrol car across five impact categories. As shown in Figure 4.13, climate change impacts are reduced by 70% when using an electric car compared to a petrol car, and the land use impact is also slightly lower. In contrast, impacts related to freshwater ecotoxicity, freshwater eutrophication, and water use are higher for electric car transport. Although the differences are smaller than in the previous scenario, the results still reflect that electric vehicles reduce climate change and land use impacts, but come with increased impacts in certain water-related impact categories.

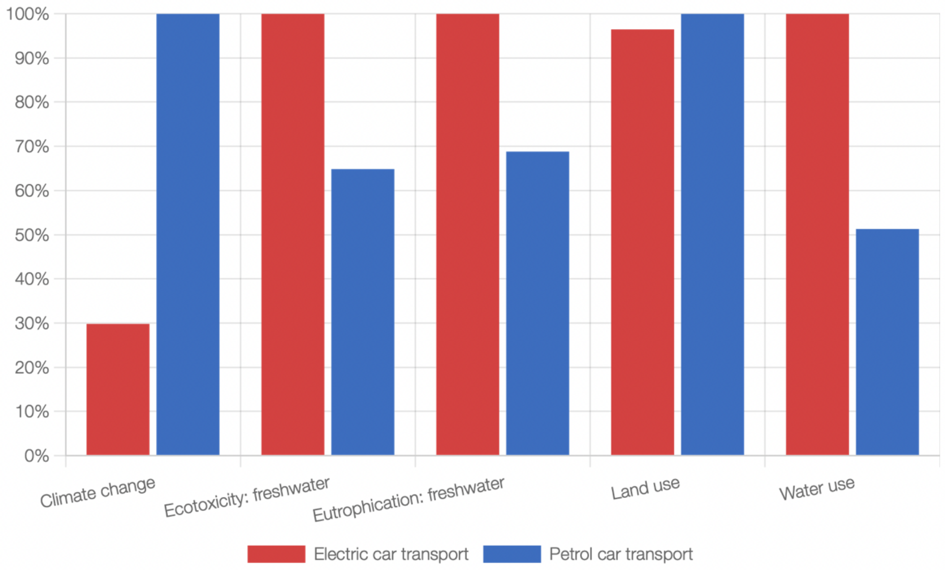

Figure 4.13: Sensitivity analysis comparing a fossil car and an electric car for all impact categories

4.3.2 Second-hand Usage Rate

Second-hand purchases reduce the demand for new clothing production, based on the assumption that a second-hand garment replaces a new garment in the wardrobe. This results in lower environmental impacts across all life cycle phases for the lifestyles. The production phase, a key contributor to environmental impact, is particularly affected since there is no new manufacturing required. Furthermore, second-hand garments also extend the lifespan of clothing, further reducing environmental impacts. The sensitivity analysis for the second-hand usage rate examined what the impact of the three lifestyles would be if all garments were purchased second-hand across the five impact categories assessed in this study. As shown in Tables C.2, C.3, C.4, C.5, and C.6 in Appendix C, the analysis compares three different lifestyles: slow fashion, modern average, and ultra-fast fashion. The impact categories assessed include climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use. The results show that the ultra-fast fashion consumer has the highest impact and the slow fashion consumer has the lowest impact for all impact categories. The results present impacts associated with ironing, drying, washing, user transport, and all processes included in the modelling of second-hand garments, such as sorting, distribution and retail, and end-of-life, referred to as "second hand" in the figures.

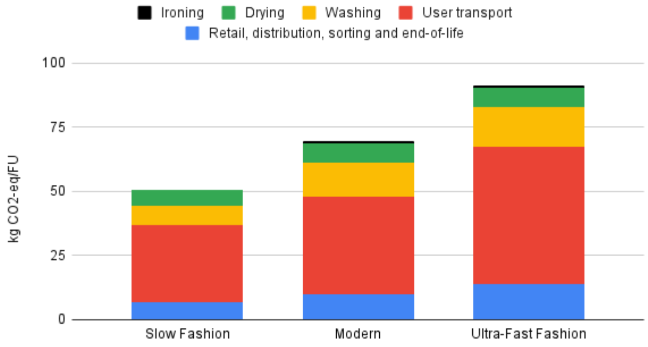

Figure 4.14: Climate change impacts per consumer per year [kg CO_2-eq]

Regarding climate impact, the results in Figure 4.14 show that the most important driver of environmental impact is the user transport for purchasing garments. The impact from the use phase is dependent on factors such as transport distance, mode of transport, number of garments purchased during the trip, and also if other errands were done during the trip. As mentioned in this report, it is assumed that a consumer purchases 1 kg of garments for each trip. The impact from user transport can therefore vary heavily between individuals as it is dependent on all of these factors. If the three lifestyles would switch from the standard rate of second-hand purchase to 100% second hand it would reduce the climate impact by 73% for the slow fashion consumer, 77% for the modern consumer, and by 79% for the ultra-fast fashion consumer. The end-of-life and distribution and retail contributes with a relatively small amount while washing and laundry have some impact.

For the water use results in Figure 4.15, it can be seen that, in particular, washing, drying, and user transport associated with new garments have a higher water use compared to second-hand garments.

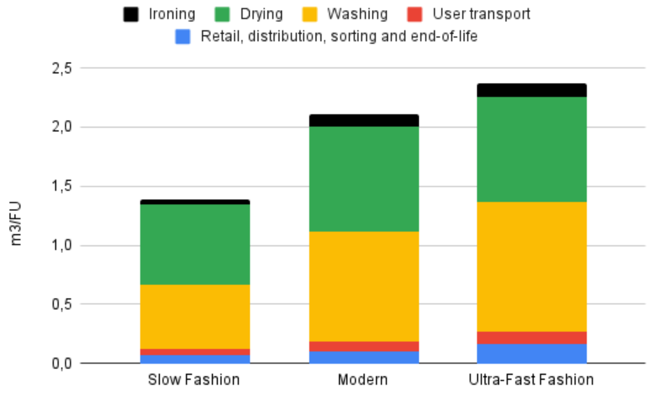

Figure 4.15: Water use impacts per consumer per year [$\mathrm{m}^3 water$]

For the freshwater eutrophication results shown in Figure 4.16, washing and drying have higher impact, and user transport still contribute with a significant portion of the impact. The eutrophication impact from the most impactful lifestyle behaviour is washing, and the impacts result mainly from the electricity use (44%), wastewater treatment (30%) and detergent production (22%) for washing at 60°C.

For the freshwater eutrophication and ecotoxicity results in Figure 4.16 and Figure 4.17, second-hand usage helps reduce the impacts, especially in the use phase for garments such as T-shirt, jeans, and dresses. However, the differences between the modern and ultra-fast fashion lifestyles are marginal in these categories.

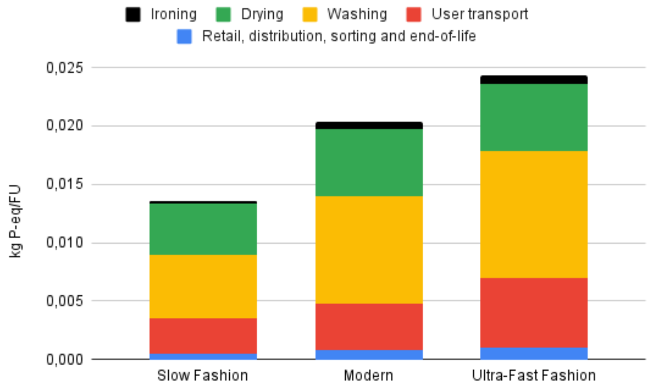

Figure 4.16: Freshwater eutrophication impacts per consumer per year [kg P-eq]

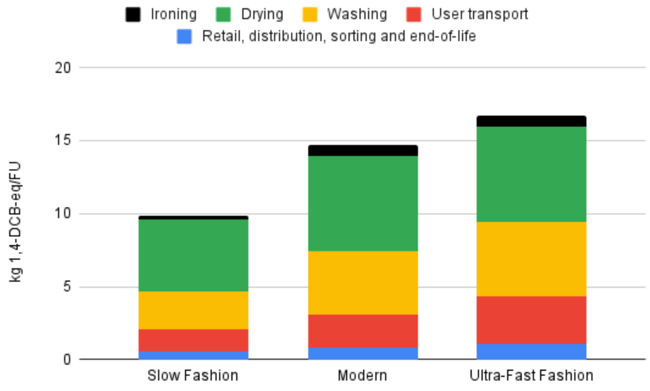

Figure 4.17: Freshwater ecotoxicity impacts per consumer per year [kg 1.4-DCB-eq]

For the land use results in Figure 4.18, the trend of increased impact from ultra-fast fashion persists. Results for ultra-fast fashion are higher compared to the slow fashion consumer or the modern consumer. Although second-hand usage leads to lower land use impacts, user transport and washing in the use phase still contribute.

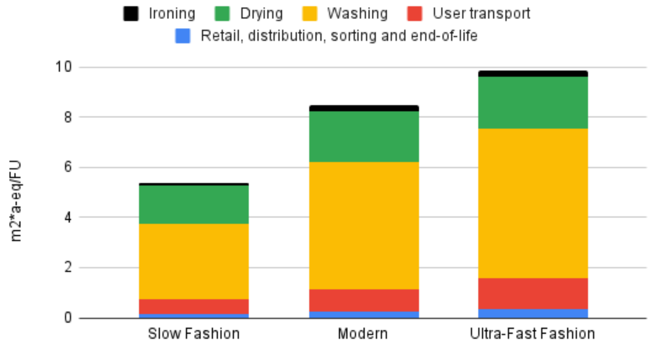

Figure 4.18: Land use impacts per consumer per year [m2*a crop-eq]

The sensitivity analysis clearly shows that increasing the use of second-hand clothes can significantly mitigate environmental impacts across several categories, assuming that the second-hand garment fully replaces a new garment in the wardrobe. The level of reduction depends on garment type, but in general, second-hand usage contributes to lower emissions, reduced water use and land use, and less freshwater pollution compared to new clothing production.

4.4 Discussion

This section critically evaluates the results, assumptions, and limitations encountered in this study, drawing comparisons with relevant studies identified in the literature review. By examining the methodologies and theory of similar research, this discussion highlights key similarities and differences.

4.4.1 Interpretation of Results

The results of this study show that the majority of environmental impacts stem from the production phase for all garment types and across all impact categories, except for freshwater ecotoxicity, where laundry and drying also contribute significantly. While the impact of the laundry was low for the other impact categories, there are a few other aspects to consider in this case. The first is that the primary driver of environmental impact for clothing comes from the production of new clothes, and excessive laundering may have impacts on the longevity of the clothes. Secondly, a large portion of the impact from laundry and drying comes from the use of electricity, therefore the environmental impact will depend on the electricity mix used. This means that the results of this project would likely differ if the impact of a non-Swedish consumer was assessed.

The result that the production phase contributes to most amounts of environmental impacts confirms findings in previous research, e.g., Zamani et al. (2017) and Sandin et al. (2019). This highlights the importance of reducing impacts related to production. The most effective strategy to reduce environmental impact is to slow down or avoid garment production by extending the use phase.

Extending the technical lifespan of garments, through frequent use and repair, can reduce impacts. Choosing second-hand clothing instead of newly produced garments also avoids the impacts of production. However, it is important to mention that second-hand systems are not perfect since garments may be discarded, exported, or not worn again, which reduce their actual environmental impact. In this context, consumer behaviour becomes critical. A key insight from Nielsen et al. (2023) is the distinction between *fashion-oriented* and *style-oriented* consumers. Fashion-oriented consumers seek to follow current trends and are closely aligned with the ultra-fast fashion model, which purchases new garments frequently and drives high impacts. In contrast, style-oriented consumers are more focused on personal expression and are less influenced by trends, which may lead to extended garment use and lower environmental impact.

Alternative models, such as clothing libraries, could fulfill the desire for variety in clothing while reducing production. According to Zamani et al. (2017), such business models have potential to reduce environmental impacts by increasing garment use and slow down production of new garments. This suggests that clothing libraries may be one way of fulfilling a similar function to the one provided by fast fashion while reducing impact from production.

This study also supports findings by Sandin et al. (2025) that textile recycling, although beneficial in categories such as water use, is not the only solution to reduce environmental impact. While recycled fibres avoid impacts from fibre production, they must still go through energy- and resource intensive production stages. Recycling could therefore be considered as a complementary strategy, and not as a replacement for reduced consumption. Regarding fibre type, the results show that no textile in this study is truly sustainable, and all materials contribute to impacts across several categories. Garments consisting of cotton, such as T-shirts and jeans, show highest impact in water use and land use, while polyester garments have the highest climate impacts. Therefore, reducing production and extending use are far more effective strategies overall.

The use phase also contributes to environmental impact, especially user transport. Surprisingly, user transport including type, distance, and purpose of travel, have a more significant role than transport in production phase. The sensitivity analysis showed that using an electric car reduces climate impact but increases other impact categories, such as water use and land use, due to battery production. In contrast, options such as public transport, walking, or bicycling, show lower impact across the impact categories.

4.4.2 Uncertainties and Limitations

This study comes with several uncertainties and limitations, many of which relate to data availability and necessary assumptions. The wardrobe used was based on four garment categories that are intended to represent the full diversity of clothing purchased by consumers. While the proportions of the garment categories included in the wardrobe are intended have similar fibre types, value chains and use patterns as that of a Swedish consumer, further improvements could be made. Expanding the wardrobe to include more garments would likely improve the accuracy of the results.

Some lifestyle data, particularly for the slow fashion and ultra-fast fashion lifestyles, was created using assumptions based on literature rather than exact behavioural data. For instance, assumptions were made regarding second-hand shopping habits and user transport. These assumptions affect the precision of the estimates of environmental impacts. When assuming acquirement of new garments for the modern lifestyle, the volume of garment purchased per average Swedish person per year was based on the Swedish Environmental Protection Agency (Naturvårdsverket, 2024). However, the import statistics only cover imports by companies. As a result, private import of garments is not included, such as garments purchased by consumers from international websites. This means that the environmental impacts of clothing consumption in Sweden may be underestimated, as well as the import of ultra-fast fashion.

All three lifestyles were modelled to represent Swedish consumers. As a consequence, most of the data used in this study are based in Europe, primarily in Sweden, in line with the scope of the EU-funded CARE project.

One important limitation of this study is the lack of data and methods for assessing ecotoxicity impacts in the life cycle of clothing. The results related to toxicity are uncertain due to the limited availability of data on the use and emissions of toxic chemicals during production. While the lack of data and characterisation factors make it difficult to quantify the ecotoxicity impacts within LCA, excluding these impacts risks conveying that it is not a relevant environmental issue. As argued by Roos et al. (2015), including toxicity categories in LCA, even when based on uncertain data, still adds value by acknowledging the existence of these impacts.

Furthermore, the exclusion of concerns such as microplastic pollution represents another limitation. Microplastics are not included in this LCA due to the lack of impacts assessment methods, yet they are a growing area of concern. Excluding such impacts may lead to an underestimation of the environmental impacts of synthetic textiles.

4.4.3 Integrating the Underlying Motivations Driving Environmental Impact into LCA

This section discusses the two first research questions. Klint (2024) argues for the importance of understanding the underlying motivations for behaviour rather than just its consequences. One way to integrate such perspectives into LCA could be by assessing the environmental impacts of entire lifestyles and categorise the impact based on the motivations that drive behaviour. For example, motivations might include a desire to follow fashion trends, to feel confident in social situations, to avoid appear unclean, or to meet basic clothing needs.

This approach would require extensive data collection, such as surveys investigating consumer motivations and norms. However, it could provide valuable insights into which psychological or social drivers that are associated with the highest environmental impacts. While these motivations could be interpreted as "midpoint" indicators of wellbeing, the ultimate "endpoint" in this context might be overall wellbeing. Nonetheless, addressing the midpoint drivers could be more actionable for policy interventions.

One possible framework for this analysis could be the set of nine fundamental needs discussed by Meadows (1998), which are: subsistence, protection, affection, understanding, participation, idleness, creation, identity, and freedom. By mapping clothing consumption behaviour related to these needs, researchers could better understand which behaviour lead to the highest environmental impacts, and perhaps identify sustainable ways to fulfill them. This approach could be applied to other product categories as well, enabling more targeted interventions. It would also complement the recommendations by Klint (2024) to focus on motivations driving environmental impact and could offer a new way to extend LCA beyond value chain optimisation towards understanding the reasons why environmental hotspots occur.

Another aspect that is difficult to determine but could nonetheless be important when it comes to the environmental impacts of clothing is the interaction between the fast fashion business model and norms. As fast fashion promotes short use spans, this has coincided with a reduction in the quality and technical lifetime of clothing Peters et al. (2021). The worsing quality of clothing might then cause third order effects such as normalising low use times of garments and discarding clothes after fewer uses. This type of consumer behaviour might then in turn further promote and entrench fast fashion business models as consumers will demand cheaper and lower quality clothes. Such an interaction could be described as a feedback loop, driving decreasing lifespan for garments, worse quality, normalisation of fast fashion consumption patterns and worse environmental outcomes. These types of interactions risk being left out of the calculation with an LCA using a functional unit such as one garment. While the impact of such effects are difficult to assess, they are nonetheless important to discuss if one wants to address the root causes of the environmental impacts of clothing consumption.

4.4.4 Investigating the Impacts of Online Shopping

Online shopping and second-hand shopping differ from conventional shopping since they represent alternative ways of purchasing clothing. Online shopping is conducted through e-commerce platforms, while second-hand shopping refers to purchasing pre-owned clothing.

This study initially included modelling of conventional, online and second-hand shopping. However, since the results for online shopping were very similar to those for conventional shopping and assumptions were highly uncertain due to data limitations in the value chain, the report focused on the results for conventional and second-hand purchases. Online shopping contributes to environmental impacts through emissions from transportation, packaging waste, and energy consumption in warehouses. Another factor is the environmental impact of returns in online shopping, which increases transportation distances, adding complexity and uncertainty to the modelling. However, the results show that the user transport to stores has higher impacts compared to transportation related to distribution and retail, even though the distances are longer, which is due to the mode of transportation. Online shopping is an increasingly important part of clothing consumption. However, due to data limitations and the complexity of value chains, this study did not include a detailed assessment of online shopping. This represents an important area for future research.

Online shopping may have both positive and negative environmental effects. Since user transport contributed to high environmental impacts, it could be reduced by shopping online since the transport for distribution and retail were comparatively lower. Deliveries can be more efficient than individual store visits if the logistics are well planned. The deliveries may also involve higher emissions if fragmented deliveries are used. Furthermore, higher return rates are common in online shopping, particularly because consumers can not try garments on before purchase. These returns can lead to garments being landfilled, incinerated, or shipped to second-hand markets, rather than being sold to another consumer.

Additionally, third-order effects of online shopping must be considered. The ease of online shopping purchases may encourage customer to increase their clothing purchases, as they do not need to go to a physical store and can access online shopping at any time. The third order effects of online shopping might change consumption behaviour by encouraging impulsive purchases or increased experimentation with styles and trends. These negative environmental impacts from third order effects might then outweigh potential benefits of online shopping reducing user transport.

To assess the environmental impact of online shopping, future research should aim to map the logistics chains of the most common e-commerce platforms, gather data on return rates and end-of-life outcomes for returned garments, and investigate the psychological drivers behind shopping behaviours. By combining these findings with the LCA methodology, and integrating motivational frameworks as proposed by Klint (2024), could offer a deeper understanding of consumer habits that affect environmental impacts.

5

Conclusion

This study has assessed the environmental impacts of clothing consumption across different lifestyles and identified several hotspots in the clothing value chain by applying a life cycle assessment. Additionally, the study identified methodological challenges associated with conducting LCA on clothing and explored ways to address them.

The results show that the total environmental impact varies considerably depending on lifestyle, with the ultra-fast fashion consumer demonstrating the highest impact across all impact categories. The selected impact categories were climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use. The study identified key environmental hotspots in the clothing life cycle for different lifestyles. They were particularly found in the production phase of garments, as well as in user transport to and from stores.

Several methodological challenges were identified, especially related to data availability. In particular, the results for online shopping were excluded due to insufficient data and the complexity associated with the value chain. The LCA was useful for identifying environmental hotspots in the clothing life cycle, although certain assumptions introduced uncertainties. One key challenge was the lack of data availability. In the future, initiatives by EU such as a Digital Product Passport in the clothing sector may help improve data availability and transparency. In addition, there is a lack of data regarding the consumer behaviour. This could be addressed with more extensive surveys analysing the consumer behaviour and motivations. Observations of actual consumer behaviour would also address this issue.

While the LCA approach provides a framework for identifying hotspots in the clothing value chain, certain assumptions introduce uncertainties that could be reduced given more data. The major challenge is data transparency and complexity in the value chain, which in the future could be improved by Digital product Passport within the textile sector.

The findings in this study support the need for targeted consumer guidance. Reducing the consumption of fast and ultra-fast fashion, extending garment lifespans, and choosing low-impact transport options when acquiring clothes are important actions for reducing environmental impact.

5.1 CARE Interventions for Reducing Environmental Impact

The CARE project contributes to Sustainable Development Goal 12 and aligns with the EU Circular Economy Action Plan. Furthermore, policy initiatives such as Extended Producer Responsibility and the Digital Product Passport could be important factors to support the transition toward sustainability in the textile sector by improving traceability and consumer awareness.

Within the CARE project, three interventions related to clothing consumption will be implemented in participating households: detoxing, washing, and repairing. According to this study, the most effective intervention is to "detox" and purchase less clothes per year, as production consistently represents the major environmental impact across all categories. Washing and drying contributed marginally to the total impact, although this result may not be valid in countries with a different electricity supply than Sweden. In addition, one might also want to consider a first order effect of laundering and drying: laundering and drying might create increased wear on clothes and therefore decrease the lifespan of a garment. This means that these processes generate further indirect impact on the environment that are not included in the scope of this study.

Another way to affect the lifespan of clothing is through repairing them, reducing the need for new purchases and thus lowering environmental impact. For the households located in Sweden, this study highlights detoxing and repairing as the most effective interventions.

5.2 Recommendations for Actions and Future Research

For future life cycle assessments, more detailed data on user behaviour related to clothing use is needed. This includes data related to laundry, drying, ironing, and transport. More accurate assessment of environmental impacts could be achieved by incorporating both self-reported and observed data on clothing consumption behaviour. Enhanced availability of data would improve the accuracy and usefulness of the results produced by the model. Hence, future research could use the model used in this study to calculate the environmental impact of other types of lifestyles.

Future research could also examine the social dimensions of lifestyle changes and integrate broader behavioural or systemic factors. Expanding the LCA to include varied data for transport modes and distances, washing practices, and garment use could significantly improve the results.

5.2.1 Understanding the Behavioural Drivers of Environmental Impacts

As discussed in the thesis, understanding the underlying psychological factors driving the behaviour that causes environmental impacts could lead to improved decision-making when it comes to reducing the impacts of clothing consumption. Therefore, future research could gather survey data regarding the consumer behaviour and motivations for consumption, such as questions determining the degree of fashion-orientation of the consumer, the customer's satisfaction with their wardrobe, the degree to which consumers feel judged if they do not keep up with current trends, et cetera.

Connecting the behaviour with the underlying motivations could provide interesting insights. The survey data could be used to identify different consumer typologies defined by behaviour and psychological drivers for clothing consumption. While Gwozdz et al. (2017) categorise consumer typologies based on behaviour and how large part of the population consists of each segment, it would also be interesting to further expand upon that framework and examine if the psychological drivers for consumption differ between the segments. This could provide a good basis for designing interventions tailored to the specific consumer segments, that targets the specific underlying motivations. For example, a high consuming fashion-oriented consumer segment may be able to use services such as a clothing library to achieve similar outcomes in terms of fulfilling the psychological needs instead of mass consumption of fast fashion.

Another approach is to design interventions to shift the consumer motivation from fashion-orientation to generating a style-orientation, where the clothing reflects a sense of internal identity and is less dependent on rapidly shifting trends. Essentially, working in the opposite way of the ultra-fast fashion business model, which relies on consumers becoming more invested in following these trends. In addition, interventions on a national or an EU-level could target fast-fashion brands, providing penalties and incentives intended to promote these brands to shift their business model to a more sustainable one.

Another potentially interesting future research topic could be to investigate the environmental impact of the consumer segments discussed in the previous paragraph. Understanding the environmental impact of consumer groups could provide an improved decision-basis for policy makers. For example, it would be insightful to understand how large of an environmental impact is generated by the top clothing consumers. An important consideration is if all consumers would generate relatively similar amounts of environmental impacts, or if there are variations, with certain consumer segments responsible for a large share of the impacts.

Results of such research may provide a better decision-basis for policy makers. For example, if the majority of the environmental impact is generated by a smaller consumer segment that is heavily fashion-oriented and invested in the fast fashion model, interventions such as promoting repairs may fail to generate significant positive effects as it might be unlikely to be adopted by the fashion-oriented consumer segment. As fast fashion trends shift rapidly, the clothes are unlikely to be discarded due to their technical lifetime being reached, and are instead discarded due to consumers being bored with them and a newer trend emerging, making their previous wardrobe deemed out of fashion. Understanding which consumer typologies generate most environmental impact may therefore create better decision support for policy makers to design interventions to reduce environmental impacts. As described by Klint (2024), understanding the motivations behind behaviour is the key to create better policies and interventions that address the environmental impacts.

5.2.2 Lifestyles and Absolute Sustainability

As mentioned in the literature review, absolute LCA is an approach where LCA is connected to the planetary boundaries framework described by Rockström (2009). An interesting potential topic for future research would be to connect the results of this thesis to the planetary boundaries. Understanding the relation of the average consumer to the planetary boundaries would potentially be useful. This could provide insights into what changes the average consumer needs to make in order to remain within the planetary boundaries. A normative example of a lifestyle that remains within the planetary boundaries could also be assessed.

Integrating absolute sustainability in the assessment would require data of how much environmental impact is allowed while still remaining within the planetary boundaries. In addition, determining how large share of the allowed environmental impact is allocated to the clothing industry would require normative choices that could make the results of such an assessment more uncertain. Despite these uncertainties, comparing the impact categories to the planetary boundaries would enable understanding of what impact categories that are the most vital to reduce, and understanding what behaviour drives these impacts could help create effective interventions and policies.

While this study assesses how much environmental impact stems from a lifestyle and where the hotspots are, it does not assess how severe the environmental problems caused are for each impact category. Relating the results with the planetary boundaries would help assess what impact categories are the most critical in terms of causing environmental issues.

5.2.3 Environmental Impacts of Purchasing New Clothes

In the context of this study, conventional shopping refers to in-store purchases of new clothing. The primary focus is on three different consumer lifestyles, and it is important to address the role of conventional shopping within each of these lifestyles. Conventional shopping contributes to the demand for new clothing production, which drives higher environmental impacts. Specifically, production impacts are only included in conventional shopping, while second-hand shopping does not contribute to new garment production. As more garments are produced, the associated environmental impacts increase.

Additionally, conventional shopping has an impact during the distribution and retail phase, mainly due to the transportation of garments to stores and the energy required for the retail stores. However, it is important to note that user transport have a significant higher impact compared to transoceanic shipping and domestic transport to distribution and retail locations.

In the context of fast fashion and consumer habits, conventional shopping leads to higher environmental impacts, especially regarding the production phase. It is clear that conventional shopping (especially production phase) is a contributor to the environmental impacts across all categories included in this study.

In conclusion, conventional shopping remains a key contributor to environmental impact. Furthermore, there are alternatives, such as second-hand shopping, which provide a more sustainable option with lower environmental impacts.

References

André, H. (2024). “If less is more, how you keeping score?” Outlines of a life cycle assessment method to assess sufficiency. *Frontiers in Sustainability*, *5*. https://doi.org/10.3389/frsus.2024.1342223

Baumann, H., & Tillman, A.-M. (2004). *The Hitch Hiker’s Guide to LCA*. Studentlitteratur.

Bjørn, A., Diamond, M., Owsianiak, M., Verzat, B., & Hauschild, M. Z. (2015, June). Strengthening the link between life cycle assessment and indicators for absolute sustainability to support development within planetary boundaries. https://doi.org/10.1021/acs.est.5b02106

Bossek, D., Bach, V., & Finkbeiner, M. (2023). Lifestyle-LCA: Challenges and Perspectives. *Sustainability (Switzerland)*, *15*(14). https://doi.org/10.3390/su151411313

Bossek, D., Goermer, M., Bach, V., Lehmann, A., & Finkbeiner, M. (2021). Life-LCA: the first case study of the life cycle impacts of a human being. *International Journal of Life Cycle Assessment*, *26*(9), 1847–1866. https://doi.org/10.1007/s11367-021-01924-y

CARE. (2025, February). European households invited to join CARE’s circular pilots. https://www.circularhouseholds.eu/european-households-invited-to-join-cares-circular-pilots/

Daly, H. (1971). *Economics, Ecology, Ethics Essays toward a steady-state economy.*

Daystar, J., Chapman, L., Moore, M., Pires, S., & Golden, J. (2019). Quantifying apparel consumer use behavior in six countries: Addressing a data need in life cycle assessment modeling. *Journal of Textile and Apparel, Technology and Management*, *11*(1).

Dzhengiz, T., Haukkala, T., & Sahimaa, O. (2023). (Un)Sustainable transitions towards fast and ultra-fast fashion. https://doi.org/10.1186/s40691-023-00337-9

European Commission. (2020). Circular economy action plan. https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

European Commission. (2023, July). *Circular economy for textiles: taking responsibility to reduce, reuse and recycle textile waste and boosting markets for used textiles* (tech. rep.). Brussels. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3635

European Commission. (2024, October). *ECODESIGN IMPACT ACCOUNTING OVERVIEW REPORT* (tech. rep.). https://europa.eu

European Commission. (n.d.). Household Washing Machines Energy labelling and ecodesign requirements apply to this product. https://energy-efficient-products.ec.europa.eu/product-list/household-washing-machines_en

European Parliament. (2024, June). *Digital product passport for the textile sector* (tech. rep.). https://doi.org/102861947638

Guinée, J. B., de Koning, A., & Heijungs, R. (2022). Life cycle assessment-based Absolute Environmental Sustainability Assessment is also relative. *Journal of Industrial Ecology*, *26*(3), 673–682. https://doi.org/10.1111/jiec.13260

Gutowski, T. G. (2018). A Critique of Life Cycle Assessment; Where Are the People? *Procedia CIRP*, *69*, 11–15. https://doi.org/10.1016/j.procir.2018.01.002

Gwozdz, W., Nielsen, K. S., & Müller, T. (2017). An environmental perspective on clothing consumption: Consumer segments and their behavioral patterns. *Sustainability (Switzerland)*, *9*(5). https://doi.org/10.3390/su9050762

Hertwich, E. G. (2005, July). Life cycle approaches to sustainable consumption: A critical review. https://doi.org/10.1021/es0497375

Huijbregts, M. A. J., Steinmann, Z. J. N., Elshout, P. M. F., Stam, G., Verones, F., Vieira, M. D. M., Hollander, A., Zijp, M., & van Zeim, R. (2016). *ReCiPe 2016 A harmonized life cycle impact assessment method at midpoint and endpoint level Report I: Characterization* (tech. rep.).

Jevons, W. S. (1865). *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-mines* (A. Flux, Ed.; 3rd edition 1905). Augustus M. Kelley.

Joanes, T., Gwozdz, W., & Klöckner, C. A. (2020). Reducing personal clothing consumption: A cross-cultural validation of the comprehensive action determination model. *Journal of Environmental Psychology*, *71*. https://doi.org/10.1016/j.jenvp.2020.101396

Klint, E. (2024). *Washing with (con)science Combining psychology and life cycle assessment to better understand the environmental impacts from domestic laundering.*

Klint, E., Johansson, L. O., & Peters, G. (2023). Mind the (reporting) gap—a scoping study comparing measured laundry decisions with self-reported laundry behaviour. *International Journal of Life Cycle Assessment*, *28*(9). https://doi.org/10.1007/s11367-023-02189-3

Max-Neef, M. (1991). *Human Scale Development.*

Meadows, D. (1998). *Indicators and Information Systems for Sustainable Development: A Report to the Balaton Group* (tech. rep.). The Sustainability Institute.

Naturvårdsverket. (2024). Textilkonsumtion, kilo per person i Sverige. https://www.naturvardsverket.se/data-och-statistik/textil/textilkonsumtion/

Nellström, M., Lidfeldt, M., Martvall, A., Sandin, G., & Andersson, S. (2025, January). *Sustainability assessment of textile reuse and recycling in and outside of Europe Environmental, economic, and social implications.*

Nielsen, K. S., Joanes, T., Webb, D., Gupta, S., & Gwozdz, W. (2023). Exploring the psychological characteristics of style and fashion clothing orientations. *Journal of Consumer Marketing*, *40*(7), 897–910. https://doi.org/10.1108/JCM-04-2022-5344

Nihart, A. J., Garcia, M. A., El Hayek, E., Liu, R., Olewine, M., Kingston, J. D., Castillo, E. F., Gullapalli, R. R., Howard, T., Bleske, B., Scott, J., Gonzalez-Estrella, J., Gross, J. M., Spilde, M., Adolphi, N. L., Gallego, D. F., Jarrell, H. S., Dvorscak, G., Zuluaga-Ruiz, M. E., . . . Campen, M. J. (2025). Bioaccumulation of microplastics in decedent human brains. *Nature Medicine*. https://doi.org/10.1038/s41591-024-03453-1

Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. https://doi.org/10.1038/s43017-020-0039-9

Nordic Council of Ministers. (2023, November). Unfortunate statistic: Nordic countries surpass the global average in clothing consumption.

Peters. (2025). Personal Communication.

Peters, Li, M., & Lenzen, M. (2021). The need to decelerate fast fashion in a hot climate - A global sustainability perspective on the garment industry. *Journal of Cleaner Production*, *295*. https://doi.org/10.1016/j.jclepro.2021.126390

Peters, Sandin, & Spak. (2019). Environmental Prospects for Mixed Textile Recycling in Sweden. *ACS Sustainable Chemistry and Engineering*, *7*(13). https://doi.org/10.1021/acssuschemeng.9b01742

Rockström, J. (2009). A safe operating space for humanity.

Roos, S., Jönsson, C., Posner, S., Arvidsson, R., & Svanström, M. (2019). An inventory framework for inclusion of textile chemicals in life cycle assessment. *International Journal of Life Cycle Assessment*, *24*(5), 838–847. https://doi.org/10.1007/s11367-018-1537-6

Roos, S., & Peters, G. M. (2015). Three methods for strategic product toxicity assessment—the case of the cotton T-shirt. *International Journal of Life Cycle Assessment*, *20*(7). https://doi.org/10.1007/s11367-015-0895-6

Roos, S., Posner, S., Jönsson, C., & Peters, G. M. (2015). Is Unbleached Cotton Better Than Bleached? Exploring the Limits of Life-Cycle Assessment in the Textile Sector. *Clothing and Textiles Research Journal*, *33*(4), 231–247. https://doi.org/10.1177/0887302X15576404

Rydh, C. J., Lindahl, M., & Tingström, J. (2002). *Livscykelanalys : en metod för miljöbedömning av produkter och tjänster*.

Sandén, B., & Karlström, M. (2007). Positive and negative feedback in consequential life-cycle assessment. *Journal of Cleaner Production*, *15*(15), 1469–1481. https://doi.org/10.1016/j.jclepro.2006.03.005

Sandin, G., Lidfeldt, M., & Nellström, M. (2025). Exploring the Environmental Impact of Textile Recycling in Europe: A Consequential Life Cycle Assessment. *Sustainability*, *17*(5). https://doi.org/10.3390/su17051931

Sandin, G., & Peters, G. M. (2018, May). Environmental impact of textile reuse and recycling – A review. https://doi.org/10.1016/j.jclepro.2018.02.266

Sandin, G., & Roos, S. (2019). Environmental impact of textile fibres-what we know and what we don't know. Fiber Bible part 2. https://doi.org/10.13140/RG.2.2.23295.05280

Sandin, G., Roos, S., Spak, B., Zamani, B., & Peters, G. (2019). *Environmental assessment of Swedish clothing consumption-six garments, sustainable futures* (tech. rep.). RISE Research Institutes of Sweden. www.ri.se

SCB Statistical Database. (2025). Average number of persons per household by region, type of housing, size of dwelling and year.

Schwarz, A. E., Herlaar, S., Cohen, Q. M., Quik, J. T., Golkaram, M., Urbanus, J. H., van Emmerik, T. H., & Huijbregts, M. A. (2024). Microplastic aquatic impacts included in Life Cycle Assessment. *Resources, Conservation and Recycling*, *209*. https://doi.org/10.1016/j.resconrec.2024.107787

Suski, P., Augenstein, K., & Greiff, K. (2024). Life Cycle Assessment of Consumption Patterns – Understanding the links between changing social practices and environmental impacts. *Journal of Cleaner Production*, *477*. https://doi.org/10.1016/j.jclepro.2024.143813

Swedenergy. (2024, June). Tillförd energi. https://www.energiforetagen.se/statistik/fjarrvarmestatistik/tillford-energi/

Swedish Standards Institute. (2006, July). *SVENSK STANDARD* (tech. rep.). www.sis.se

The Global Goals. (n.d.). Goal 12: Responsible consumption and production. https://www.globalgoals.org/goals/12-responsible-consumption-and-production/

Yang, J., Al Mamun, A., Reza, M. N. H., Yang, M., & Aziz, N. A. (2024). Predicting the significance of consumer environmental values, beliefs, and norms for sustainable fashion behaviors: The case of second-hand clothing. *Asia Pacific Management Review*, *29*(2). https://doi.org/10.1016/j.apmrv.2024.01.001

Zamani, B., Sandin, G., & Peters, G. M. (2017). Life cycle assessment of clothing libraries: can collaborative consumption reduce the environmental impact of fast fashion? *Journal of Cleaner Production*, *162*. https://doi.org/10.1016/j.jclepro.2017.06.128

Zhang, Z., Huang, J., Yao, Y., Peters, G., Macdonald, B., La Rosa, A. D., Wang, Z., & Scherer, L. (2023, October). Environmental impacts of cotton and opportunities for improvement. https://doi.org/10.1038/s43017-023-00476-z

A

Appendix 1

In Appendix A, the modelling details for the garments are presented, including inputs and outputs, datasets used in the model, and corresponding quantities. The modelling was conducted in the software openLCA using datasets from EcoInvent 3.11, and was based on Sandin et al., (2019).

The modelling details for electricity mix used in production are presented in Table A.1 below, which is modelled according to Sandin et al., (2019).

Table A.1: Electricity mix used in the production phase of garments

Electricity mix	**Dataset used in model**	**Share of total mix**
China	CN: market group for electricity, medium voltage	55.80%
Bangladesh	BD: market for electricity, medium voltage	17.80%
Turkey	TR: market for electricity, medium voltage	12.60%
India	IN: market group for electricity, medium voltage	6.10%
Pakistan	PK: market for electricity, medium voltage	3.00%
Vietnam	VN: market for electricity, medium voltage	2.60%
Cambodia	KH: market for electricity, medium voltage	2.10%

The modelling details for chemical products used in production are presented in Table A.2 below. The table is modelled according to Table B-3 in Sandin et al., (2019).

Table A.2: B-3: Chemical products used in production

Chemical product / function	**Dataset used in model**	**Quantity (kg)**
Antifoaming agent, average	GLO: benzo[thia]diazole-compound	0.02
	RoW: polydimethylsiloxane	0.05
	RoW: dimethyl sulfate production	0.001
	RoW: sodium hydroxide (50% solution)	0.02
	RoW: water, ultrapure	0.94
Detergent, average	RoW: acrylic acid	0.1
	RoW: dimethyl sulfate	0.05
	RoW: ethoxylated alcohol (AE3)	0.25
	RoW: ethoxylated alcohol (AE7)	0.1
	RoW: water, ultrapure	0.5
Detergent/wetting agent, average	RoW: ethoxylated alcohol (AE7)	0.2
	GLO: maleic anhydride	0.1
	RoW: water, ultrapure	0.7
Peroxide stabiliser	RoW: acrylic acid	0.1
	GLO: magnesium oxide	0.005
	GLO: phosphoric acid (85%)	0.1
	RoW: water, ultrapure	0.795
Reducing agent VAT, average	RoW: calcium carbonate, precipitated	0.02
	RoW: sodium dithionite, anhydrous	0.9
	RoW: sodium sulfite	0.08
Softener, average	GLO: diethanolamine	0.03
	GLO: stearic acid	0.2
	RoW: water, ultrapure	0.77
Wetting agent for better printability	GLO: 2-methyl-1-butanol	0.15
	GLO: isohexane	0.1
	RoW: ethoxylated alcohol (AE7)	0.75
Wetting/penetrating agent, cellulosic	GLO: 3-methyl-1-butanol	0.2
	GLO: alkylbenzene sulfonate, linear	0.6
	GLO: ethoxylated alcohol (AE11)	0.1
	RoW: water, ultrapure	0.1
Wetting/penetrating agent, synthetic	GLO: fatty alcohol	0.5
	GLO: maleic anhydride	0.15
	RoW: water, ultrapure	0.35

The modelling details for treatment of textile waste in production are presented in Table A.3 below. The table is modelled according to Sandin et al., (2019).

Table A.3: Treatment of textile waste in production (no credit for energy recovery)

Waste fraction	**Dataset used in model**
Cotton, viscose	GLO: treatment of waste textile, soiled, municipal incineration
Polyester	GLO: treatment of waste polyethylene terephthalate, municipal incineration
Polyamide 6, elastane	GLO: treatment of waste polyurethane, municipal incineration

The modelling details for fibre production are presented in Table A.4 to Table A.6 below. The tables are modelled according to Table B-5 to B-7 in Sandin et al., (2019).

Table A.4: Model of melt spinning of polyester fibres

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyester	GLO: market for polyethylene terephthalate, granulate, amorphous	1	kg
Lubricating oil	RoW: market for lubricating oil	0.01	kg
Antimony	GLO: market for antimony	0.0002	kg
Toluene diisocyanate	RoW: market for toluene diisocyanate	0.0002	kg
Electricity	CN: market group for electricity, medium voltage	1.5	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	2.2	MJ
Outputs	**Description**	**Quantity**	**Unit**
PES fibres	To yarn production / non-woven production	1	kg

Table A.5: Model of melt spinning of polyamide fibres

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyamide 6	GLO: market for polyethylene terephthalate, granulate, amorphous	1	kg
Lubricating oil	RoW: market for lubricating oil	0.01	kg
Sodium formate	GLO: sodium formate production	0.001	kg
Toluene diisocyanate	RoW: market for toluene diisocyanate	0.0002	kg
Electricity	CN: market group for electricity, medium voltage	1.5	kWh
Heat	RoW: heat production, light fuel oil, at boiler 10kW, non-modulating	2.2	MJ
Outputs	**Description**	**Quantity**	**Unit**
Polyamide 6 fibres	To yarn production	1	kg

Table A.6: Model of dry spinning of elastane fibres

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyurethane	RoW: market for polyurethane, flexible foam	1	kg
Lubricating oil	RoW: market for lubricating oil	0.06	kg
Dimethylacetamide	GLO: market for dimethylacetamide	0.02	kg
Electricity	CN: market group for electricity, medium voltage	1.5	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	2.2	MJ
Outputs	**Description**	**Quantity**	**Unit**
Elastane fibres	To yarn production	1	kg

The modelling details for yarn production are presented in Table A.7 to Table A.13 below. The tables are modelled according to Table B-8 to B-14 in Sandin et al., (2019).

Table A.7: Yarn spinning to cotton yarn for T-shirt, 169 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton fibres	GLO: market for fibre, cotton	1.1236	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	4	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton yarn 169 dtex	To knitting	1	kg
Cotton waste	To incineration without energy recovery	0.1236	kg

Table A.8: Yarn spinning to cotton and elastane yarn for jeans, 470 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton fibres	GLO: market for fibre, cotton	1.0449	kg
Elastane fibres	See description above	0.07865	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	2	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton/elastane yarn 470 dtex	To bleaching	1	kg
Cotton waste	To incineration without energy recovery	0.1236	kg

Table A.9: Yarn spinning to cotton yarn for jeans, 578 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton fibres	GLO: market for fibre, cotton	1.1236	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	2	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton yarn 578 dtex	To dyeing	1	kg
Cotton waste	To incineration without energy recovery	0.1236	kg

Table A.10: Yarn spinning to polyester staple yarn for dress, 114/119 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES fibres	See description above	1.005	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	3.8	kWh
Outputs	**Description**	**Quantity**	**Unit**
PES yarn 114/119 dtex	To weaving/knitting	1	kg
Polyester waste	To incineration without energy recovery	0.005	kg

Table A.11: Yarn spinning to polyester staple yarn for jacket lining, 70 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES fibres	See description above	1.005	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	4	kWh
Outputs	**Description**	**Quantity**	**Unit**
PES yarn 70 dtex	To weaving	1	kg
Polyester waste	To incineration without energy recovery	0.005	kg

Table A.12: Yarn spinning to cotton/elastane yarn for jacket gussets, 300 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton fibres	See description above	1.0146	kg
Elastane fibres	See description above	0.109	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	3.3	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton/elastane yarn 300 dtex	To knitting	1	kg
Cotton waste	To incineration without energy recovery	0.005	kg

Table A.13: Yarn spinning to polyamide staple yarn for jacket, 90 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyamide fibres	See description above	1.005	kg
Lubricating oil	RoW: market for lubricating oil	0.0016	kg
Electricity	Electricity mix generation: production phase (see description above)	1.5	kWh
Outputs	**Description**	**Quantity**	**Unit**
Polyamide yarn 90 dtex	To weaving	1	kg
Polyamide waste	To incineration without energy recovery	0.005	kg

The modelling details for fabric production are presented in Table A.14 to Table A.21 below. The tables are modelled according to Table B-18 to B-20, Table B-22 to B-25, and Table B-27 in Sandin et al., (2019).

Table A.14: Circular knitting to cotton tricot for T-shirt, 169 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton yarn 169 dtex	See description above	1.0152	kg
Lubricating oil	RoW: market for lubricating oil	0.08	kg
Electricity	Electricity mix generation: production phase (see description above)	0.21	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton tricot 169 dtex	To bleaching	1	kg
Cotton waste	To incineration without energy recovery	0.0152	kg

Table A.15: Circular knitting to cotton/elastane tricot for dress, 114 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES yarn 114 dtex	See description above	1.0152	kg
Lubricating oil	RoW: market for lubricating oil	0.08	kg
Electricity	Electricity mix generation: production phase (see description above)	0.33	kWh
Outputs	**Description**	**Quantity**	**Unit**
Polyester tricot 114 dtex	To dyeing	1	kg
Polyester waste	To incineration without energy recovery	0.0152	kg

Table A.16: Circular knitting to cotton/elastane tricot for jeans, 300 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton/elastane tricot 300 dtex	See description above	1.0152	kg
Lubricating oil	RoW: market for lubricating oil	0.08	kg
Electricity	Electricity mix generation: production phase (see description above)	0.13	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton/elastane tricot 300 dtex	To dyeing	1	kg
Cotton waste	To incineration without energy recovery	0.0108	kg
Polyurethane waste	To incineration without energy recovery	0.0042	kg

Table A.17: Weaving to cotton/elastane for jeans, 470/578 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Bleached cotton/elastane yarn 470 dtex	See description above	0.3293	kg
Dyed cotton yarn 578 dtex	See description above	0.6839	kg
Acrylic acid	RoW: market for acrylic acid	0.05	kg
Electricity	Electricity mix generation: production phase (see description above)	2.4	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton/denim weave 470/578 dtex	To confectioning	1	kg
Cotton waste	To incineration without energy recovery	0.0132	kg

Table A.18: Weaving to polyester weave for dress, 119/114 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES yarn 119/114 dtex	See description above	1.0132	kg
Acrylic acid	RoW: market for acrylic acid	0.05	kg
Electricity	Electricity mix generation: production phase (see description above)	8.3	kWh
Outputs	**Description**	**Quantity**	**Unit**
Polyester weave 119/114 dtex	To pre-treatment	1	kg
Polyester waste	To incineration without energy recovery	0.0132	kg

Table A.19: Weaving to polyester weave for jacket, 70 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES yarn 70 dtex	See description above	1.0132	kg
Acrylic acid	RoW: market for acrylic acid	0.05	kg
Electricity	Electricity mix generation: production phase (see description above)	19.5	kWh
Outputs	**Description**	**Quantity**	**Unit**
Polyester weave 70 dtex	To dyeing	1	kg
Polyester waste	To incineration without energy recovery	0.0132	kg

Table A.20: Weaving to polyester weave for jacket, 70 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyamide yarn 90 dtex	See description above	1.0066	kg
Polyamide yarn 200 dtex	See description above	1.0066	kg
Acrylic acid	RoW: market for acrylic acid	0.05	kg
Electricity	Electricity mix generation: production phase (see description above)	5.1	kWh
Outputs	**Description**	**Quantity**	**Unit**
Polyamide weave 90/200 dtex	To dyeing	1	kg
Polyamide waste	To incineration without energy recovery	0.0132	kg

Table A.21: Production of polyester needle-punched nonwoven for jacket, 200 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
PES fibres	See description above	1	kg
Electricity	Electricity mix generation: production phase (see description above)	6.8	kWh
Outputs	**Description**	**Quantity**	**Unit**
Cotton/polyester weave 200 dtex	To dyeing	1	kg

The modelling details for wet treatment are presented in Table A.22 to Table A.31 below. The tables are modelled according to Table B-28 - B-36, and Table B-39 in Sandin et al., (2019).

Table A.22: Bleaching cotton tricot for T-shirt, 169 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Water, river		0.06	m3
Detergent/wetting agent average	RoW: market for acrylic acid	0.05	kg
Fluorescent whitening agent	GLO: market for fluorescent whitening agent, distyrylbiphenyl type	0.06	kg
Formic acid	RoW: market for formic acid	0.01	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.07	kg
Lubricating oil	RoW: market for lubricating oil	0.08	kg
Peroxide stabiliser, average	See description above	0.002	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.025	kg
Softener, average	See description above	0.03	kg
Sulphuric acid	RoW: market for sulfuric acid	0.02	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Bleached cotton tricot 169 dtex	To drying	1	kg
COD, chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3

Table A.23: Bleaching cotton/elastane yarn for jeans, 470 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton/elastane yarn 470 dtex	See description above	1	kg
Water, river	Resource flow	0.024	m3
Detergent/wetting agent average	RoW: market for acrylic acid	0.006	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.046	kg
Peroxide stabiliser, average	See description above	0.003	kg
Phosphoric acid	GLO: market for phosphoric acid, industrial grade, without water, in 85% solution state	0.006	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.03	kg
Sulphuric acid	RoW: market for sulfuric acid	0.006	kg
Wetting/penetrating agent, cellulosic	See description above	0.003	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Bleached cotton/elastane yarn 470 dtex	To drying	1	kg
COD, chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.24: Dyeing cotton yarn for jeans, 578 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton yarn 578 dtex	See description above	1	kg
Water, river	Resource flow	0.05	m3
Acrylic acid	RoW: market for acrylic acid	0.05	kg
Aniline	RoW: market for aniline	0.02	kg
Antifoaming agent	See description above	0.02	kg
Detergent/wetting agent average	RoW: market for acrylic acid	0.02	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.055	kg
Peroxide stabilizer, average	See description above	0.001	kg
Reducing agent VAT, average	See description above	0.015	kg
Soda ash	GLO: market for soda ash, dense	0.01	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.02	kg
Sodium sulphate	RoW: market for sodium sulfate, anhydrite	0.015	kg
Wetting/penetrating agent, cellulosic	See description above	0.005	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Dyed cotton yarn 578 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.25: Pre-treatment before printing polyester weave for dress, 119/114 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyester weave 119/114 dtex	See description above	1	kg
Water, river	Resource flow	0.06	m3
Detergent/wetting agent average	RoW: market for acrylic acid	0.05	kg
Lubricating oil	RoW: market for lubricating oil	0.005	kg
Phosphoric acid	GLO: market for phosphoric acid, industrial grade, without water, in 85% solution state	0.005	kg
Wetting agent for better printability	See description above	0.005	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Pre-treated polyester weave 119/114 dtex	To disperse printing	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.26: Disperse printing polyester weave for dress, 119/114 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Pre-treated polyester weave 119/114 dtex	See description above	1	kg
Water, river	Resource flow	0.00027	m3
1-propanol	GLO: market for 1-propanol	0.105	kg
Acrylic dispersion	RoW: market for acrylic dispersion, with water, in 58% solution state	0.03	kg
Aniline	RoW: market for aniline	0.165	kg
Detergent/wetting agent average	RoW: market for acrylic acid	0.01	kg
Formic acid	RoW: market for formic acid	0.005	kg
Reducing agent VAT, average	See description above	0.01	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.01	kg
Softener, average	See description above	0.15	kg
Electricity	Electricity mix generation: production phase (see description above)	0.112	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	1.9	MJ
Outputs	**Description**	**Quantity**	**Unit**
Printed polyester weave 119/114 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.27: Dyeing polyester tricot for dress, 114 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyester tricot 114 dtex	See description above	1	kg
Water, river	Resource flow	0.078	m3
Ammonium sulphate	RoW: market for ammonium sulfate	0.01	kg
Aniline	RoW: market for aniline	0.05	kg
Detergent, average	See description above	0.075	kg
Detergent/wetting agent average	RoW: market for acrylic acid	0.02	kg
Ethylene glycol	RoW: market for ethylene glycol monoethyl ether	0.015	kg
Formic acid	RoW: market for formic acid	0.015	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.015	kg
Reducing agent VAT, average	See description above	0.005	kg
Sequestering agent	GLO: market for phosphoric acid, industrial grade, without water, in 85% solution state	0.02	kg
Soda ash	GLO: market for soda ash, dense	0.0225	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.005	kg
Softener, average	See description above	0.2	kg
Wetting/penetrating agent, synthetic	See description above	0.01	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Printed polyester weave 119/114 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.28: Dyeing cotton/elastane tricot for jacket, 300 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Cotton/elastane tricot 300 dtex	See description above	1	kg
Water, river	Resource flow	0.06	m3
Detergent, average	See description above	0.12	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.07	kg
Lubricating oil	RoW: market for lubricating oil	0.08	kg
Peroxide stabilizer, average	See description above	0.002	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.025	kg
Softener, average	See description above	0.03	kg
Sulphuric acid	RoW: market for sulfuric acid	0.03	kg
Wetting/penetrating agent, cellulosic	See description above	0.005	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Dyed cotton/elastane tricot 300 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.29: Dyeing polyester weave for jacket, 70 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyester weave 70 dtex	See description above	1	kg
Water, river	Resource flow	0.078	m3
Ammonium sulphate	RoW: market for ammonium sulfate	0.02	kg
Aniline	RoW: market for aniline	0.19	kg
Antifoaming agent	See description above	0.003	kg
Detergent, average	See description above	0.15	kg
Detergent/wetting agent average	RoW: market for acrylic acid	0.02	kg
Ethylene glycol	RoW: market for ethylene glycol	0.03	kg
Formic acid	RoW: market for formic acid	0.03	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.03	kg
Reducing agent VAT, average	See description above	0.005	kg
Sequestering agent	GLO: market for phosphoric acid, industrial grade, without water, in 85% solution state	0.04	kg
Soda ash	GLO: market for soda ash, dense	0.025	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.005	kg
Softener, average	See description above	0.2	kg
Wetting/penetrating agent, synthetic	See description above	0.015	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Dyed polyester weave 70 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	CH: treatment of sludge from pulp and paper production, sanitary landfill	0.5	kg

Table A.30: Dyeing polyamide weave for jacket, 90/200 dtex

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Polyamide weave 90/200 dtex	See description above	1	kg
Water, river	Resource flow	0.088	m3
Aniline	RoW: market for aniline	0.0615	kg
Antifoaming agent	See description above	0.0003	kg
Detergent, average	See description above	0.1	kg
Formic acid	RoW: market for formic acid	0.05	kg
Hydrogen peroxide	RoW: market for hydrogen peroxide, without water, in 50% solution state	0.01	kg
Lubricating oil	RoW: market for lubricating oil	0.02	kg
Polydimethylsiloxane	RoW: market for polydimethylsiloxane	0.5	kg
Sequestering agent	GLO: market for phosphoric acid, industrial grade, without water, in 85% solution state	0.04	kg
Soda ash	GLO: market for soda ash, dense	0.01	kg
Wetting/penetrating agent, synthetic	See description above	0.009	kg
Electricity	Electricity mix generation: production phase (see description above)	0.7	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	30	MJ
Outputs	**Description**	**Quantity**	**Unit**
Dyed polyamide weave 90/200 dtex	To drying	1	kg
COD, Chemical Oxygen Demand	Emission to water	0.0002	kg
Water, river	To waste water treatment	0.045	m3
Sludge	RoW: treatment, sludge from pulp and paper production, landfarming	0.5	kg

Table A.31: Drying of bleached/dyed yarn/textile in stenter frame

Inputs	Dataset used in model	Quantity	Unit
Yarn or woven/knitted textile	See description above	1	kg
Electricity	Electricity mix generation: production phase (see description above)	0.8	kWh
Heat	RoW: heat production, light fuel oil, at boiler 100kW, non-modulating	8	MJ
Outputs	**Description**	**Quantity**	**Unit**
Yarn or woven/knitted textile	To knitting/confectioning or confectioning	1	kg

The modelling details for confectioning are presented in Table A.32 to Table A.35 below. The tables are modelled according to Table B-40 to B-43 in Sandin et al., (2019).

Table A.32: T-shirt Confectioning

Inputs	Dataset used in model	Quantity	Unit
Knitted cotton fabric, 169 dtex	See description above	1.176	kg
Water	GLO: market group for tap water	0.18	kg
Sowing thread	GLO: market for fibre, cotton	0.0035	kg
Confectioning template	RoW: market for kraft paper	0.05	kg
Packaging film	GLO: market for packaging film, low density polyethylene	0.02	kg
Corrugated board box	RoW: market for corrugated board box	0.06	kg
Electricity	Electricity mix generation: production phase (see description above)	2.711 (incl ironing)	kWh
Heat	GLO: market group for heat, central or small-scale, natural gas	0.07	MJ
Outputs	**Description**	**Quantity**	**Unit**
T-shirt	To distribution & retail	1	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	0.176	kg

Table A.33: Jeans Confectioning

Inputs	Dataset used in model	Quantity	Unit
Woven cotton/elastane fabric, 470/578 dtex	See description above	1.176	kg
Water	GLO: market group for tap water	0.19	kg
Sowing thread	GLO: market for fibre, cotton	0.0035	kg
Brass (Button raw material)	RoW: market for brass	0.019	kg
Brass (Button production)	GLO: market for metal working, average for metal product manufacturing	0.019	kg
Steel (Zipper raw material)	GLO: market for steel, low-alloyed	0.013	kg
Steel (Zipper production)	GLO: market for metal working, average for steel product manufacturing	0.013	kg
Confectioning template	RoW: market for kraft paper	0.05	kg
Packaging film	GLO: market for packaging film, low density polyethylene	0.02	kg
Corrugated board box	RoW: market for corrugated board box	0.06	kg
Electricity	Electricity mix generation: production phase (see description above)	2.78	kWh
Heat	GLO: market group for heat, central or small-scale, natural gas	0.067	MJ
Outputs	**Description**	**Quantity**	**Unit**
Jeans	To distribution & retail	1	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	0.25	kg

Table A.34: Dress Confectioning

Inputs	Dataset used in model	Quantity	Unit
Knitted polyester fabric, 114 dtex	See description above	0.625	kg
Woven polyester fabric, 114/119 dtex	See description above	0.625	kg
Water	GLO: market group for tap water	0.356	kg
Sowing thread	GLO: market for fibre, cotton	0.0035	kg
Confectioning template	RoW: market for kraft paper	0.05	kg
Packaging film	GLO: market for packaging film, low density polyethylene	0.02	kg
Corrugated board box	RoW: market for corrugated board box	0.06	kg
Electricity	Electricity mix generation: production phase (see description above)	5.16	kWh
Heat	GLO: market group for heat, central or small-scale, natural gas	0.126	MJ
Outputs	**Description**	**Quantity**	**Unit**
Dress	To distribution & retail	1	kg
Polyester waste	GLO: treatment of waste polyethylene terephthalate, municipal incineration	0.25	kg

Table A.35: Jacket Confectioning

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Woven polyamide fabric, 90/200 dtex, olive	See description above	0.359	kg
Woven polyamide fabric, 90/200 dtex, black	See description above	0.186	kg
Woven polyester fabric, 70 dtex, orange	See description above	0.1926	kg
Knitted cotton/elastane fabric, 300 dtex	See description above	0.235	kg
Nonwoven polyester fabric	See description above	0.2774	kg
Water	GLO: market group for tap water	0.61	kg
Sowing thread	GLO: market for fibre, cotton	0.0035	kg
Brass (Button raw material)	RoW: market for brass	0.0133	kg
Brass (Button production)	GLO: market for metal working, average for metal product manufacturing	0.0133	kg
Steel (Zipper raw material)	GLO: market for steel, low-alloyed	0.0115	kg
Steel (Zipper production)	GLO: market for metal working, average for steel product manufacturing	0.0115	kg
Confectioning template	RoW: market for kraft paper	0.05	kg
Packaging film	GLO: market for packaging film, low density polyethylene	0.02	kg
Corrugated board box	RoW: market for corrugated board box	0.06	kg
Electricity	Electricity mix generation: production phase (see description above)	8.938	kWh
Heat	GLO: market group for heat, central or small-scale, natural gas	0.0216	MJ
Outputs	**Description**	**Quantity**	**Unit**
Jacket	To distribution & retail	1	kg
Polyester waste	To incineration without energy recovery	0.094	kg
Cotton waste	To incineration without energy recovery	0.042	kg
Polyamide/elastane waste	To incineration without energy recovery	0.114	kg

The modelling details for distribution and retail phase are presented in Table A.36 below. The table was modelled according to Table B-45 in Sandin et al., (2019).

Table A.36: Distribution and Retail of T-shirt, Jeans, Dress, and Jacket

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From confectioning	1.01	kg
Transport (from manufacturing country to Sweden)	GLO: market for transport, freight, sea, container ship, heavy fuel oil	18.88	tkm
Transport (distribution to store)	RER: market for transport, freight, lorry, 16-32 metric ton, diesel, EURO 6	2.85	tkm
Transport (distribution to store)	RER: market for transport, freight, lorry, 3.5-7.5 metric ton, diesel, EURO 6	0.32	tkm
Electricity (store)	SE: market for electricity, low voltage	1.94	kWh
Electricity (credit from packaging waste)	SE: market for electricity, low voltage	-0.06	kWh
Heat (credit from packaging waste)	District heating mix Sweden (See Table B-47)	-0.45	MJ
Electricity (credit from textile waste)	SE: market for electricity, low voltage	-0.01 (depends on material)	kWh
Heat (credit from textile waste)	District heating mix Sweden (See Table B-47)	0.04-0.08 (depends on material)	MJ
Outputs	**Description**	**Quantity**	**Unit**
Garment	To use phase	1	kg
Packaging waste to treatment	GLO: treatment of waste graphical paper, municipal incineration	0.13	kg
Textile waste to treatment	Depends on material (see above)	0.01	kg

The modelling details for district heating are presented in Table A.37 below. The table are modelled according to Table B-47 in Sandin et al., (2019). However, the data in the table was updated according to Swedenergy, (2024).

Table A.37: District Heating, Swedish Average 2023, Based on Swedenergy (2024)

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Heat from secondary biofuels (e.g. waste from logging)	CH: heat production, untreated waste wood, at furnace 1000-5000 kW, state-of-the-art 2014	0.318	MJ
Heat from waste incineration	SE: heat, from municipal waste incineration to generic market for heat, district or industrial, other than natural gas	0.201	MJ
Industrial waste heat	CH: heat, from municipal waste incineration to generic market for heat, district or industrial, other than natural gas	0.076	MJ
Heat from recycled wood chips	CH: heat production, wood chips from industry, at furnace 1000kW, state-of-the-art 2014	0.071	MJ
Heat from pellets, briquettes and powder	CH: wood pellets, burned in stirling heat and power co-generation unit, 3kW electrical, future	0.057	MJ
Renewable power to electric boilers, heat pumps and distribution	CH: wood pellets, burned in stirling heat and power co-generation unit, 3kW electrical, future	0.026	MJ
Heat from heat pumps	CH: heat production, air-water heat pump 10kW	0.05	MJ
Heat from landfill gas, sewage gas, industrial waste gas	SE: heat, from municipal waste incineration to generic market for heat, district or industrial, other than natural gas	0.021	MJ
Heat from peat and peat briquettes	SE: electricity production, peat	0.0028	MJ
Heat from biooil and crude tall-oil (1.9%)	RoW: heat production, wood chips from industry, at furnace 1000kW, state-of-the-art 2014	0.019	MJ
Heat from coal (0.1%)	SE: heat and power co-generation, hard coal	0.001	MJ
Heat from natural gas (0.8%)	SE: heat and power co-generation, natural gas, conventional power plant, 100MW electrical	0.008	MJ
Heat from fuel oil (1.2%)	SE: heat and power co-generation, oil	0.012	MJ
Nuclear power to electric boilers, heat pumps and distribution	SE: electricity production, nuclear, boiling water reactor	0.0269	MJ
Fossil power to electric boilers, heat pumps and distribution	SE: electricity production, oil	0.001	MJ
Output	**Description**	**Quantity**	**Unit**
Heat to district heating system		1	MJ

The modelling details for use phase are presented in Table A.38 to Table A.46 below. The tables were modelled according to Table B-48 - B-50, Table B-54 to B-56, and Table B-58 in Sandin et al., (2019). For the use phase, the activities washing, drying, and ironing were excluded.

Table A.38: Main Use Phase Process of T-shirt Excluding Washing, Drying, and Ironing

Inputs	**Dataset used in model**	**Quantity**	**Unit**
T-shirt	From distribution & retail phase	0.11	kg
Transport (to and from the store)	GLO: market for transport, passenger, car, petrol, medium size, EURO 5	0.94	km
Transport (to and from the store)	GLO: market for transport, passenger, bus, diesel, regular	0.94	pkm
Output	**Description**	**Quantity**	**Unit**
T-shirt	To end-of-life phase	0.11	kg

Table A.39: Main Use Phase Process of Jeans Excluding Washing, Drying, and Ironing

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Jeans	From distribution & retail phase	0.477	kg
Transport (to and from the store)	GLO: market for transport, passenger, car, petrol, medium size, EURO 5	4.05	km
Transport (to and from the store)	GLO: market for transport, passenger, bus, diesel, regular	4.05	pkm
Output	**Description**	**Quantity**	**Unit**
Jeans	To end-of-life phase	0.477	kg

Table A.40: Main Use Phase Process of Dress Excluding Washing, Drying, and Ironing

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Dress	From distribution & retail phase	0.478	kg
Transport (to and from the store)	GLO: market for transport, passenger, car, petrol, medium size, EURO 5	4.06	km
Transport (to and from the store)	GLO: market for transport, passenger, bus, diesel, regular	4.06	pkm
Output	**Description**	**Quantity**	**Unit**
Dress	To end-of-life phase	0.478	kg

Table A.41: Main Use Phase Process of Jacket Excluding Washing, Drying, and Ironing

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Jacket	From distribution & retail phase	0.444	kg
Transport (to and from the store)	GLO: market for transport, passenger, car, petrol, medium size, EURO 5	3.77	km
Transport (to and from the store)	GLO: market for transport, passenger, bus, diesel, regular	3.77	pkm
Output	**Description**	**Quantity**	**Unit**
Jacket	To end-of-life phase	0.444	kg

Table A.42: Residential Washing 40°C

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From main use process	1	kg
Water	RER: market group for tap water	6.2	kg
Detergent	Production of detergent, liquid for residential laundry	0.0158	kg
Electricity	SE: market for electricity, low voltage	0.225	kWh
Outputs	**Description**	**Quantity**	**Unit**
Garment	To main use process	1	kg
Water to treatment	Europe without Switzerland: market for wastewater, average	5.2	kg

Table A.43: Residential Washing 60°C

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From main use process	1	kg
Water	RER: market group for tap water	6.2	kg
Detergent	Production of detergent, liquid for residential laundry	0.0158	kg
Electricity	SE: market for electricity, low voltage	0.405	kWh
Outputs	**Description**	**Quantity**	**Unit**
Garment	To main use process	1	kg
Water to treatment	Europe without Switzerland: market for wastewater, average	5.2	kg

Table A.44: Residential Drying

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From main use process	1	kg
Electricity	SE: market for electricity, low voltage	0.67	kWh
Outputs	**Description**	**Quantity**	**Unit**
Garment	To main use process	1	kg

Table A.45: Residential Ironing, 1 Minute of Ironing

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From main use process	-	-
Electricity	SE: market for electricity, low voltage	0.027	kWh/min
Outputs	**Description**	**Quantity**	**Unit**
Garment	To main use process	-	-

Table A.46: Detergent, Liquid

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Alkyl sulphate	GLO: market for alkyl sulfate (C12-14)	0.1038	kg
Citric acid	RER: citric acid production	0.0228	kg
Enzymes	RER: enzymes production	0.0058	kg
Glycerine	RER: market for glycerine	0.0285	kg
Non-ionic surfactant	GLO: market for non-ionic surfactant	0.0591	kg
Polyethylene	GLO: market for polyethylene, linear low density, granulate	0.0466	kg
Soap	RER: soap production	0.0241	kg
Sodium hydroxide	RoW: market for sodium hydroxide, without water, in 50% solution state	0.0231	kg
Water	Europe without Switzerland: market for water, deionised	0.7022	kg
HDPE bottle	GLO: market for polyethylene, high density, granulate	0.0466	kg
PP cork	GLO: market for polypropylene, granulate	0.0101	kg
Label	GLO: market for printed paper	0.00126	kg
Electricity	RER: market group for electricity, medium voltage	0.25	kWh
Output	**Description**	**Quantity**	**Unit**
Liquid detergent (density 0.95 kg/l)	To washing process	1	kg

The modelling details for end-of-life phase are presented in Table A.47 to Table A.50 below. The tables are modelled according to Table B-59 in Sandin et al., (2019).

Table A.47: End-of-life phase for T-shirt

Inputs	Dataset used in model	Quantity	Unit
T-shirt, used	From use phase	1	kg
Transport from use phase to end-of-life phase	RER: market for transport, freight, lorry, 3.5-7.5 metric ton, diesel, EURO 6	30	kg*km
Output	**Description**	**Quantity**	**Unit**
T-shirt, disposed	To disposal	1	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	1	kg

Table A.48: End-of-life phase for jeans

Inputs	Dataset used in model	Quantity	Unit
Jeans, used	From use phase	1	kg
Transport from use phase to end-of-life phase	RER: market for transport, freight, lorry, 3.5-7.5 metric ton, diesel, EURO 6	30	kg*km
Output	**Description**	**Quantity**	**Unit**
Jeans, disposed	To disposal	1	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	1	kg

Table A.49: End-of-life phase for dress

Inputs	Dataset used in model	Quantity	Unit
Dress, used	From use phase	1	kg
Transport from use phase to end-of-life phase	RER: market for transport, freight, lorry, 3.5-7.5 metric ton, diesel, EURO 6	30	kg*km
Output	**Description**	**Quantity**	**Unit**
Dress, disposed	To disposal	1	kg
Cotton waste	GLO: treatment of waste polyethylene terephthalate, municipal incineration	1	kg

Table A.50: End-of-life phase for jacket

Inputs	Dataset used in model	Quantity	Unit
Jacket, used	From use phase	1	kg
Transport from use phase to end-of-life phase	RER: market for transport, freight, lorry, 3.5-7.5 metric ton, diesel, EURO 6	30	kg*km
Output	**Description**	**Quantity**	**Unit**
Jacket, disposed	To disposal	1	kg
Polyester waste	GLO: treatment of waste polyethylene terephthalate, municipal incineration	0.376	kg
Polyamide waste	GLO: treatment of waste polyurethane, municipal incineration	0.436	kg
Half of cotton/elastane mix waste (elastane part)	GLO: treatment of waste polyurethane, municipal incineration	0.094	kg
Half of cotton/elastane mix waste (cotton part)	GLO: treatment of waste textile, soiled, municipal incineration	0.094	kg

The modelling details for a second-hand garment are presented in Table A.51 to Table A.55 below. The tables are modelled according to Nellström et al., (2025).

Table A.51: Pre-sorting of second-hand garment

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	Collected from use phase	1.038	kg
Electricity	SE: market for electricity, medium voltage	0.0184	MJ
Outputs	**Description**	**Quantity**	**Unit**
Garment	To manual sorting	1	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	0.038	kg

Table A.52: Manual sorting of second-hand garment

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From pre-sorting	1.038	kg
Transport from pre-sorting to manual sorting (sea)	GLO: transport, freight, sea, ferry, heavy fuel oil	396	kg*km
Transport from pre-sorting to manual sorting (lorry)	RER: transport, freight, lorry, 16-32 metric ton, diesel, EURO 6	478	kg*km
Electricity	SE: market for electricity, medium voltage	0.0184	MJ
Heat	District heating mix Sweden	0.7	kWh
Outputs	**Description**	**Quantity**	**Unit**
Garment	To distribution	1	kg

Table A.53: Distribution and retail of second-hand garment

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From manual sorting	1.01	kg
Transport from manual sorting to distribution (sea)	GLO: transport, freight, sea, container ship, heavy fuel oil	990	kg*km
Transport from manual sorting to distribution (lorry)	RER: transport, freight, lorry, 16-32 metric ton, diesel, EURO 6	675	kg*km
Electricity (store)	SE: market for electricity, low voltage	1.94	kWh
Electricity (credit from packaging waste)	SE: market for electricity, low voltage	-0.06	kWh
Heat (credit from packaging waste)	District heating mix Sweden	-0.45	MJ
Electricity (credit from textile waste)	SE: market for electricity, low voltage	-0.01	kWh
Heat (credit from textile waste)	District heating mix Sweden	0.04	MJ
Outputs	**Description**	**Quantity**	**Unit**
Garment	To use phase	1	kg
Waste graphical paper	GLO: treatment of waste graphical paper, municipal incineration	0.13	kg
Cotton waste	GLO: treatment of waste textile, soiled, municipal incineration	0.01	kg

Table A.54: Use phase of second-hand garment

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From distribution and retail	1	kg
Transport (to and from the store)	GLO: market for transport, passenger, car, petrol, medium size, EURO 5	8.5	km
Transport (to and from the store)	GLO: market for transport, passenger, bus, diesel, regular	8.5	pkm
Output	**Description**	**Quantity**	**Unit**
Garment	To end-of-life treatment	1	kg

Table A.55: End-of-life phase for second-hand garment

Inputs	**Dataset used in model**	**Quantity**	**Unit**
Garment	From use phase	1	kg
Outputs	**Description**	**Quantity**	**Unit**
Garment, disposed	Disposed garment	1	kg
Textile waste	Depends on material (see description above)	-	kg

B

Appendix 2

The figures in Appendix B present the results for the impact categories for the individual garments. The selected impact categories are: climate change, water use, freshwater eutrophication, freshwater ecotoxicity, and land use. The results are presented for a T-shirt, a pair of jeans, a dress, and a jacket.

Figures B.1 to B.5 show the life cycle impact assessment (LCIA) results for four garment types, including T-shirt, jeans, jacket, and dress, across five impact categories. The results include impacts from production, distribution, and end-of-life phase.

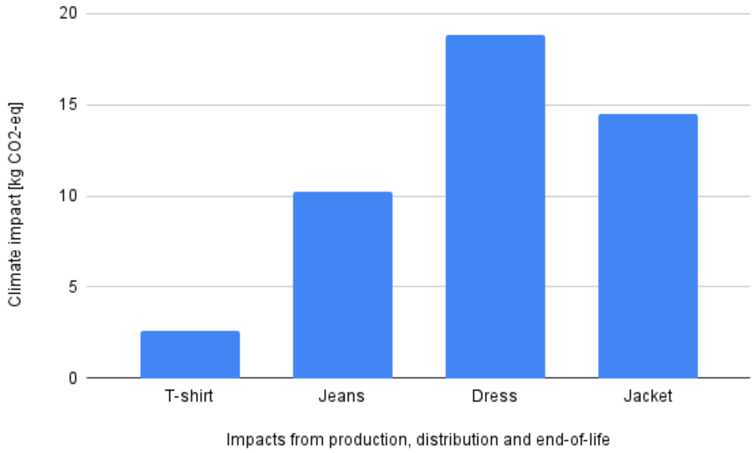

Figure B.1: Climate impact for the production, distribution and end-of-life phase of each garment [kg CO_2-eq-eq]

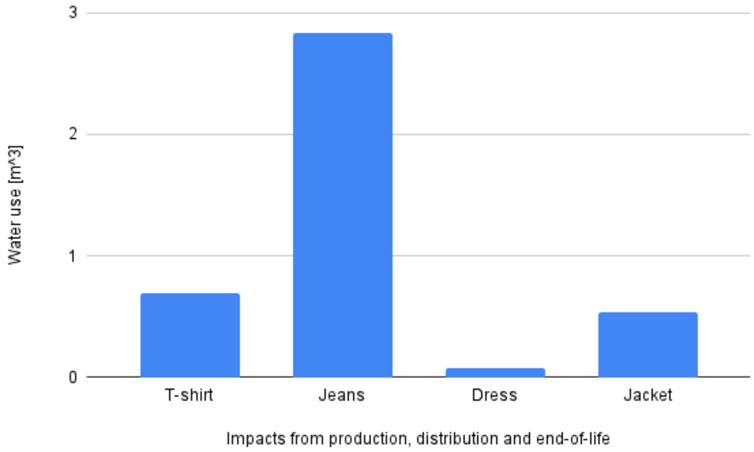

Figure B.2: Water use for the production, distribution and end-of-life phase of each garment [m^3 water]

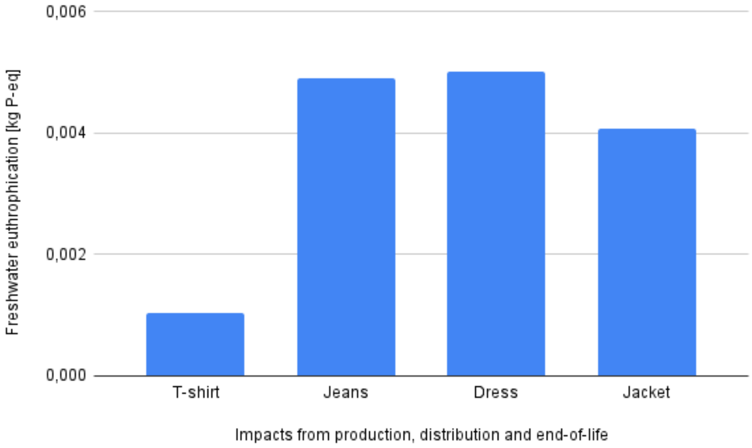

Figure B.3: Freshwater eutrophication for the production, distribution and end-of-life phase of each garment [kg P-eq]

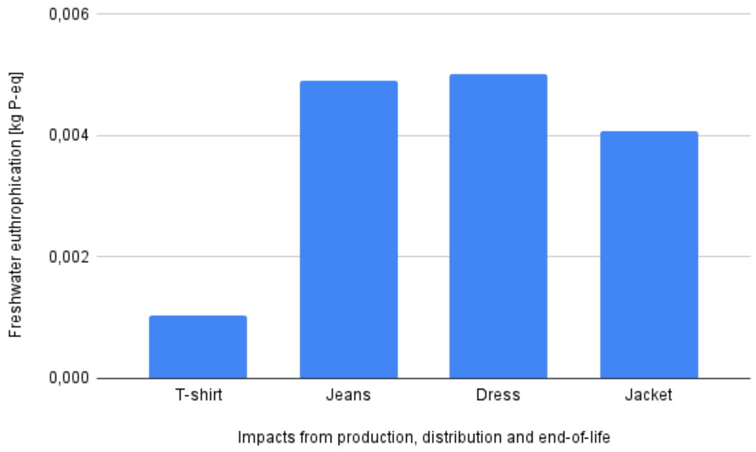

Figure B.4: Freshwater ecotoxicity for the production, distribution and end-of-life phase of each garment [kg 1.4-DCB-eq]

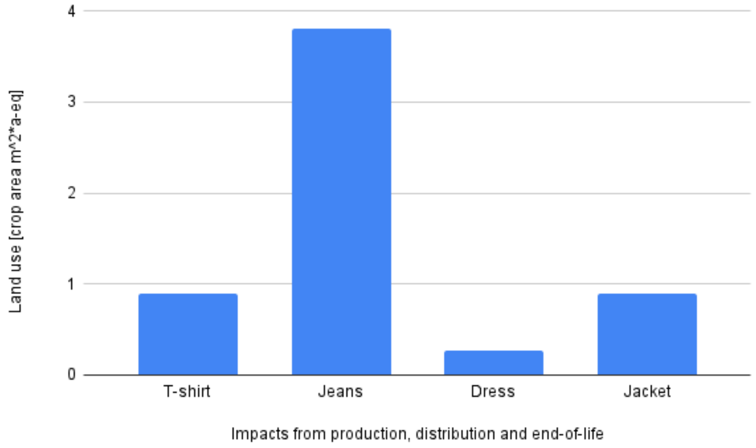

Figure B.5: Land use for the production, distribution and end-of-life phase of each garment [m2*a crop-eq]

C

Appendix 3

Appendix C presents results for the sensitivity analysis.

Table C.1 shows the results for the sensitivity analysis regarding the mode of transport for the use phase, divided by which garment that is transported. The user transport was set to 100% electric car to and from store in a total distance of 17 km. Table C.2 to Table C.6 below present the results for different impact categories for the sensitivity analysis. The second-hand usage rate was set to 100% for each lifestyle, and no new clothes was assumed to be purchased.

Table C.1: Environmental impact per garment in the production phase (rounded to 2 significant figures)

Impact Category	**T-shirt**	**Jeans**	**Dress**	**Jacket**	**Unit**
Climate change	0.23	1.0	1.0	0.93	kg CO_2-eq
Water use	0.0036	0.016	0.016	0.015	m^3
Freshwater eutrophication	0.00015	0.00064	0.00064	0.00059	kg P-eq
Freshwater ecotoxicity	0.095	0.41	0.41	0.39	kg 1.4-DCB-eq
Land use	0.016	0.070	0.070	0.065	$m^2 \cdot$ a crop-eq

Table C.2: Climate Change impact (kg CO_2-Eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	0	0	0	kg CO_2-eq
Jeans	0	0	0	kg CO_2-eq
Dresses	0	0	0	kg CO_2-eq
Jackets	0	0	0	kg CO_2-eq
Distribution & retail phase				
T-shirts	0	0	0	kg CO_2-eq
Jeans	0	0	0	kg CO_2-eq
Dresses	0	0	0	kg CO_2-eq
Jackets	0	0	0	kg CO_2-eq
Distribution & retail phase for second-hand clothes				
T-shirts	1.63	2.41	3.37	kg CO_2-eq
Jeans	1.7	2.52	3.53	kg CO_2-eq
Dresses	1.32	1.95	2.73	kg CO_2-eq
Jackets	2.01	2.98	4.18	kg CO_2-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport for purchasing second-hand garments	30.13	38.21	53.49	kg CO_2-eq
User transport for purchasing new garments	0	0	0	kg CO_2-eq
Washing 40°C	4.71	8.01	9.42	kg CO_2-eq
Washing 60°C	3.05	5.19	6.11	kg CO_2-eq
Drying	5.84	7.63	7.63	kg CO_2-eq
Ironing	0.31	0.92	0.92	kg CO_2-eq
End-of-Life phase				
T-shirts	0	0	0	kg CO_2-eq
Jeans	0	0	0	kg CO_2-eq
Dresses	0	0	0	kg CO_2-eq
Jackets	0	0	0	kg CO_2-eq
TOTAL IMPACT	**50.7**	**69.82**	**91.38**	**kg CO_2-eq**

Table C.3: Water Use Impact (m^3) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	0	0	0	m^3
Jeans	0	0	0	m^3
Dresses	0	0	0	m^3
Jackets	0	0	0	m^3
Distribution & retail phase				
T-shirts	0	0	0	m^3
Jeans	0	0	0	m^3
Dresses	0	0	0	m^3
Jackets	0	0	0	m^3
Distribution & retail phase for second-hand clothes				
T-shirts	0.017	0.025	0.055	m^3
Jeans	0.018	0.026	0.036	m^3
Dresses	0.014	0.02	0.028	m^3
Jackets	0.021	0.031	0.043	m^3
Use phase (incl. transport, washing, drying, ironing)				
User transport for purchasing second-hand garments	0.053	0.079	0.11	m^3
User transport for purchasing new garments	0	0	0	m^3
Washing 40°C	0.316	0.538	0.633	m^3
Washing 60°C	0.232	0.395	0.465	m^3
Drying	0.679	0.889	0.889	m^3
Ironing	0.036	0.107	0.107	m^3
End-of-Life phase				
T-shirts	0	0	0	m^3
Jeans	0	0	0	m^3
Dresses	0	0	0	m^3
Jackets	0	0	0	m^3
TOTAL IMPACT	**1.39**	**2.11**	**2.37**	**m^3**

Table C.4: Freshwater Eutrophication Impact (kg PO_4-Eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	0	0	0	kg P-eq
Jeans	0	0	0	kg P-eq
Dresses	0	0	0	kg P-eq
Jackets	0	0	0	kg P-eq
Distribution & retail phase				
T-shirts	0	0	0	kg P-eq
Jeans	0	0	0	kg P-eq
Dresses	0	0	0	kg P-eq
Jackets	0	0	0	kg P-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.0001	0.0002	0.0003	kg P-eq
Jeans	0.0001	0.0002	0.0003	kg P-eq
Dresses	0.0001	0.0002	0.0002	kg P-eq
Jackets	0.0002	0.0002	0.0002	kg P-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport for purchasing second-hand garments	0.003	0.004	0.006	kg P-eq
User transport for purchasing new garments	0	0	0	kg P-eq
Washing 40°C	0.0033	0.0055	0.0065	kg P-eq
Washing 60°C	0.0022	0.0037	0.0043	kg P-eq
Drying	0.0044	0.0057	0.0058	kg P-eq
Ironing	0.0002	0.0007	0.0007	kg P-eq
End-of-Life phase				
T-shirts	0	0	0	kg P-eq
Jeans	0	0	0	kg P-eq
Dresses	0	0	0	kg P-eq
Jackets	0	0	0	kg P-eq
TOTAL IMPACT	**0.014**	**0.021**	**0.025**	**kg P-eq**

Table C.5: Freshwater Ecotoxicity Impact (kg 1.4-DCB-eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	0	0	0	kg 1.4-DCB-eq
Jeans	0	0	0	kg 1.4-DCB-eq
Dresses	0	0	0	kg 1.4-DCB-eq
Jackets	0	0	0	kg 1.4-DCB-eq
Distribution & retail phase				
T-shirts	0	0	0	kg 1.4-DCB-eq
Jeans	0	0	0	kg 1.4-DCB-eq
Dresses	0	0	0	kg 1.4-DCB-eq
Jackets	0	0	0	kg 1.4-DCB-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.13	0.19	0.27	kg 1.4-DCB-eq
Jeans	0.14	0.20	0.28	kg 1.4-DCB-eq
Dresses	0.11	0.16	0.22	kg 1.4-DCB-eq
Jackets	0.16	0.24	0.33	kg 1.4-DCB-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport for purchasing second-hand garments	1.57	2.32	3.25	kg 1.4-DCB-eq
User transport for purchasing new garments	0	0	0	kg 1.4-DCB-eq
Washing 40°C	1.36	2.31	2.72	kg 1.4-DCB-eq
Washing 60°C	1.19	2.03	2.39	kg 1.4-DCB-eq
Drying	4.94	6.47	6.47	kg 1.4-DCB-eq
Ironing	0.26	0.78	0.78	kg 1.4-DCB-eq
End-of-Life phase				
T-shirts	0	0	0	kg 1.4-DCB-eq
Jeans	0	0	0	kg 1.4-DCB-eq
Dresses	0	0	0	kg 1.4-DCB-eq
Jackets	0	0	0	kg 1.4-DCB-eq
TOTAL IMPACT	**9.86**	**14.69**	**16.7**	**kg 1.4-DCB-eq**

Table C.6: Land Use Impact (m^2*a crop-eq) by lifestyle and garment

Phase / Garment	Slow Fashion	Modern	Ultra-Fast Fashion	Unit
Production phase				
T-shirts	0	0	0	m^2*a crop-eq
Jeans	0	0	0	m^2*a crop-eq
Dresses	0	0	0	m^2*a crop-eq
Jackets	0	0	0	m^2*a crop-eq
Distribution & retail phase				
T-shirts	0	0	0	m^2*a crop-eq
Jeans	0	0	0	m^2*a crop-eq
Dresses	0	0	0	m^2*a crop-eq
Jackets	0	0	0	m^2*a crop-eq
Distribution & retail phase for second-hand clothes				
T-shirts	0.04	0.06	0.09	m^2*a crop-eq
Jeans	0.04	0.06	0.09	m^2*a crop-eq
Dresses	0.03	0.05	0.07	m^2*a crop-eq
Jackets	0.05	0.08	0.11	m^2*a crop-eq
Use phase (incl. transport, washing, drying, ironing)				
User transport for purchasing second-hand garments	0.59	0.87	1.22	m^2*a crop-eq
User transport for purchasing new garments	0	0	0	m^2*a crop-eq
Washing 40°C	1.85	3.15	3.71	m^2*a crop-eq
Washing 60°C	1.13	1.93	2.27	m^2*a crop-eq
Drying	1.57	2.05	2.05	m^2*a crop-eq
Ironing	0.08	0.25	0.25	m^2*a crop-eq
End-of-Life phase				
T-shirts	0	0	0	m^2*a crop-eq
Jeans	0	0	0	m^2*a crop-eq
Dresses	0	0	0	m^2*a crop-eq
Jackets	0	0	0	m^2*a crop-eq
TOTAL IMPACT	**5.39**	**8.50**	**9.84**	**m^2*a crop-eq**

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS
DIVISION OF ENVIRONMENTAL SYSTEMS ANALYSIS
CHALMERS UNIVERSITY OF TECHNOLOGY
Gothenburg, Sweden