THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Sharing household products for a sustainable environment: A city diagnostic

DIVIA JIMÉNEZ ENCARNACIÓN

Department of Architecture and Civil Engineering

CHALMERS UNIVERSITY OF TECHNOLOGY

Gothenburg, Sweden 2025

Sharing household products for a sustainable environment: A city diagnostic
DIVIA JIMÉNEZ ENCARNACIÓN
ISBN 978-91-8103-241-3

Acknowledgements, dedications, and similar personal statements in this thesis, reflect the author's own views.

Doktorsavhandlingar vid Chalmers tekniska högskola
Ny serie nr 5699
ISSN 0346-718X

Department of Architecture and Civil Engineering
Chalmers University of Technology
SE-412 96 Gothenburg
Sweden
Telephone + 46 (0)31-772 1000

Cover:
A map of Gothenburg, Sweden, showing places with high street network local integration and existing sharing initiatives – For more information, see Paper 4 in the Thesis

Chalmers Reproservice
Gothenburg, Sweden 2025

Sharing household products for a sustainable environment: A city diagnostic

DIVIA JIMÉNEZ ENCARNACIÓN
Department of Architecture and Civil Engineering
Chalmers University of Technology

Abstract

The Sharing Economy (SE) has emerged as a potential pathway to sustainable consumption in cities, allowing households to replace their purchases of newly manufactured products and reduce their material, energy, and emissions impacts, among others. However, as the research field expands, it becomes clear that sharing can only be environmentally sustainable under specific circumstances. To address essential gaps in understanding whether the SE can hold its promise, particularly for household products, this thesis aims to advance knowledge on the environmental sustainability potential of sharing household products in an urban context. Taking Gothenburg, Sweden, as a case, the research focuses on three questions: (1) What factors influence whether sharing household products is more environmentally sustainable than purchasing new products?, (2) In which ways can consumption reduction play a role in the environmental sustainability of sharing household products?, and (3) What is the potential of different geographic areas, demographic groups, and product groups to achieve sustainable outcomes through sharing?. The mixed-methods research design involved a literature review, qualitative coding, statistical analysis of questionnaire survey data, quantification of household consumption amounts with an extrapolation method, spatial analyses, and collaboration with the local government. The analysis reveals (1) 29 factors before, during, and after sharing that influence the sustainability outcomes of sharing. In particular, (2) consumption-reduction factors play a crucial role, often depending on consumer behavior and competing with transport and energy impacts, and (3) varying levels of potential were observed for different geographic areas, such as the inner and outer city, various demographic groups regarding gender, age, and education level, and for the product groups of clothes, tools, and hobby equipment. The variations were shaped by each group's levels of product consumption and ownership, attitudes toward sharing, and accessibility to different types of sharing initiatives. These results can provide actionable insights for local governments, practitioners, and households to leverage the SE as a sustainable tool while contributing to reducing fragmentation in the literature, particularly concerning the environmental sustainability potential of sharing household products.

Keywords: sharing economy, sustainable consumption, household consumption, qualitative analysis, statistical analysis, spatial analysis

Publications

This thesis is based on the following papers:

Paper 1:

Jiménez Encarnación, D., Thuvander, L. & Rosado, L. Determining influential factors for the environmental sustainability of sharing household products: A systematized review. *Under review.*

DJE conceptualized the study in consultation with LT and LR. DJE collected the data, conducted the formal analysis, and visualized the results. DJE wrote the manuscript with inputs from LR. LT and LR reviewed the manuscript.

Paper 2:

Jiménez Encarnación, D., Thuvander, L. & Rosado, L. A foray into the role of consumption reduction for the sustainability of sharing household products. *Manuscript.*

DJE conceptualized the study in consultation with LT and LR. DJE collected the data, conducted the formal analysis, and visualized the results. DJE wrote the manuscript. LT and LR reviewed the manuscript.

Paper 3:

Jiménez Encarnación, D., Metheney, E. A., Thuvander, L., Kalmykova, Y., & Rosado, L. (2024). Revealing patterns in household product consumption and sharing: An approach to support urban governance towards a sustainable sharing economy. *Sustainable Production and Consumption*, *45*, 244-264. https://doi.org/10.1016/j.spc.2024.01.009

DJE conceptualized the study with YK, LT, and LR. DJE designed the data collection strategy and curated the data. EAM produced the results and analyzed them with input from DJE. EAM visualized the results. DJE wrote the manuscript with inputs from EAM. LT, LR, and EAM reviewed the manuscript.

Paper 4:

Jiménez Encarnación, D., Thuvander, L., Stavroulaki, G., Elangovan, E. & Rosado, L. Mapping opportunities for a neighborhood-scale sharing economy: A geospatial methodological framework focused on household products. *Under major revisions*.

DJE conceptualized the study in consultation with GS, LT, and LR. DJE produced the results and analyzed them with inputs from GS. DJE visualized the results and wrote the manuscript with inputs from GS, EE, LT, and LR. LT, LR, GS, and EE reviewed the manuscript.

Other work and publications not appended:

Jiménez Encarnación, D., Thuvander, L., & Rosado, L. (2024). Everything, everyone, everywhere all at once: How modeling and assessing household product consumption can reveal opportunities for a sustainable sharing economy. *(*Poster). Presented at the Joint International Society of Industrial Ecology Socio-Economic Metabolism and Asia-Pacific Conference. Beijing 24-27 August 2024

Jiménez Encarnación, D., Thuvander, L., & Rosado, L. (2023). Sharing and consuming in space – what is important to know for the planning of a Sharing City? *(*Abstract). Oral presentation at the 11th International Conference on Industrial Ecology. Leiden 2-5 July 2023

Jiménez Encarnación, D. (2023). From consumption to sharing: Generating knowledge to support urban governance of the sharing economy. Licentiate Thesis, Chalmers University of Technology.

Jiménez Encarnación, D., Gkagkalidis, G., Rosado, L. (2022). Sharing Economy´s contribution to social sustainability and well-being in Gothenburg (Abstract). Oral presentation at the Act Sustainable Research Conference, Gothenburg, 16-18 November 2023

Patricio, J., **Jiménez Encarnación, D.**, Kalmykova, Y., & Rosado, L. (2021). Top-down method and databases for typical product demands of 103 manufacturing industries. *Resources, Conservation and Recycling, 164*, 105165. https://doi.org/10.1016/j.resconrec.2020.105165

Acknowledgements

This thesis was only possible due to the support of the Kamprad Family Foundation for Entrepreneurship, Research & Charity through their funding grant for the SEsam project, and the European Union through the Driving Urban Transitions Partnership and Formas, FCT, LMT and MUR, with their funding grant for the ECLECTIC project.

I would like to thank my supervisors, Leonardo Rosado and Liane Thuvander, for their patience, encouragement, and guidance throughout this arduous path. I only mention these three words, but there´s a universe behind them. I would also like to thank my examiner, Oskar Modin, for always asking questions that made me reflect upon my research.

I´m thankful to have had Erica Metheney, Gianna Stavroulaki, Emiline Elangovan, Yuliya Kalmykova, and Joao Patricio as co-authors throughout this process; your every contribution has shaped me into a better researcher. Other collaborators who left an imprint on my research are Emma Öhrwall, Tove Lund, Marco Adelfio, Elena Malakhatka, Xin Bian, Adam Gustafsson, Irma Magnusson, Eva Kultje, Albin Nimheim, Rikard Lundberg, Jacobo Castaño Rodríguez, Filip de Boer, Julia Ekander, Tobias Frendberg, Kajsa Wiksten, Xiaoxia Li, and Grigorios Gkagkalidis. Thank you, respectively, for meeting me and sharing your thoughts, letting me join your courses and advising me on methodology, introducing me to behavioral theories, helping my GIS maps appear in the right place, spreading my surveys, and teaching me how to teach.

At some point, I planned to write the acknowledgments as an extended CREdIT statement, but it became very complicated because many of you have shifted between roles, be it colleagues, advisors, helpers, friends, cheerleaders, and so on. If I try to simplify it, I want to express such gratitude to Sanjay Somanath, Jonathan Cohen, Maud Lanau, and Alex González. You all have such a helpful nature, and your inputs throughout the past five years, and especially these last few months, have meant a great deal to me. I truly appreciate the kindness of Martine Buser, Krystyna Pietrzik, Michael Martin, Holger Wallbaum, and Angela Sasic Kalagasidis, who have taken the time to see me and give me insightful feedback. I also want to thank Ingela Gustafson and Ingrid Engström, who have always been prompt and considerate to all my questions.

I´m not sure I would have gotten anywhere without the wisdom, fun, and reassurance that my colleagues, past and present, have nourished me with. First in WET, my original Chalmers home, and then in BT. I appreciate each and every one of you. I want to especially mention Jennifer, Dawn, Yiwen, Shuang, Aida, David, Luca, Sara, and a few others who sneaked into the paragraphs above. Thank you! And for my dream team, the ones who have truly had all possible roles, Anna and Marie/a, a thank you is not enough.

Finally, I´d like to acknowledge my friends in the outside world (Kaisa, Rafael, Yoaska, Nathali, Nadia, Adriana), my family (Mom, Dad, Oanny, Pedrin, Hernan, Alfonsina, Monica, Mami Olivia, Ulla), and my sweetest Calle. First, for their constant support, and second, for their patience. Doing a PhD has translated into so many missed events, trips, and birthdays, and your understanding has not been taken for granted. I also want to thank my parasocial relationships, Beyoncé and Thais Herrera, for keeping me going every morning. And I want to thank me, for most literally keeping me going every morning.

Table of Contents

Glossary

Access-based activities / temporary transactions
Activities and transactions where the products are only accessed temporarily and their ownership is not transferred (e.g., loaning, renting).

Durable products
Durable products do not deteriorate quickly (e.g., cars, bikes, sports equipment, electronics, kitchen equipment, furniture, and household equipment), and potentially stand unutilized for long periods of time.

Household
An individual, or a group of people who live together and have such a common economy that the expenses of the different people cannot be meaningfully separated (SCB, 2013).

Household consumption
Households consume assets to support their activities, satisfy their needs and wants, and enhance their well-being. While consumption can be conceptualized as purchasing products, using them, and eventually disposing of them (Magrabi et al., 1991), in the thesis, I focus solely on the first step.

Household products
In the thesis, "household products" include manufactured products such as clothes and shoes, kitchen, hobby and children´s equipment, furniture and decoration, tools and electronics.

Idle capacity
This refers to when products stand unutilized or "idle" for long periods of time, even if they are still functional. When idle, products hold a "capacity" to fulfill a function that is untapped.

Mediators or intermediaries
"Mediators" or "intermediaries" can be sharing initiatives which regulate the sharing transaction between two private parts in peer-to-peer sharing (Sutherland & Jarrahi, 2018). In this case, the platform type could also be called peer-to-business-to-peer (P2B2P).

Ownership transfer activities / permanent transactions
Activities and transactions where the ownership of the product is transferred permanently (e.g., gifting, exchanging, selling and buying second-hand).

Ownership retention activities / repair
Activity where the purchase of a new product can be postponed due to repair of a product already owned.

Prosumers
As opposed to the separate roles of consumer and provider, prosumers produce and consume simultaneously through sharing.

Rebound effects
Change in consumption behavior due to saved or generated money through sharing. The money is spent on other products and services, which carry environmental effects that might reduce or completely offset the environmental benefits of the sharing transaction. The definition is adapted from E. Hertwich (2005) and Kjaer et al. (2019) and is congruent with indirect (Borenstein, 2015) and environmental rebounds (Goedkoop, 1999).

Replacement rate
To what degree sharing replaces consumer purchases.

Rivalry
Indicates whether use of a product by a person prevents simultaneous use by another.

Semi-durable products
Products that are used regularly, but do not last as long as durable goods (e.g., clothes).

Sharing economy
Refers to the redistribution of products, services, skills, and spaces through various sharing actions effectuated by product providers and consumers; with the purpose of reducing the time that the assets remain unutilized (Botsman & Rogers, 2010; Frenken & Schor, 2017). In my SE definition, I include any action that could reduce product consumption rates, inspired by Muñoz and Cohen (2017), Schor (2016) and Botsman (2013).

Sharing initiatives
Organizations and/or businesses that provide shared products or mediate sharing transactions in formalized sharing.

Sustainable consumption
Sustainable consumption entails using products and services to satisfy needs and contribute to quality of life while minimizing its impacts so that they do not affect the capacity of future generations to meet their needs (UNEP, 2010).

Sustainable sharing
“Sustainable sharing” refers to sharing that leads to decreased environmental impacts such as reduced resource use, greenhouse gas emissions, water and energy footprints, in comparison to the impacts of purchasing newly manufactured household products.

Tangible products
As opposed to intangible products, tangible products include space, durable household products, and non-durables such as food (Curtis & Lehner, 2019).

Users
Users in the sharing economy are individuals/households within the roles of consumers (who obtain a product) and providers (who provide a product). To differentiate from sharing initiatives, users that provide are called “peer-providers” throughout the thesis.

Acronyms

B2C – Business-to-consumer

CLD – Causal loop diagram

CO_2 – Carbon dioxide

CO_2eq – Carbon dioxide equivalent

ECLECTIC – Research project "Enabling CircuLar Economy aCTIon plans for small and medium-sized Cities"

GHG – Greenhouse gas emissions

HBS – Household budget survey

LCA – Life cycle assessment

P2P – Peer-to-peer

P2B2P – Peer to business to peer

RQ – Research question

SCG – Research project testbed "Sharing Cities Gothenburg"

SE – Sharing economy

SEsam – Research project "Sharing Economy sustainability assessment method to support the implementation of SE initiatives"

SI – Sharing initiative

TPB – Theory of planned behavior

UMFA – Urban material flow accounting

1. Introduction

The increasing household consumption rates during the last decades have had important environmental effects, especially at the urban level (Shittu, 2020). In the European Union, the consumption of diverse manufactured products is responsible for 25% of the material footprints and 20% of the embodied greenhouse gas emissions (GHG) associated with household consumption (Ivanova et al., 2016). Considering the growing environmental degradation, the effects of increasing household consumption highlight the urgency of transitioning towards more sustainable consumption patterns.

The sharing economy (SE) has emerged as a concept to facilitate sustainable consumption patterns in the household. While the precise meaning of the SE is contested, definitions often involve the redistribution of products, services, skills, and spaces through various sharing actions effectuated by product providers and consumers; with the purpose of reducing the time that the assets remain unutilized (Botsman & Rogers, 2010; Frenken & Schor, 2017). As the SE constitutes a possibility to reduce individual purchases of newly manufactured products, it has been associated with sustainability by, e.g., private individuals, businesses, governmental institutions, and researchers. According to the European Commission (2016a), the SE has the potential to increase circularity, economic growth, and communities' resiliency, while according to Botsman and Rogers (2010) and Heinrichs (2013), the SE is the "potential new pathway to sustainability".

Although research on the impacts of the SE is increasing, the environmental sustainability of the SE is still uncertain (De las Heras et al., 2021; Geissinger et al., 2019). On one hand, replacing a product purchase with sharing might cut down on effects associated with the production of a good (Ala-Mantila et al., 2017). On the other hand, there are commonly recognized hurdles to this. For example, money saved or generated by using the SE can be invested in other emission- and resource-intensive purchases, households may incur in new purchases solely to share them (Frenken & Schor, 2017), and consumers might not replace their purchases by sharing. In these cases, the sustainability of the SE is threatened as consumption may not be reduced, but rather displaced or increased. Additionally, the environmental benefits of consumption reduction might be negated if users make repeated trips or travel long distances to share, causing higher GHG emissions (Demailly & Novel, 2014). In this way, a net reduction of consumption and a minimizing of transport effects are necessary preconditions to achieve the sustainability benefits of the SE, as well as other factors that have been investigated to varying degrees, such as energy and additional resource use (Bernardi & Diamantini, 2018; Cohen & Muñoz, 2016). However, research about these factors is still underdeveloped, both conceptually and empirically. Especially, the narrative that the SE can contribute to the reduction of environmental impacts often relies on assumptions, with the role of consumption reduction and its feasibility taken for granted. Thus, whether the SE can be less impactful than conventional household product consumption remains to be seen.

This lack of understanding about the environmental impacts of sharing poses a risk of increased environmental burdens instead of increased sustainability (Curtis & Lehner, 2019; Mont et al., 2020). Thus, the generation of actionable information regarding the impacts of sharing can enable a sustainable SE; through supporting academia in furthering environmental assessments, providing an evidence base for decision making and governance at the local level, providing information to individuals and households on how to optimize their sustainable consumption choices in relation

to sharing, and enabling sharing initiatives in adapting their operations to support their environmental motivations.

1.1. Aim and research questions

As a response to the problem statement above, this thesis aims to advance knowledge on the environmental sustainability potential of sharing household products in an urban context, with a special focus on the role of consumption reduction associated with sharing.

A first objective of the thesis is to identify factors that can quantitatively impact the environmental sustainability outcomes of sharing, in comparison to purchasing newly manufactured products. The objective is articulated in the first research question:

> **RQ1.** What factors influence whether sharing household products is more environmentally sustainable than purchasing newly manufactured products?

The second objective is to select and characterize from the factors above those that impact net consumption amounts (i.e., "consumption-reduction" factors). The third objective is to identify the factors that either promote, or compete, with the consumption-reduction factors. The objectives are articulated in the second research question:

> **RQ2.** In which ways does consumption-reduction play a role in the environmental sustainability of sharing household products?

Finally, the fourth objective is to make a diagnostic of the current state of consumption and sharing in the city of Gothenburg, by considering selected consumption-reduction and competing factors. The assessment is made from the perspectives of geographical areas, demographic groups, and product groups. This is articulated in the third research question:

> **RQ3**. What is the potential of different geographic areas, demographic groups, and product groups to achieve sustainable outcomes through sharing?

Part of the thesis was developed within a transdisciplinary project involving Gothenburg Municipality, in Sweden. The Municipality influenced the elaboration of RQ3, including using Gothenburg as a case and focusing on the geographic, demographic and product perspectives, while RQs 1 and 2 were developed to further contextualize the findings of RQ3.

1.2. Delimitations and scope

The delimitations and scope of the thesis relate to the following aspects: what is considered consumption, what is considered sharing, who consumes and shares, where and when the consumption and sharing happen, and how sustainability is defined (details about the terminology can be seen in Chapter 2):

While consumption can be conceptualized as purchasing products, using them, and eventually disposing of them (Magrabi et al., 1991), this thesis focuses solely on the first step. Product consumption is estimated on the basis of households, where the definition of a household is adopted from the Swedish Household Budget Survey as "individuals, or groups of people who live together and have such a common economy that the expenses of the different people cannot be meaningfully separated" (SCB, 2013). This includes families, cohabiting individuals, and single individuals.

Furthermore, only the consumption of tangible and durable/semi-durable shareable products is considered (e.g., clothes and shoes, kitchen, children´s and hobby equipment, tools and electronics). While household consumption studies usually address the categories of "manufactured products" and "clothes" separately, in this thesis, they are aggregated into the term "household products". Also, for simplicity, I include semi-durable products within durables. Household products were chosen due to gaps in the research fields of consumption and sharing, thus excluding the study of food, mobility, and accommodation. No distinction is made between products purchased nationally or internationally, which could affect the implications related to environmental impacts from production.

The definition of SE in this thesis is comprehensive, including any action that could increase the utilization of products that remain idle and reduce the consumption rate of newly manufactured products, inspired by Muñoz and Cohen (2017), Schor (2016) and Botsman (2013) . Thus, sharing transactions can be permanent or temporary and monetized or non-monetized, including activities such as loaning/lending, renting and renting out, selling/buying second-hand, and repairing. While other activities have a straightforward relationship to increased utilization and consumption reduction, repairing is seen two-fold: as a provision of tools by sharing initiatives (e.g., repair cafes), and as a prevention of untimely product replacement in the household that may reduce consumption rates. Other informal activities such as giving, receiving, and exchanging fit within this scope but are not addressed in the thesis due to data limitations. Although sharing activities present opportunities for social and economic sustainability, this thesis focuses exclusively on environmental sustainability. "Sustainable sharing" therefore refers to sharing that leads to decreased environmental impacts such as reduced resource use, greenhouse gas emissions, water and energy use, etc., in comparison to the impacts of purchasing newly manufactured household products.

In terms of sharing actors, the thesis mainly refers to the user´s potential to share sustainably. Users are defined as individuals and households within the roles of consumers and peer-providers. While peer-providers are not assumed to replace their purchases by sharing products, they are seen as potential facilitators for reduced consumption on the consumer side and as potential increasers of consumption if they make purchases solely for the purpose of sharing. "Prosumers", who produce

and consume simultaneously through sharing, are not explicitly considered. Finally, the thesis refers to sharing initiatives and to governing actors, but only to the extent that they can affect users in relation to consumption and sharing. The scope includes sharing initiatives within the business-to-consumer and peer-to-peer platform models.

Finally, the geospatial scope of the thesis refers to the metropolitan area of Gothenburg City. The findings are cross-sectional, with most data sources referring to the year 2021.

1.3. Research context

This research was part of the SEsam project from 2020 to 2023 and is conducted within the ECLECTIC project from 2023, which influenced the research process (see subchapter 3.4). Below are details about the SEsam project and the ECLECTIC project. Additionally, information about Gothenburg demographics, administrative divisions, and relation to the consumption and sharing topics is provided below to facilitate understanding and contextualization of the thesis, particularly for RQ3 findings.

1.3.1. SEsam project

The aim of the SEsam project ("Sharing Economy sustainability assessment method to support the implementation of SE initiatives") was to develop the Urban Material Flow Accounting Method to quantify the environmental impact of consumption in different households, describe consumption in different geographic areas, and propose appropriate sharing initiatives according to their potential sustainability impacts (method described in subchapter 3.2.7.). In the project, I was responsible for carrying out all research tasks under the supervision of the project owner. The SEsam project also facilitated a collaboration with Gothenburg Municipality through the Sharing Cities Gothenburg testbed (SCG) (see subchapter 3.2.4.). Accordingly, findings from the method application were meant to provide cost-effective guidance for local strategic decision-making (Whetstone et al., 2020).

1.3.2. ECLECTIC project

The ECLECTIC project ("Enabling CircuLar Economy aCTIon plans for small and medium-sized Cities"), which is ongoing, aims to design, implement, and monitor strategic circular economy action plans for climate-neutral, sustainable, and just small and medium-sized cities in the European Union. The project involves developing an impact assessment framework to model cities' resource flows, stocks, and environmental impacts, contributing to a toolbox for sustainable circular and sharing economy action plans. Additionally, ECLECTIC intends to target behavioral change in high-consumption groups. In the project, I am part of the team addressing the method development research tasks, although my work is mostly independent.

1.3.3. Gothenburg

Gothenburg is the second largest city in Sweden, with an approximate population of 590.000 and a household count of 270.000. As of May 2025, Gothenburg is divided into 96 neighborhoods (i.e., *primärområde* in Swedish). Additionally, the city´s Development Plan divides Gothenburg into three functional areas: the inner-, middle-, and outer city, each with distinct population density, dwelling type profiles, and services (Göteborgs Stad, 2022). See maps of Gothenburg and Sweden in Figure 1, and its neighborhood and city divisions in Appendix Figures 1.A. and 1.B. – Paper 4.

In Gothenburg, 45% of the households are composed of one person. Only 23% of the households include children, while almost half of the population is between 30-64 years of age. The median income per person in 2022 was approximately 330.000 SEK/year (€29.000/year), and about 38% of inhabitants over 18 years have post-secondary education levels (Göteborg Statistik och Analys, 2021), while showing differences in socioeconomic trends across Gothenburg´s areas.

In Sweden, the Sustainable Development Goal 12 – Sustainable consumption and production is one of the most challenging to achieve due to high incomes and above-average private consumption levels (Eurostat, 2022; Göteborg Stad, 2021). Accordingly, Gothenburg Municipality has ambitions to be among the world´s most progressive cities in preventing environmental and climate issues. Gothenburg´s Environmental and Climate program states that their current consumption-based impacts of 9,3 tons of CO_2eq/person/year shall decrease by at least 7,6% annually until 2030 (Göteborgs Stad, 2020). Official documents monitoring this goal emphasize that changing consumption patterns is a way to achieve this goal (Göteborgs Stad, 2024). The Gothenburg Region (which includes Gothenburg Municipality) also targets the reduction and prevention of waste in the household, including the reduction of product consumption that would eventually become waste.

As a part of addressing overall sustainability goals, Gothenburg has actively promoted the development of the SE. The Gothenburg Region wants to ensure that every resident can access sharing close to where they live, especially to decrease electronic waste by 50% per person (Göteborgsregionen, 2020). In 2017, the city received the Eurocities Award for co-creating the Smart Map (2023b), a digital tool that collects and locates the city´s sharing initiatives. Besides this, Gothenburg Municipality has adopted several governing roles regarding the SE, including providing funds for initiatives and initiating their own (Voytenko Palgan et al., 2021). From 2018 to 2021, the city participated in the Sharing Cities Sweden national program through their Sharing Cities Gothenburg (SCG) testbed, which investigated the role of the SE in achieving sustainable cities (Sharing Cities Sweden, 2021).

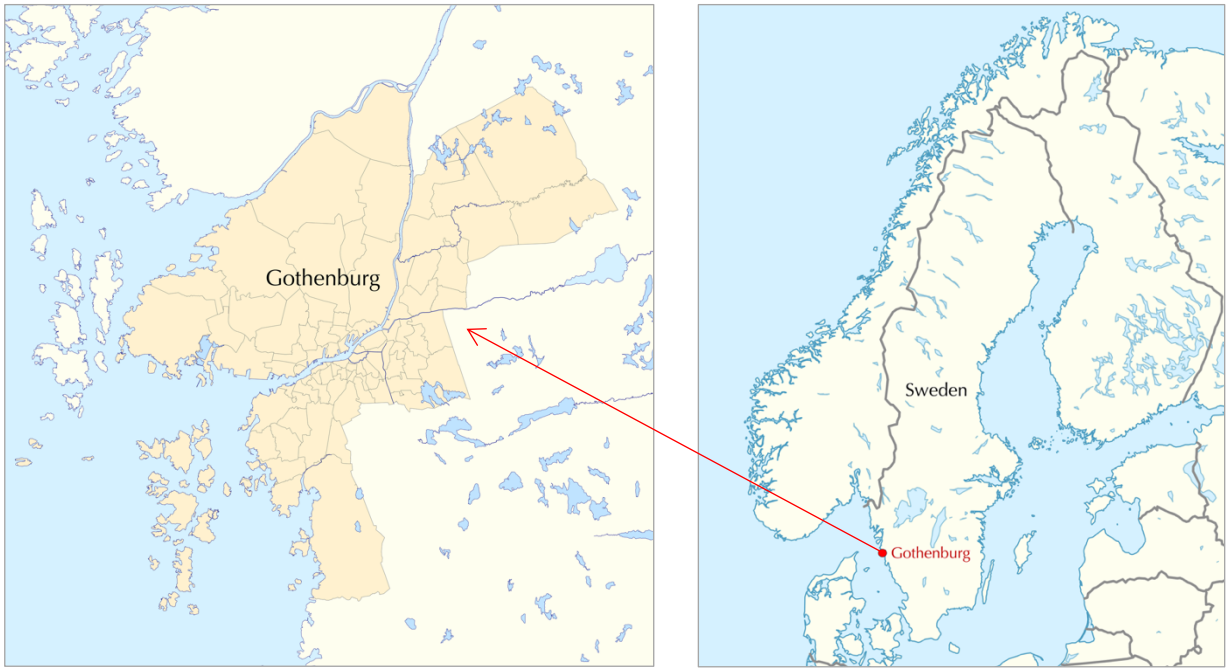

Figure 1 – Maps showing Gothenburg in orange (Left) and Sweden in yellow (Right). Images adapted from TUBS (2011), CC BY-SA 3.0, and Roskenrollmusis (2017), CC BY-SA 4.0, via Wikimedia Commons.

1.4. Structure of the thesis

The thesis is structured as follows: Chapter 2 introduces the theoretical and conceptual background for the thesis, and Chapter 3 presents the research design, methods utilized, and my perspectives as a researcher. Parts of these two chapters are based on my licentiate thesis (Jiménez Encarnación, 2023). Then, Chapter 4 highlights the main research findings for each research question. Chapter 5 discusses findings considering extant literature, reflects upon the research process and limitations, and suggests future research. Finally, Chapter 6 concludes the thesis. After that are appended additional materials and the papers that constitute the basis for the thesis.

2. Theoretical and conceptual background

The thesis lies at the intersection of the household product consumption and sharing economy fields, with a focus on environmental sustainability (see Figure 2). In this chapter, the basic concepts, state of the art, and research gaps are presented regarding household consumption, sharing economy (SE), and sustainability aspects of the SE. The introduced terminologies will be used throughout the rest of the thesis and are summarized in the Glossary.

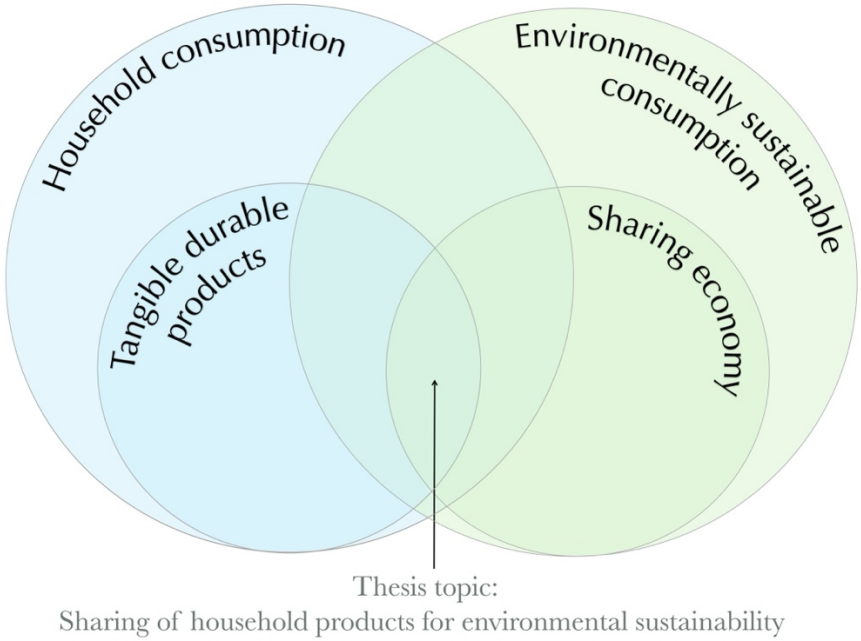

Figure 2 – Venn diagram showing the scientific fields relevant to the thesis topic: household consumption, consumption of tangible durable products, environmentally sustainable consumption, and sharing economy.

2.1. Household consumption

Households consume products to support their activities, satisfy their needs and wants, and enhance their well-being (Magrabi et al., 1991). Globally, household consumption contributes to more than 60% of the total GHG emissions and 50%-80% of land, material, and water use, including categories such as housing, mobility, food, services, clothes and diverse manufactured products. The latter two categories (from now on, called "household products") account for 25% of the household material footprints, 20% for carbon footprints, and 17-15% for water and land footprints within the European Union. Notably, the emissions and resource use associated with the consumption of household products are much more significant in developed economies, driven by the high levels of disposable income (Ivanova et al., 2016), while the growing rates of urbanization make cities a focal point for increased consumption and impacts (Ottelin et al., 2019).

The continued growth of consumption highlights the importance of studies to quantify household consumption rates, their environmental effects, and the behaviors and practices underlying consumption (Shittu, 2020). Results from household consumption studies may reveal opportunities for transitioning towards more sustainable consumption patterns.

2.1.1. Measuring the impacts of household consumption

Measures of household consumption, either by purchased unit or by money expenditure, are commonly obtained through interview- or questionnaire-based surveys (Beegle et al., 2012), and constitute the base for national statistics (e.g., national expenditure surveys). Top-down models for investigating the impacts of household consumption, such as Input-Output and Material Flow Accounting assessments, are generally based on statistics and combined with environmental impact accounts (e.g., carbon footprints, resources and energy required, etc.) (Hertwich & Peters, 2009; Ivanova et al., 2016; Tian et al., 2024) . Across various studies and geographical contexts, some findings have been consistent.

Both the literature reviews of E. G. Hertwich (2005) and Tukker and Jansen (2006) indicated housing, mobility and food as the largest contributors for the most commonly evaluated impact categories, with comparable results in more recent studies. Similarly, several studies have confirmed that impacts such as CO_2 increase alongside income and expenditure levels (Hertwich & Peters, 2009), with 51–91% of the planetary boundaries breach attributed to the global top 20% of consumers (Tian et al., 2024). The income effects are seen when comparing countries and their impacts, but also between the consumers of a same country.

The Nordic countries, as developed economies with high-income levels, have higher than average impacts despite their environmentally sustainable public image (Maczionsek et al., 2023). For 2007, Ivanova et al. (2016) found that Sweden´s carbon footprints ascend to 8.7 CO_2eq per capita, although this was lower than countries with comparable incomes. For the last decade, it is seen that Sweden´s consumption has continued to increase (Hagberg et al., 2022), while comparatively having the least environmental development in the European Union (Jankiewicz, 2024).

Another consistent trend is seen related to income levels, where not only the amounts of consumption and respective impacts vary according to income, but also the distribution of different product categories. While housing, mobility, and food retain their importance, the impacts of household product consumption become more relevant for high-income countries and groups, often following the three former categories (Hertwich & Peters, 2009; Ivanova et al., 2016; Tian et al., 2024). Research in Sweden based on national statistics and extrapolation to the postcode level confirm this trend (Dawkins et al., 2024); while expenditure-based research shows that Sweden´s overall consumption increase is also reflected in the consumption of some specific household products (Hagberg et al., 2022).

With this in mind, some gaps appear in relation to research and practice: First, although the significance of household products impacts has been recognized for a long time, these continue to be relatively neglected by policy and planning practices (Hertwich & Peters, 2009; Hult & Bradley,

2017). Second, there is a challenge in judging the significance of specific products due to the lack of disaggregation in product categories and different categorizations used across studies.

2.1.2. Transitioning towards sustainable product consumption patterns

Sustainable consumption entails the use of products and services to satisfy needs and contribute to quality of life, while minimizing their impacts so that they do not affect the capacity of future generations to meet their needs (UNEP, 2010). For products, the concept involves actions throughout the product life cycle (i.e., raw material extraction, production, transport, retail, use, and end-of-life treatments). This may include reducing the impacts of raw material extraction and production, decreasing material and energy used during production, shifting consumption towards products with lower impacts, using products more efficiently, and reducing overall consumption levels.

As seen, some of these actions pertain stakeholders throughout the lifecycle of products, while others are closely related to household behaviors. To generate a deeper understanding of how to achieve consumption shifts in the household, some studies complement household consumption rates by researching the behaviors and attitudes underlying the consumption (Shittu, 2020). Recent studies for Nordic countries have focused, for example, on identifying factors related to unsustainable consumption patterns. Sahari et al. (2024) used survey results and a carbon calculator app to identify psychological and socio-demographic factors related to variations in carbon footprints in Finland, while Árnadóttir et al. (2024) applied a similar methodology across five Nordic countries. Maczionsek et al. (2023) investigated the levels of discrepancy between self-perceived climate sustainability and actual carbon footprints of consumers in the same region. For the consumption of durable products, these studies show that in addition to income; specific genders, lower environmental attitudes, and support for the societal status quo were associated with a higher carbon footprint. Counterintuitively, high reported understanding of climate change also raised carbon footprints (Sahari et al., 2024; Maczionsek et al., 2023).

Other studies have suggested and/or modeled the effect of diverse actions on household environmental impacts. For example, Dawkins et al. (2024) suggested policy interventions based on the CO_2 results in Sweden; while Andersson and Nässén (2023) and Halonen et al. (2024) investigated the effects of low-carbon lifestyles through survey results and carbon calculator app; in Sweden and Finland, respectively. Generally it was seen that while durable products have a greater significance in the Nordic countries, scenario-based research often does not address the lowering of household consumption through, for example, sharing them (Andersson & Nässén, 2023), or covers it superficially (Dawkins et al., 2024; Halonen et al., 2024).

2.1.3. Behavioral theories related to sustainable consumption

Several different theoretical lenses have been used to understand what influences consumers´ behaviors. These frameworks are also useful in the context of sustainable consumption, to create knowledge on how to shift the population´s behaviors. Theories stemming from the economic field initially posed that consumer behaviors were the product of conscious decisions that weighed the

cost and benefits of an action (Jackson, 2005), but further empirical studies demonstrated that psychological factors influence what would´ve otherwise been "rational" decisions (Tversky & Kahneman, 1974; Zoli & Congiu, 2024). With this realization, frameworks such as the Theory of Planned Behavior (TPB) (Ajzen, 1991) proposed that individual behavior is driven by behavioral intentions, which are determined by attitudes toward the behavior, subjective norms, and perceived behavioral control. Although TPB is amongst the most utilized theories, it still excludes the role of other "irrational" aspects, such as emotions and habits, and the influence of external factors that can shape consumer´s decisions. Integrative models, such as the one by Kollmuss and Agyeman (2002), depart from the complexity of attitude-behavior gaps, where consumers might see a sustainable behavior as desirable but still not engage in it. Their model highlights how different factors can drive or hinder pro-environmental behaviors, including demographic characteristics, internal factors (motivation, environmental knowledge, awareness, values, attitudes, emotions, locus of control, responsibilities, and priorities), and external factors (institutional, economic, social, and cultural aspects). In this thesis, I take inspiration from Kollmuss and Agyeman´s model, especially related to the importance of external factors.

2.2. Sharing Economy

The sharing economy (SE) is an emerging phenomenon that was popularized with the success of AirBnB and Uber (Martin, 2016), and that entered the academic field through the book of Botsman Botsman and Rogers (2010) on collaborative consumption. As a contested concept, the literature recognizes several definitions going from restrictive models ("Sharing is an alternative to the private ownership that is emphasized in both marketplace exchange and gift-giving"; Belk, 2014) to broader definitions ("An economic model based on sharing underutilized assets from spaces to skills to stuff for monetary or non-monetary benefits"; Botsman, 2013). According to some, the difference between the conventional sharing that has occurred since the origins of humanity and the SE lies in its efficiency and sustainability (Hossain, 2020). Other authors subdivide the SE according to characteristics of the exchanges, for example Acquier et al. (2017), who introduce three cores of the SE: access economy (i.e., which focuses on optimizing the use of underutilized assets), platform economy (i.e., where digital platforms mediate peer-to-peer exchanges), and community-based economy (i.e., interactions without economic remunerations, hierarchy, or contracts). Ultimately, as an umbrella concept the SE can include close cousins such as "collaborative consumption" (e.g., Benoit et al., 2017; Hamari et al., 2016), "gig economy" (Acquier et al., 2017), "access-based consumption" and "access-based services" (Bardhi & Eckhardt, 2012; Schaefers et al., 2016), and has an overlap with concepts as "circular economy" and "product-service systems" (Camacho-Otero et al., 2018).

2.2.1. Basic elements of the SE

As seen above, academic definitions of the SE vary according to some basic elements (e.g., shared assets, roles, platform models, and activities). Here is presented a collection of elements included in different definitions, which helps in understanding the scope of the thesis:

Shared assets
These are classified into tangible and intangible, where the first refers to space, durable products and non-durables such as food; and the latter refers to services, time, knowledge, money, and online content (Curtis & Lehner, 2019). Durable and semi-durable products do not deteriorate quickly (e.g., cars, bikes, sports equipment, electronics, kitchen equipment, furniture, household equipment and clothes), and potentially have a high idling capacity (i.e., they stand unutilized or "idle" for long periods of time, even if they are still functional). Shared assets can also be classified by their level of rivalry (i.e., whether use by a person prevents simultaneous use by another).

Roles and platform models in the SE
Households, businesses, organizations, and governmental institutions can adopt various roles depending on the platform model of the sharing initiative (SI). In business-to-consumer models (B2C), a business or organization might provide the assets (e.g., Styr & Ställ, 2023), while in peer-to-peer models (P2P), individuals and households adopt both the roles of provider and consumers (e.g., Hygglo, 2023) (Curtis & Lehner, 2019). Extant literature introduces additional roles, such as "prosumers" (i.e., individuals who can switch between being consumers and service providers in P2P models, often in accommodation and energy sharing, Magnusson & Palm, 2019; Xiang et al., 2022), and "mediators" or "intermediaries" (i.e., businesses/organizations which regulate the transaction between two private parts in P2P models, which in this case could also be called P2B2P, Sutherland & Jarrahi, 2018). Beyond individuals and businesses, governmental institutions can also act as service providers through self-initiated SIs or as consumers in B2C models.

Sharing activities
While some authors only include actions that result in temporary access to assets (e.g., sharing, lending, borrowing, and renting diverse assets, Belk, 2014; Frenken & Schor, 2017), others extend the definition to include permanent transactions (e.g., through exchanging, gifting, and selling and buying used products, Benkler, 2004; Muñoz & Cohen, 2017; Schor, 2016); although admittedly, the latter are included to a lesser extent in the SE literature (Laurenti et al., 2019). These transactions could be monetized (e.g., renting, co-buying) or not (e.g., lending, swapping).

According to these elements, the scope of this thesis is based on tangible and durable/semi-durable products, through platform models that cater to users (e.g., B2B, P2P/B2P2P), and through activities that allow temporary and permanent transactions, whether monetized or not.

2.2.2. SE state-of-the-art

The SE has so-far been researched from various perspectives. According to Laurenti et al. (2019), the main thematic clusters within sharing research are user behavior (26.4%), business models and organizational aspects (22.7%), institutional and governance systems (18.7%), conceptualization matters (17%), and sustainability evaluations (15.3%). Similar themes were identified in the reviews by Cheng (2016) and Hossain (2020).

By sector, the SE research has focused on sharing of space (21.4%) (e.g., accommodation and co-working) and mobility (18.1%) (e.g., cars, bikes and scooters), with only 2.6% of studies focusing on other tangible assets such as household products. Within space sharing, a lot of research is devoted to Airbnb guests, hosts, the accommodation supply, its impacts on destinations and

regulation (Guttentag, 2019). For bikes, common topics include the safety and benefits of bike usage, system optimization, design and integration with public transit, and the impacts of bike sharing on the cities´ urban form, operation, and on users´ health (Si et al., 2019). While household products have received relatively little attention, most research refers to fields within user behavior and business models, mirroring the general trend in the SE.

A general issue seen in the SE research field is the degree of fragmentation (Gurău & Ranchhod, 2020). It is common to find in-depth studies that focus on one or few shareable products (Strulak-Wójcikiewicz & Wagner, 2021), specific business models (Noh et al., 2020), single sharing initiatives (Shmidt, 2019), and limited households or user profiles (Morone et al., 2018; Yates, 2018). In fact, the fragmentation starts from lacking a common definition for the SE, and extends to the rest of topics studied; with for example Arrigo (2021) and Shams Esfandabadi et al. (2022), identifying fragmentation in the clothes sharing literature, and in SE sustainability assessments. Mont et al. (2020) underlines the need for a comprehensive framework that allows comparability of results, as the fragmentation poses a challenge in understanding the SE thoroughly.

2.3. Sustainability of the SE

The SE has been widely associated with sustainability benefits, encompassing the following social, economic and environmental aspects (Böcker & Meelen, 2017; Botsman, 2013; Botsman & Rogers, 2010; Geissinger et al., 2019):

Socially, the SE can enhance interactions and promote bonding at both individual and community levels, especially in P2P models (Plewnia & Guenther, 2018). It also has the potential to improve resource access for underprivileged groups (Martin et al., 2015) and to provide opportunities for fun and novel experiences. However, some studies indicate that racial discrimination and income inequalities may persist in accommodation and mobility sharing (Jin et al., 2018; Plewnia & Guenther, 2018).

Economically, SE initiatives and peer-providers have the opportunity to generate additional income, partake in entrepreneurship, and foster economic growth (European Commission, 2016b). At the same time, costs are reduced for the SE consumers in comparison to purchasing new products (Botsman & Rogers, 2010). However, the money saved or generated could be used for "unproductive economic purposes" (Hossain, 2020), contributing to environmental rebound effects.

Environmentally, the SE promises to make more efficient use of materials and products through the reduction of purchase amounts (Kalmykova et al., 2018), leading to an eventual decrease in production and raw material extraction (Ala-Mantila et al., 2017); of water and energy use, of GHG emissions (Cheng, 2016), and of waste amounts (Puschmann & Alt, 2016). However, these effects are uncertain, as savings made from participating in the SE may be invested in other products and services. Also, long travel distances to access shared products may increase GHGs, leading to trade-offs (Demailly & Novel, 2014), and energy use of electric products may increase alongside the number of users. Subchapter 2.3.1. expands on the state-of-the-art for SE´s environmental sustainability, while specific sustainability factors are described in Papers 1 and 2, and summarized in subchapters 4.1. and 4.2.

2.3.1. Environmental sustainability of the SE

Over the past decades, SE research has seen a gradually changing focus toward sustainability topics (Cheng, 2016; De las Heras et al., 2021). Yet, the actual environmental impacts of sharing remain poorly understood, augmenting the risk that the SE might instead promote increased consumption and environmental burdens (Curtis & Lehner, 2019; Mont et al., 2020). Like the general trend in the SE field, much of the research on the sustainability of the SE has to do with users´ environmental motivations, and some refers to SIs expressing their link to sustainability (Geissinger et al., 2019; Hossain, 2020). Thus, the environmental sustainability of sharing is a common narrative in the field, though often addressed superficially (Arrigo, 2021).

Many scholars emphasize the importance of conceptualizing and empirically evaluating the SE from multiple sustainability perspectives, particularly in light of limited available data (Curtis & Lehner, 2019; Frenken & Schor, 2017; Mont et al., 2020). Some researchers take a broad approach in addressing this—for example, Curtis and Lehner (2019) propose theoretical conditions under which the SE could be sustainable, including digital mediation, non-commercial ownership motives, temporary transactions, and the sharing of tangible assets.

Other studies focus on assessing the environmental sustainability of specific shareable assets. For example, Meshulam et al. (2024) find that the environmental sustainability of accommodation sharing is limited in comparison to hotel stays, likely due to reduced car ownership and the use of more efficient vehicles. In contrast, ride-hailing services have increased carbon emissions by diverting users from public transport and increasing travel distances (Schor & Vallas, 2021). The sustainability of bike sharing remains uncertain, as studies with favorable results often overlook operational impacts and rely on assumed displacement rates (Meshulam et al., 2024). Just as in household consumption research, the sustainability of sharing household products has been neglected. This is notable given their potential for sustainability gains (Meshulam et al., 2023; Schor & Vallas, 2021). Some progress has been made through environmental assessments using life cycle assessments (LCA) (e.g., Martin et al., 2019; Zamani et al., 2017), hybrid methods supported in input-output assessment (e.g., Ala-Mantila et al., 2017), and material flow accounting studies (e.g., Wiprächtiger et al., 2022). These studies reveal varying sustainability outcomes depending on the products, activities, and factors considered.

Another challenge in evaluating the sustainability potential of the SE lies in the limited integration of consumption perspectives. It is widely agreed that the sustainable potential of the SE lies in its ability to reduce overall consumption by utilizing the idle capacity of products, thereby decreasing the need for new production and its associated environmental impacts (Arrigo, 2021; Curtis & Lehner, 2019). Various studies recognize and empirically address consumption in combination with sharing, including Moon (2024), Ribera Jemio et al. (2024), and Ottelin et al. (2020). Nonetheless, most research still shows a gap in investigating consumption aspects such as purchase replacement behavior, rebound effects, and sharing causing new consumption needs (Martin et al., 2021). Notably, much of the consumption reduction associated with sharing is related to user behaviors (e.g., replacing consumption by sharing, engaging in rebound consumption) (Johnson & Plepys, 2021). But although user behavior is a key topic in the SE, Laurenti (2019) highlights a major gap in research connecting these behaviors to the actual environmental outcomes, and recommends exploring what drives user behavior, how to measure it, and how much rebound

effects might reduce the environmental benefits of sharing. While Pouri and Hilty (2018) explained that the lack of rigour in studying the SE´s impacts might be related to its novelty, the recent surge of relevant research calls for clearer assessment frameworks, especially in matters related to consumption reduction.

2.3.2. Relevance of the SE for environmentally sustainable cities

The sustainability potential of the SE is especially relevant in urban areas. As cities experience increasing household consumption rates and environmental impacts, innovative solutions like the SE become necessary (Ottelin et al., 2019; Shittu, 2020). High income levels in cities contribute to this elevated consumption, while the higher population densities represent a surplus of underutilized assets whose idle capacity could be leveraged through sharing (Mont et al., 2020). The close proximity of residents in urban settings facilitates the engagement in sharing activities within shorter distances; and at the same time, sharing products can address issues with limited living space, as well as space for infrastructures and services (Bocken et al., 2020). Thus, the higher rates of consumption and environmental impacts, the scarcity of space, as well as the shorter distances and agglomeration of unused products, make cities an ideal unit for analyzing the sustainability potential of the SE.

3. Research approach and methodology

This chapter provides details on the methods used throughout the thesis and defines the theoretical perspectives that influenced the research approach.

3.1. Research design

This research is organized around three research questions (RQs), see Figure 3. The questions have been addressed through a descriptive and exploratory approach. Descriptive research describes phenomena "as they exist", while exploratory research looks for patterns rather than trying to test or confirm hypotheses (Vogt, 2005). Additionally, RQs 1 and 2 are addressed qualitatively, while RQ3 is addressed quantitatively, giving the thesis a mixed-methods character. The mixed-method character, with the progressive integration of theory to contextualize quantitative results, makes the research design abductive (Wheeldon & Åhlberg, 2014). Finally, due to the involvement of both academic and non-academic stakeholders, the research is transdisciplinary (Kiatkoski Kim et al., 2022).

Chronologically, the research was initiated by quantitatively exploring the potential of different group categories to achieve sustainable sharing focused on consumption reduction (RQ3), to then conduct qualitative research by elaborating a conceptual diagram delineating the factors that influence the sustainability potential of sharing (RQ1) and further elaborating on role of consumption reduction factors (RQ2). In this way, the last part of the research offers context on the sustainability potential of sharing and serves as a foundation for the discussion. This chronology was influenced by the timing of the research projects and the collaboration with Gothenburg Municipality, which is discussed in subchapter 5.4.

To facilitate the understanding of this thesis, the RQs and results are presented from general (all sustainability factors – RQ1) to specific (consumption factors – RQ2, and then, the measurement of selected factors for specific groups – RQ3). Following this order, the thesis first uses a literature review (subchapter 3.2.1.) and qualitative thematic coding (subchapter 3.2.2.). These methods are used to collect extant literature on quantitative sustainability assessments of household product sharing, and to identify which factors influence whether sharing can be more sustainable than purchasing newly manufactured household products. Here, a conceptual diagram is elaborated; and the outcome of the research is communicated through Paper 1.

Then, a causal loop diagram (subchapter 3.2.3) is applied to analyze the relationships between the factors identified, and to characterize how they relate to the consumption reduction factors. Qualitative coding is also used in this part to elaborate on the role of the consumption-reduction factors, and to elucidate which factors relate to the sharing user. The outcomes of this part are communicated in Paper 2.

For the last part of the research, diverse user-related factors associated with consumption and sharing are quantified. The results are analyzed from the perspectives of geographic areas, demographic groups, and product groups. The research was prefaced by stakeholder collaboration with the Municipality (subchapter 3.2.4.), leading to the identification of the relevant analytical

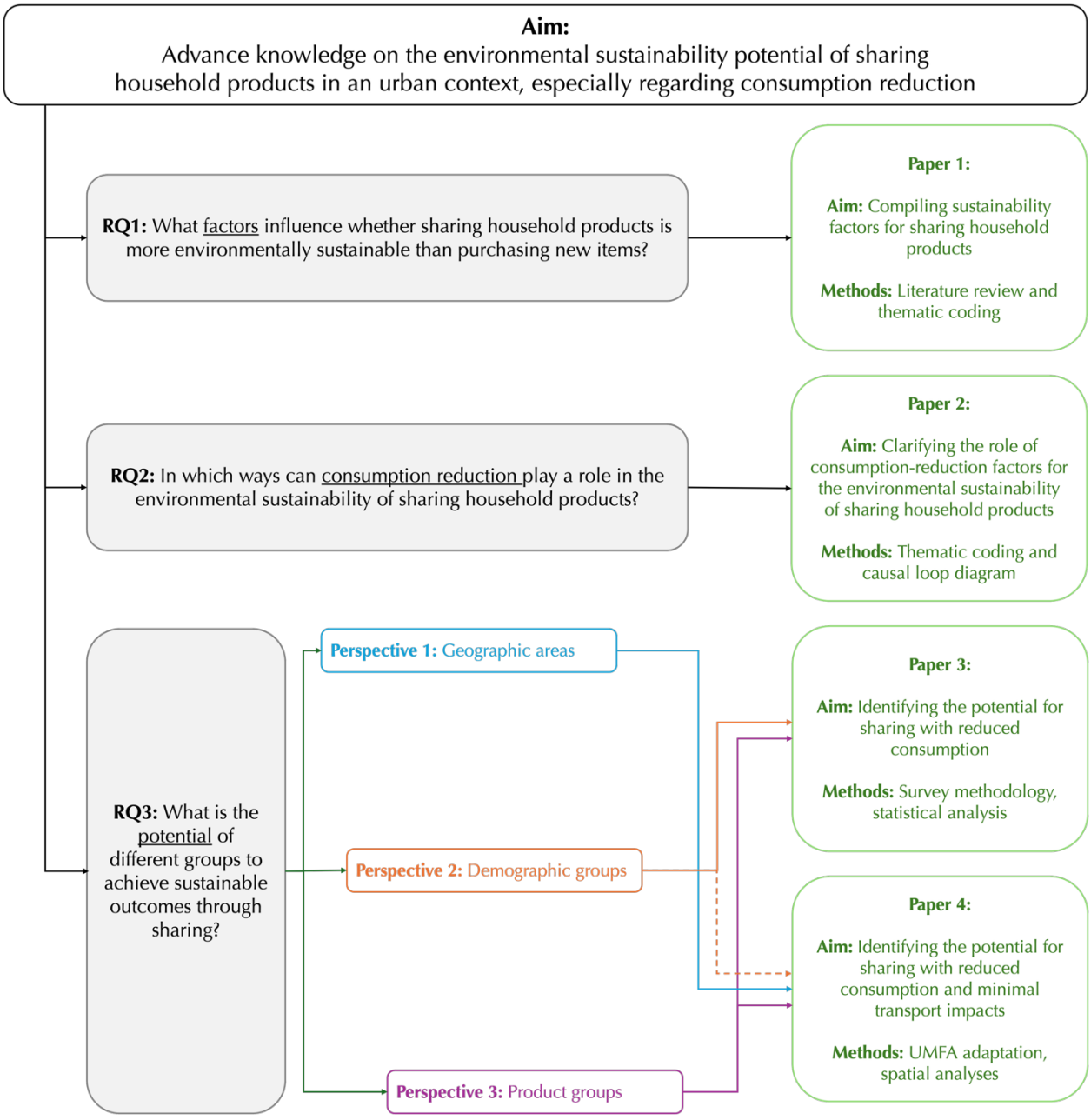

Figure 3 – Overview of aim, research questions, and contributions of the papers. The perspectives of RQ3 are marked in blue (geographic), orange (demographic), and purple (product). The pointed line means that results about the demographic groups were a methodological input for Paper 4.

perspectives, the exchange of survey data used for the analyses (subchapter 3.2.5.), and the co-selection of consumption and sharing variables to analyze. Then, the consumption of shareable products in Gothenburg at both the city and neighborhood levels was calculated. City-level results were generated through statistical analysis (subchapter 3.2.6.), while neighborhood-level results were produced through an extrapolation method (subchapter 3.2.7). Further, the attitudes towards consumption and sharing, as well as participation in the SE were quantified according to different

products. This part also involved statistical analysis at the city level and extrapolation to the neighborhood level. Finally, neighborhood-level results also underwent spatial analyses (subchapter 3.2.8.). The data sources for the quantitative part of the research included data from a survey conducted by the researcher and a survey conducted by Gothenburg Municipality (subchapter 3.2.5.), as well as national, city, and neighborhood statistics, city street network data, and the location of SIs throughout the city (see Paper 4). The outcomes of the quantitative research are communicated through Papers 3 and 4.

Finally, the qualitative findings influenced the analysis of the quantitative findings for the thesis by affecting how some variables were interpreted a posteriori.

3.2. Overview of methods and approaches

3.2.1. Literature review

Literature reviews gather the existing information within a specific knowledge field, aiming to summarize and analyze current theories and methodologies, pinpoint gaps, and offer evidence to support decision-making (Pickering et al., 2015). Several types of reviews have been identified, where both systematic and systematized reviews follow standardized steps to ensure the comprehensiveness of the sample and reproducibility of results. However, systematized reviews may skip some formal steps typically included in systematic reviews (Grant & Booth, 2009).

A systematized review approach was deemed appropriate to compile the existing studies on quantitative environmental assessments of the SE. The resulting data sample was used to identify the factors influencing the sustainability of sharing (RQ1) and to clarify the role of consumption reduction (RQ2). The review was based on quantitative studies to further the production of knowledge about the SE´s sustainability away from actors' assumptions and towards factors that are, or could potentially be, measured.

To ensure rigor, I followed the literature review steps delineated by Livoreil et al. (2017), including establishing a test list; identifying search terms and building search strings (see Figure 4), choosing relevant bibliographic sources and management software; assessing the need for grey literature; retrieving and assessing the results; and recording the results (see steps in Paper 1). Aspects that deviated from the traditional systematic review were the use of only one bibliographic source (Scopus), and subsequent exclusion of grey literature. I chose to forego grey literature due to the objective of the review, which was not to summarize the results of the environmental assessments but to qualitatively identify sustainability factors. Throughout the process, it was seen that the grey literature in the test list was sometimes less rigorous in their calculations than numerical models, LCA, and Input-Output approaches in the academic literature. Further, comparing the results from the review with grey works included in the test-list pointed to thematic saturation in the review sample (Rahimi & Khatooni, 2024), as no additional factors were identified in the grey literature during the qualitative content analysis step (see next subchapter).

Search string 1:

("sharing economy" OR "collaborative consumption") AND ("environmental" AND (assess OR benefit OR potential OR performance OR sustainability OR impact OR effect OR friendliness OR evaluat* OR quantif*))*

Search string 2:

("sharing economy" OR "collaborative consumption" OR "product-sharing" OR "product sharing" OR "goods sharing" OR "item-sharing" OR "item sharing") OR ((loan OR lend* OR "peer-to-peer product sharing" OR library OR rent* OR "product-service system" OR "second-hand" OR secondhand OR reus* OR "access-based" OR PSS OR exchang* OR repair) W/2 ("household products" OR "consumer products" OR "consumer goods" OR "household goods" OR "clothes" OR "clothing" OR "fashion" OR "shoe" OR "kitchen" OR "laundry" OR "tool" OR "electronic" OR "furniture" OR "children" OR "kid" OR "hobby" OR "leisure")) AND ("environmental" W/2 (assess* OR benefit OR potential OR performance OR sustainability OR impact OR effect OR friendliness OR evaluat* OR quantif*))*

Search string 3:

("sharing economy" OR "collaborative consumption") AND ("life cycle assessment" OR lca OR "input-output" OR "material flow accounting" OR "MFA" OR "resource consumption" OR "CO2 emissions")

Figure 4 – Search strings utilized for the literature review, including terms related to the sharing economy, to household products, to sharing activities, and to environmental assessments.

3.2.2. Thematic analysis

Thematic analysis aims to extract implicit and explicit meanings from linguistic material (Willig, 2017). This involves coding, where researchers label data excerpts to identify, organize, and interpret text, and then organize them into themes (Miles et al., 2019). Content analysis, a form of thematic analysis, seeks to analyze texts objectively and systematically. Qualitative content analysis, the most prevalent approach for interpreting documents, differs from its quantitative counterpart by not using predetermined coding categories and not aiming to quantify the resulting themes (Bell et al., 2018).

In this thesis, I used qualitative content analysis on the studies retrieved in the literature review to identify the sustainability factors and examine the roles of consumption-reduction factors (RQs 1 and 2). The software MaxQDA24 facilitated the analysis process.

Initially, I considered identifying which sustainability factors were most impactful by comparing the quantitative results of the environmental assessments. However, a qualitative approach was more suitable due to the limited number of studies per product and activity, the high variability in factors considered, and differences in whether the factors were assumed or empirically measured. Here, the flexibility of qualitative content analysis and the inductive approach to coding were preferred. Furthermore, the coding process was semantic/descriptive, following the thematic analysis phases delineated by Willig (2017): familiarization, coding, theme development, reviewing, and defining themes through a series of iterative rounds.

Additionally, quantitative content analysis was used in the thesis as a data processing step for assessing the current state of sharing in Gothenburg from a product perspective (RQ3). The SEsam survey (see subchapter 3.2.5.) included open-ended questions about product sharing (e.g., "Which

product types are already obtained/provided by the household through SIs?"). Responses were coded in vivo and grouped into deductive themes corresponding to the study's product groups.

3.2.3. Causal loop diagram

Causal loop diagrams (CLDs) are a qualitative tool used to understand complex problems by visualizing the interactions between variables within a system (Tulinayo et al., 2012). A CLD was used to represent relationships between the sustainability factors in a neutral way, contributing to elucidating the role of consumption-reduction factors. In the CLD, the sustainability factors were connected through arrows marked with signs (i.e., positive or negative) indicating cause and effect between the factors. The CLD was done using the System Mapping Toolkit template in Miro (System Mapping Academy, 2025), following the guidelines of Kim (2018).

3.2.4. Transdisciplinary approach and collaboration with local government

Due to the uncertain effects of the SE, several authors highlight the need for effective governance to maximize its positive sustainability impacts (Henry et al., 2021; Voytenko Palgan et al., 2021). Effective governance can be supported by addressing the knowledge needs of local actors and through collaborative mechanisms. For this thesis, collaboration was established with representatives from Gothenburg Municipality´s Democracy and Citizen Service (Göteborg Stad, 2025). These representatives were simultaneously involved in the Sharing Cities Gothenburg (SCG) testbed (see subchapter 1.3.), henceforth referred to as “SCG representatives”.

The collaboration with the SCG representatives for the quantitative part of the research reflected the principles of transdisciplinary research: supporting a societal goal besides a scientific goal, and actively involving non-academic actors throughout the research process, including the aim definition (Kiatkoski Kim et al., 2022). More specifically, the collaboration consisted of the identification of the knowledge needs of the city, mutual provision of data, and informal consultation during the research process. The co-creation process included a workshop with the SEsam research team and an SCG representative. In the workshop, the knowledge gaps from the SCG testbed were matched with data available from SEsam and a survey previously conducted within the SCG testbed (see subchapter 3.2.5.). Additionally, the research perspectives for RQ3 were chosen. An example of the ideas generated in the workshop can be seen in Additional Material - Figure A.1.

3.2.5. Questionnaire surveys

Self-completed questionnaires are amongst the main instruments for gathering data within survey research and have been widely used within the fields of household consumption and sustainable consumption (Beegle et al., 2012; Bell et al., 2018). Within the thesis, questionnaire surveys provided data to understand the current status of consumption and sharing in Gothenburg, contributing to RQ3. This methodology was suitable for this part of the thesis due to the large

number of cases necessary for quantitative approaches, contrary to qualitative data-gathering approaches that are richer in detail but require fewer samples.

Data were obtained from two independent questionnaire surveys: one conducted by me and the SEsam research team (SEsam survey), and one conducted by SCG (SCG survey) through the Institute for Quality Indicators AB (2021). The data from these surveys were complementary for the purpose of the thesis, as the SEsam survey focused mainly on household consumption, and the SCG survey on sharing.

SEsam survey

The data from the SEsam survey were used to address the demographic and product perspectives in RQ3. The SEsam survey was conducted following the process described by Blair et al. (2013), where I designed the pre-test and final questionnaires and elaborated the sampling strategy. The survey was originally designed to study the consumption of shareable products per population group and per neighborhood in 2021. A secondary goal was to obtain data about the proportion of households that participated or expressed interest in participating in SIs and regarding which specific products.

The survey had a cross-sectional design, thus collecting data at a single point in time (Bell et al., 2018). Most questions were closed-ended, except for those referring to sharing interests and habits. The questionnaire surveyed behaviors (amounts consumed, participation in the SE) and attitudes (desire to participate in the SE). Questions about demographic characteristics related to the household groups in Whetstone et al. (2020) and other characteristics compatible with the Gothenburg Census (Göteborgs Stad Statistik och Analys, 2022). To improve participation rates, I included an introduction providing information about the purpose of the survey and the confidentiality of the data provided, and provided auxiliary information when referring to terms possibly unknown to the respondents (e.g., disposable income, SE). A web-survey modality was chosen, which typically implies a lower cost, improved speed, and the possibility to reach a larger participant sample, though with lower response rates than other survey modalities.

Following my design, Master-level students taking the Urban Metabolism course at Chalmers University of Technology conducted the pre-test as a part of a group assignment. They distributed the survey to acquaintances, obtained feedback from respondents, and identified questions that needed modification. I obtained further feedback from the SCG representatives and modified the questionnaire accordingly. After the pre-test, students conducting their Bachelor´s thesis at Chalmers University of Technology distributed the final survey (de Boer et al., 2021), hosted in the web platform SurveyMonkey (2023). Survey participants were contacted through social media, including the spread of the survey link in diverse Gothenburg neighborhoods' Facebook groups. The sampling resulted in 364 survey responses. Additional details regarding population, sampling strategy, quotas, and questionnaire are shown in Paper 3 (Jiménez Encarnación et al., 2024).

SCG survey

Results from the SCG survey, conducted in 2021, were utilized to address the demographic, product, and geographic perspectives in RQ3. The goal of the SCG survey was to obtain details about the attitudes and behaviors in Gothenburg related to the SE. The survey was designed with feedback from me and other researchers and stakeholders in the SCG testbed and resulted in 961

responses with a 34.3% response rate. Further details about this survey can be seen in Paper 3 (Jiménez Encarnación et al., 2024).

3.2.6. Statistical analysis at the city level

Statistical analysis can help identify patterns and relationships between variables and evaluate the significance of the relationships in quantitative data (Bell et al., 2018). Both descriptive and inferential statistics are used to answer RQ3. Descriptive statistics (i.e., mean values and percentages) are used when describing the potential of the product groups, and inferential statistics are used to assess the significance of the demographic groups in relation to dependent variables. The analyses are explained below, while specific variables analyzed are seen in Paper 3 – Table 1:

- Logistic regression analyses were used to examine the relationship between categorical independent variables and binary dependent variables. For example, logistic regressions evaluated whether gender (categorical variable: male/female) has a significant effect on being "very interested" in sharing (binary variable: yes/no).

- Linear regression tests showed if there was a relationship between an independent variable and a continuous dependent variable. An example refers to the question, "*How many of the [following] products did your household buy in the last year?"*. In this case, the relationship between an independent continuous variable - age (categories: 18-24, 25-44, 45-64, and 65+), and the dependent continuous variable - amount purchased (categories: 1-9, 10-20, 21-30, 31-40, 41-50, 51+) was tested. Alternatively, the analysis could be made in relation to an independent categorical variable, such as type of dwelling (categories: house/apartment).

- Zero-inflated Poisson model, a linear model, was used when the data presented an excess of zero counts. An example is seen for the variable reflecting a "very positive" attitude towards sharing activities, where most participants were not "very positive" towards any (i.e., 0) sharing activities.

- The difference of proportions test was used to assess if the difference between two percentages in a sample was statistically significant. In the thesis, this is used to analyze the question, *"Are there product types that the household already obtains/provides through sharing initiatives (SIs)?"*. Due to the small size of the sample, these analyses were performed to confirm the logistic regression results.

For this part of the research, I designed the study and co-selected the variables to be analyzed, while a statistician from the Governance and Local Development Institute at Gothenburg University conducted the statistical analyses (GLD, 2025). After, we co-identified product patterns by observing the relative position of each product within each variable considered and demographic patterns by selecting demographic characteristics that had statistical significance both within consumption and sharing variables. Here, variables were analyzed for "extreme" results to avoid desirability bias (i.e., whether respondents were "very interested" rather than "interested" in the SE).

3.2.7. Quantifying consumption and sharing at the neighborhood level

The UMFA* method was developed by Whetstone et al. (2020) as a step toward performing neighborhood-scale** urban metabolism studies. Whetstone et al. (2020) proposed that neighborhood-scale consumption estimations are helpful to devise localized interventions for the SE, as this geographical unit is a middle point between costly household-level interventions, and city-scale interventions which lack granularity. In the original UMFA method, household product expenditure data from the Swedish Household Budget Survey (HBS) (Statistics Sweden, 2024) is extrapolated to the neighborhood level as follows: First, expenditure data are classified according to which population group they belong, depending on the disposable income level in the household, the type of dwelling, and whether there are children in the household. Then, an average expenditure is calculated for each product per population group and is converted from price to mass and number of products through a conversion database. The consumption per neighborhood is extrapolated by combining the average product consumption by population group with demographic information stating the proportion of population groups within each neighborhood. Finally, the consumption per neighborhood in mass units is connected to CO_2 emission values per product, to estimate environmental impacts of product consumption at the neighborhood level.

For the thesis, I draw upon the extrapolation steps of the UMFA to explore the potential of different group categories to achieve sustainable sharing (RQ3). I developed and applied an adaptation of the method to extrapolate the variables of product consumption (national level) from the HBS, and perception of owning too much and attitude toward sharing activities (city-level) from the SCG survey to the neighborhood level. Further, in the extrapolation I utilized selected population groups from Jiménez Encarnación et al. (2024). Since the transformation of expenditure data to physical units and the calculation of environmental impacts were excluded in the thesis, I henceforth refer to this process as the "extrapolation method" to avoid implications of material flow accounting. See details of the modification and application of the extrapolation method in Paper 4 - Appendix 3.

In this thesis, the extrapolated consumption and sharing results are connected with the potential to share at nearby SIs, underlining the significance of minimizing transportation impacts (Demailly & Novel, 2014; Frenken & Schor, 2017). Furthermore, having SIs at close distances could be a primary motivator for non-sharers to start engaging in the SE (Öhrwall, 2021; Skjelvik et al., 2017). Otherwise, a disadvantage of using the extrapolation method was the difficulty of verifying the results through methods other than direct surveying. Thus, for the consumption part, I visually compared the expenditure results to GIS postcode-level CO_2 emissions data from the Consumption Compass model (Axelsson et al., 2022; Dawkins et al., 2024). For the attitudes, the population groups and subsequent results were verified by using the original SCG dataset and comparing our neighborhood-level results aggregated by district to the district-level averages available in the raw data.

*Note that the UMFA method is called "SEsam method" in Paper 3.
** What Whetstone et al. (2020) calls districts, I call neighborhoods. The difference arises because there is no official translation to English for Swedish geographical units.

3.2.8. Spatial analyses

Urban morphology studies, particularly those from the field of "space syntax," have focused on characterizing the level of accessibility and centrality of street networks and how these characteristics affect the inhabitants' use of the built environment (Hillier et al., 1993; Scoppa & Peponis, 2015).

In this thesis, I propose that urban morphology analyses are suited to study the SE with a high level of geospatial granularity. To support the geographical perspective in assessing the current potential for sustainable sharing in Gothenburg (RQ3), I used the attraction distance analysis and the street network angular centrality analysis. The former determines how accessible sharing initiatives are for residents in neighborhoods when walking or riding a bike, and the latter allows identifying pedestrian accessible locations for new SIs with high precision. As such, these analyses help understand which places in the city are suitable for sharing with low-impact transportation. Further, the analyses are overlapped with the extrapolations of consumption and sharing variables to the neighborhood level, to assess sustainable sharing possibilities specifically in areas with high values in the consumption or sharing variables.

The advantage of utilizing urban morphology methods is that they reflect more precisely how individuals move in a city; thus, contributing to the understanding of user behavior in a sharing transaction. Accessibility is based on measuring walking distance, not straight-line distance (i.e., as the crows fly), which is potentially inaccurate; and angular centrality uses angular distance (i.e., total degrees turned from origin to destination), which has been shown to correspond better to how pedestrians navigate (Dalton, 2003; Hillier & Iida, 2005).

All analyses were performed with the Place Syntax Tool (PST), an open-source plugin to the open-source GIS platform QGIS (Ståhle et al., 2005; Stavroulaki et al., 2023). The analyses were performed for each product and sharing activity in the scope using the non-motorized street network data, data for the building locations provided by the Spatial Morphology Group at Chalmers University of Technology (2024) , and the SI locations which are shown in the Smart Map (2023b). The Smart Map is an online platform co-produced by Gothenburg Municipality and the organization Kollaborativ Ekonomi Sverige. It collects the locations of a self-selected, non-comprehensive sample of SIs that fit within specific social and environmental sustainability criteria (Smarta Kartan, 2023a). Paper 4 shows more detail on how the spatial analyses were conducted. While the analyses are conducted at the neighborhood level, the results are presented according to the city´s functional areas (inner-, middle-, and outer-city) to facilitate analysis.

3.3. Research perspectives of the author

My ontological and epistemological perspectives align with *post-positivism*, a stance that recognizes the strengths of empirical research while accepting that the results are impacted by the subjectivity of the researcher and the context in which research occurs (Robson, 2002). Within post-positivism, a mixed-methods design is often ideal for bridging the need for empirical data

with the concept of subjectivism. Additionally, post-positivism is well aligned with abductive research designs (Wheeldon & Åhlberg, 2014).

The thesis utilizes knowledge developed under the multidisciplinary field of industrial ecology, particularly for the literature review in RQs 1 and 2. Industrial ecology stands "between science and technology, between research and activism, and between objectivity and normativity" (Allenby, 2006), seeking to understand behaviors within the complex interactions of human and natural systems. Hence, industrial ecology can integrate more ontologies besides the positivism and scientific realism of other quantitative sciences. At the same time, the thesis also draws from concepts from the social sciences, especially for the interpretation of survey variables in RQ3. Within the social sciences, post-positivism encourages a more reflexive and context-sensitive approach to research than positivist stances (Karupiah, 2022).

Considering the definition of sustainability, I reflect on five pairs of opposites delineated by Hedenus et al. (2022): This research adopts a *low substitutability approach* (vs. high substitutability), as it supports the reduction of consumption rather than maintaining current consumption rates by developing ways to alleviate the impacts. Along the same line, my vision of the SE relies upon *lifestyle changes* (vs. technology-based changes that do not involve user behavior). While digital technologies are often considered a defining factor for the growth of the SE; the use of technology still relies upon people choosing to change their habits. Nonetheless, individuals often do not have the means to transition to sustainable lifestyles without the support of external factors. As the implications of this thesis provide information that may facilitate decision-making in governance, practice, and the private sphere, the thesis can be placed in the middle of the *individual-political* action spectrum. Finally, reducing product consumption in the household could be related to *sufficiency* (vs. efficiency), but I consider this process would happen gradually, where a slow increase of SE can be considered *reformism* (vs. radicalism). According to Hedenus et al. (2022), these positionings support a *strong view of sustainability*.

Finally, I reflect upon my role as a researcher within a transdisciplinary project: Some perspectives addressed in this thesis were decided in consultation with representatives from local government (see subchapter 3.2.4.), and both Papers 1 and 2 could provide evidence for decision-making at the local government level, while expanding the range of possible choices governance choices. This coincides with the definition by Pielke Jr (2007) of an *honest broker*, who actively integrates scientific knowledge with stakeholder values and policy alternatives. *Honest brokers* differ from scientific roles that disengage from the societal use of their research (*pure scientists*) and that specifically advocate for a course of action (*issue advocates*). They also differ, but overlap, with roles that address very narrow policy questions without explicit involvement in the decision-making process (*science arbiters*).

4. Results

In this chapter, findings are presented for each research question. First, a conceptual diagram on factors that influence the environmental impacts of sharing is introduced (RQ1). Then, more detail is provided regarding consumption reduction factors in the diagram and their relationship with other factors (RQ2). Finally, a summary of the potential to achieve sustainable outcomes is presented, organized by geographical areas, demographic groups, and product groups (RQ3). The potential to share sustainably is based on selected factors from RQs 1 and 2.

4.1. Factors influencing the environmental sustainability of sharing.

In addressing RQ1, I developed a conceptual diagram elucidating and integrating 29 factors that can influence the sustainability outcomes of sharing household products across several impact categories. The factors are applicable to a broad scope of sharing activities, products, platform models, and platform infrastructures. The diagram also integrates factors utilized in top-down (e.g., input-output analyses, material flow accounting) and bottom-up (e.g., life cycle assessment) assessment methodologies, which contributed to capturing factors pre-, during, and post-sharing, as well as contextual and consumer-related (see Figure 5).

As seen in the figure, I highlight in red the factors related to consumers' characteristics and behaviors (12 in total). This perspective is highlighted due to the importance placed on user behavior by the existing literature (Ala-Mantila et al., 2017; Harris et al., 2021; Johnson & Plepys, 2021). The remaining factors (17 in total) are related to the context where sharing occurs, and to other actors throughout the shared products´ lifetime, for example, manufacturers, providers, end-of-life actors, etc.

Details about all factors can be seen in Paper 1. The factors relevant to the thesis, which will be considered when answering RQ3, correspond to the following stages: (2) consumer-related factors, which affect consumer behavior throughout the temporality of sharing, such as demographic characteristics and psychological factors; (3) consumer behavior pre-sharing, namely the replacement rates; (5) factors related to the product provider, including the time frame of the transaction (e.g., access-based vs. ownership transfer) and the number of providers; (6) factors related to the transport provider-consumer during the use-phase, including frequency, mode and distance; (7) factors related to the use phase of the shared product, including the energy and resource use of the product; (8) factors related to supporting activities, namely cleaning and maintenance of the shared products, including use of energy and resources; and (10) consumer behavior post-sharing, namely rebound effects. Note that due to the broad scope of the diagram, the factors are labelled in a way that they could be applicable independently of the product type or sharing activity (e.g., "transaction time frame" might refer to a shorter time for access-based sharing activities, and a longer time for ownership-transfer sharing activities).

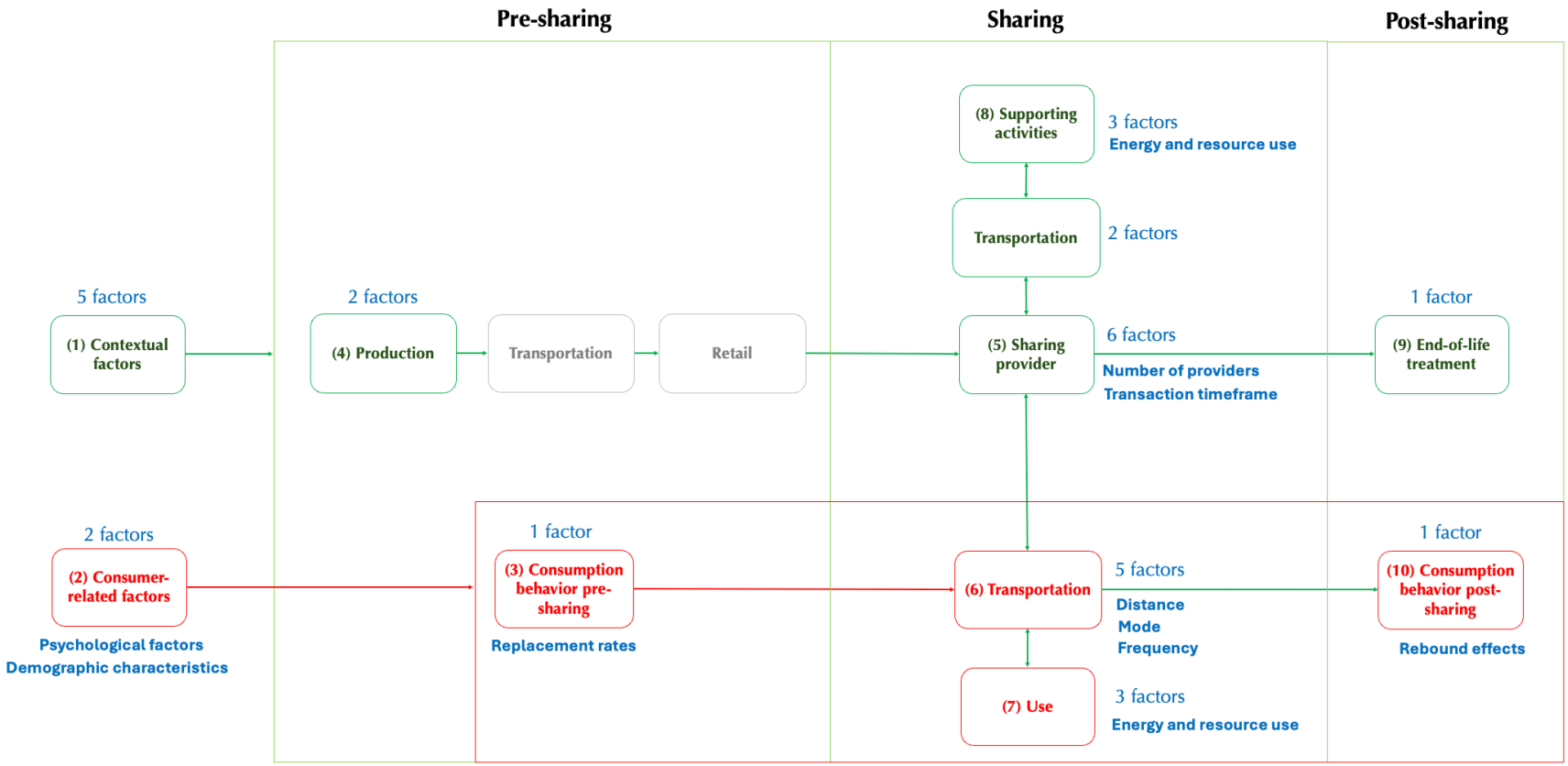

Figure 5 – Simplified conceptual diagram showing the factors that affect the sustainability of sharing household products, adapted from Paper 1. The factors considered in the thesis are in bold blue.

4.2. The role of consumption reduction for the sustainability of sharing

The role of "consumption-reduction" factors is investigated through two objectives. First, the factors that impact net consumption amounts are selected from the conceptual diagram and described; second, the factors that either promote or compete with the consumption-reduction factors are identified.

4.2.1. Consumption-reduction factors

From the conceptual diagram, the factors that can reduce consumption when sharing are the replacement rates, the provider stock, the resource use from supporting services, and the consumer rebounds. The literature review and thematic analysis revealed complementary factors such as the baseline consumption rates, whether sharing originates a new need, as well as system and provider rebounds. In line with the scope of the thesis, three of the consumption-reduction factors related to the user perspective are explained below. More details about the remaining consumption-reduction factors can be seen in Paper 2.

Baseline product consumption

Studies assessing the potential impacts of sharing sometimes consider a baseline consumption, upon which replacement rates are applied. The quantification of the baseline product consumption rates helps understand the magnitude of potential impact savings associated with sharing, but also which products might be relevant for consumption reduction through sharing. Authors emphasize the importance of context-specific data, as different areas might have varying consumption patterns (Behrend, 2020; Kerdlap et al., 2021).

Replacement rates

Replacement rates, otherwise called "substitution" or "displacement" rates, indicate the degree to which sharing replaces the purchase of new products. As such, the replacement of purchases is the base for a potential reduction of environmental impacts in sharing, while non-replacement behavior could lead to increased impacts. Replacement rates are likely to vary according to different aspects, including the product types and the consumer characteristics (Dhanorkar, 2019; Moon, 2024).

Consumer rebound effects

Consumer rebound effects occur when the income saved by accessing shared products is used for the consumption of other purposes, which also carry environmental effects. Consumer rebound purchases are often not within the same product group that was shared. Empirical studies highlight that rebound effects have the power to reduce or completely offset any impact savings associated with sharing. Further, these studies unveil variations on the rebound effects according to the population´s demographic characteristics and psychological factors (Junnila et al., 2018; Ribera Jemio et al., 2024). These rebound effects are congruent with the with indirect (Borenstein, 2015) and environmental rebounds (Goedkoop, 1999) previously noted in literature.

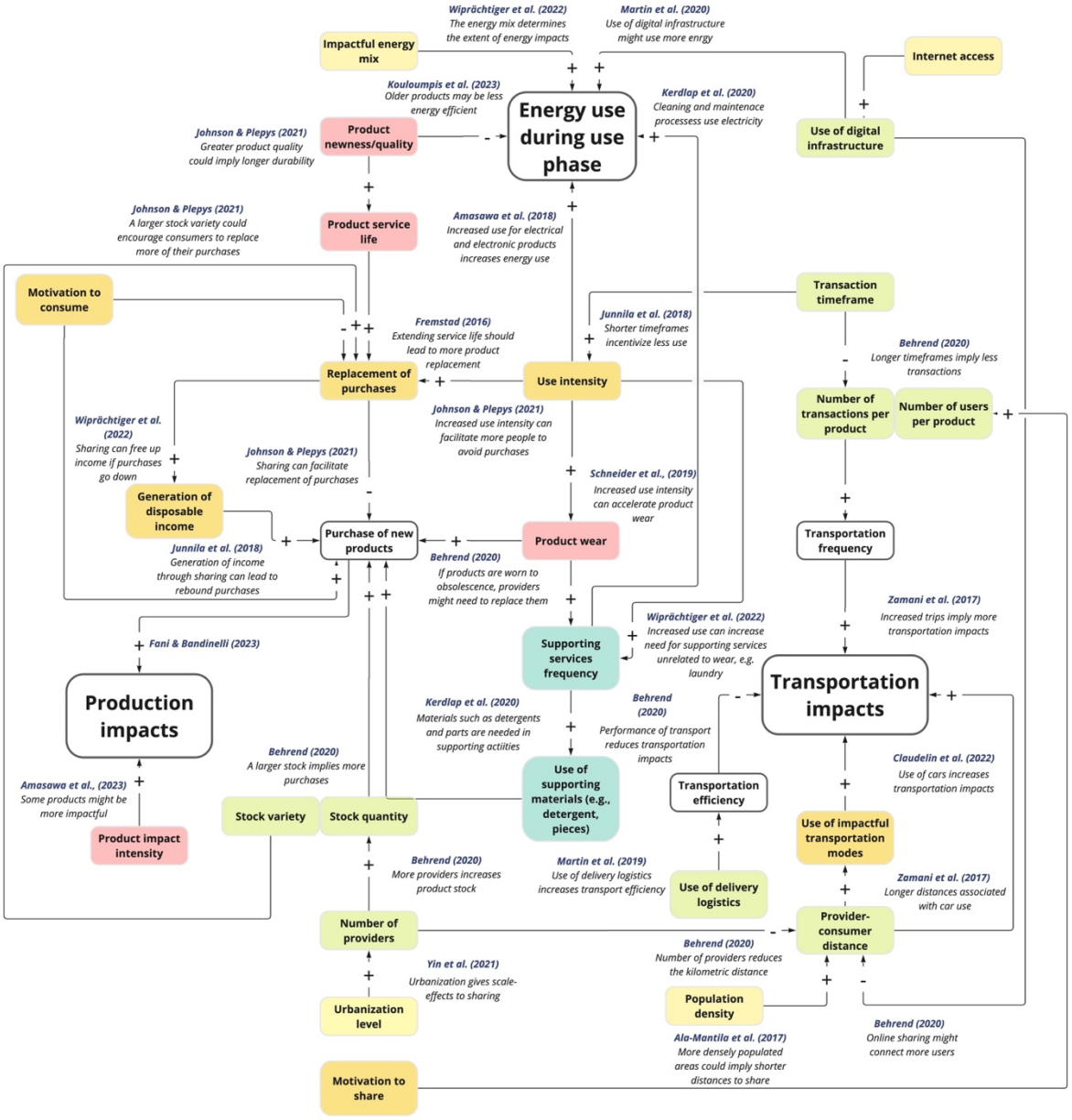

Figure 6 – Causal loop diagram connecting sustainability factors, from Paper 2. The arrows depict whether the increase of a factor increases (+) or decreases (-) another factor. Next to each arrow, there is an explanation of the relationship and an example reference. Factors are colored according to the actors related to them: Orange – Consumer, Green – Provider, Yellow – Context, Blue – Supporting services, Red – Products, White – Several actors. The big boxes represent impacts related to consumption, transportation in the use phase, and energy use in the use phase.

4.2.2. Competing factors

In Figure 6, I adapt the factors from the conceptual diagram in Figure 5 and map their interrelationships through a causal loop diagram. The main finding is that all factors directly or indirectly relate to production impacts, transport impacts, and energy during the use-phase impacts. Focusing on the selected factors in RQ1, the baseline consumption patterns can be either increased (e.g., through rebound effects) or reduced (e.g., through replacement rates), which is influenced by the demographic characteristics and their psychological factors. This translates to increased or reduced production impacts, assuming that production systems are responsive to consumer demand. In the case of reduced production impacts, sharing can still

lead to increased transportation impacts that may compete with the impact savings (depending on, e.g., the transportation distances, the frequency of transport to retrieve and potentially return a product, which is related to the transaction timeframe, and the transportation mode). Sharing may also increase energy use impacts (depending on, e.g., the product characteristics and energy mix of the geographical context) that may compete with the impact savings. Finally, some products and activities might need supporting services, which require resources and energy inputs. If these competing factors increase the impacts during sharing, in comparison to the reduced purchase of new products, then the impact savings from sharing may be reduced or offset.

4.3. Potential for environmentally sustainable outcomes through sharing

In this subchapter is presented a city diagnostic on the potential to achieve sustainable outcomes through sharing in Gothenburg. The potential is represented as the likelihood of reducing baseline consumption, preventing the increase of transport impacts, and minimizing energy use. The results are shown within three perspectives and their respective categories: geographical areas, demographic groups, and product groups. For each perspective, findings are shown for the groups that had the most significant results, shown in bold in Table 1, while the remaining groups are mentioned briefly.

Table 1 - Geographical areas, demographic groups, and product groups studied in the research. The groups with the main findings are marked in bold font and detailed in the thesis.

Geographical areas	Demographic groups	Product groups
Inner City	**Gender** (Men – Women)	**Clothes and shoes**
Outer City	**Age** (Below 65 years – 65 years or more)	**Tools**
Middle City	**Education Level** (Secondary or below – Post secondary)	**Hobby equipment**
	Income (Poor – Low – Middle – High)	Kitchen equipment
	Dwelling type (House – Apartment)	Electric and electronic products
	Household composition (Children – No children) (Number of adults)	Furniture and decoration
		Children´s equipment

4.3.1. Geographical areas

Geographical areas characteristics, such as demographic makeup, existing infrastructure, and urban form, influence interest and behaviors in sharing and, consequently, its environmental sustainability (Hunka & Habibi, 2023; Johnson & Plepys, 2021; Sánchez-Vergara et al., 2021). For this subchapter, the potential to achieve sustainable outcomes is based on the potential to reduce consumption through sharing, and to reduce transportation impacts of sharing (see considered variables in Table 2).

Generally, higher consumption values were spread throughout the city, while ownership and sharing attitudes showed more distinctive geographical patterns. Further, the spatial distribution of SIs was similar for most products and sharing activities, although varying in proportion. For a map of the considered areas, along with general SI accessibility in the city, see Figure 7. For detailed results, see Paper 4.

Table 2 - Variables considered to describe the potential for environmentally sustainable sharing across different geographical areas, and how they have been interpreted in the thesis. All findings for the variables can be seen in Paper 4.

Factors	Variable analyzed	Interpretation
Reducing consumption through sharing	Higher baseline consumption levels	Consumption could be reduced
	Perception of owning too much	Psychological precedent to reduce consumption
	Very positive attitudes to sharing activities	Psychological precedent to share
Reducing transport impacts in sharing	Higher pedestrian and biking accessibility to SIs	Potential for shorter distances and low-impact transportation modes
	Higher local street network integration	Likelihood of pedestrian activity
	Type of activities offered by SIs	Ownership transfer activities and repair: Potentially lower transport frequency Access-based activities: Potentially increased transport frequency

Inner city

Inner-city neighborhoods had higher consumption levels for all products except tools, while the only product with higher ownership perceptions was clothes. Inner-city neighborhoods also had the most positive attitudes toward access-based sharing activities. Therefore, there are high levels of consumption to be reduced in the inner city and interest in several sharing activities, but it is not clear that sharing would be associated with reduced consumption besides clothes.

In addition, all products and sharing activities in the study had corresponding SIs with high pedestrian accessibility (0.5 km or less). This, combined with highly integrated street networks, indicates a likelihood of pedestrian activity in these areas. Kitchen equipment and access-based SIs had slightly higher, but still accessible distances (3 km or less), though this is likely related to limitations in the study data source (see Paper 4). This means that there are good conditions in the inner city for sharing with low-impact transportation. Still, the variety of second-hand activities present the opportunity to reduce trip frequency, but the positive attitudes toward access-based activities might increase it (e.g., collecting a second-hand product once, versus travelling frequently to collect and return rented products).

Outer city

Outer-city neighborhoods had higher levels of consumption and ownership perceptions for all products except furniture and electronics. Tool consumption and ownership perceptions, and children's equipment ownership were especially concentrated in the outer city, likely because of its demographic makeup (Göteborgs Stad, 2022). Thus, the outer city has good potential for reducing consumption through sharing for the given products.

However, SI accessibility was limited, with only city libraries present. Additionally, the local integration levels were generally not high. Therefore, sharing in the outer city has lower potential for low-impact transportation, except for products offered in libraries (e.g., books)

and in locations with middle-high local integration (i.e., local centers, see Appendix Figure 4.U. - Paper 4). Nonetheless, the most positive attitudes toward second-hand and repair activities were also here, so households who share in these areas may not need to travel frequently to share, as opposed to access-based activities. Thus, there is potential for users to reduce the higher levels of consumption through sharing activities that require relatively few trips, but the lack of corresponding SIs might imply longer transportation distances and more impactful transportation modes.

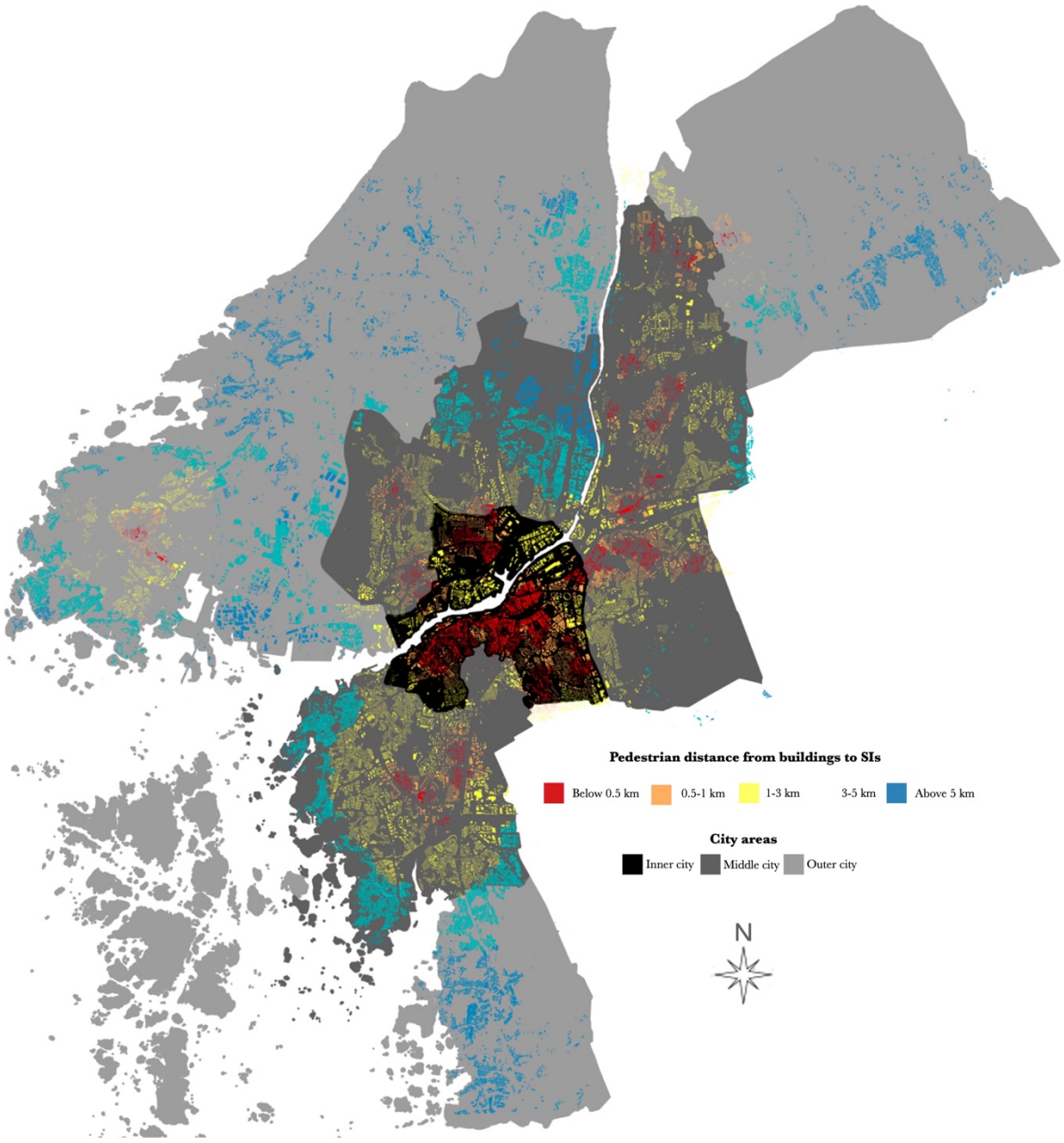

Figure 7 - Gothenburg functional division areas marked in black (inner city), medium gray (middle city) and light gray (outer city). The figure also includes accessibility distances from all buildings in the city toward all SIs within the study sample, marked in red (0.5 km or less, preferable for walking), orange (0.5-1 km, preferable for biking), yellow (1-3 km, suitable for biking), teal (3-5 km), and blue (above 5 km, driving distance). Image adapted from Paper 4.

Other areas

Large variations were seen for the middle-city divisions. Two of the middle city divisions in the North of the city share consumption and sharing characteristics with the inner city but have lower SI accessibility; one of the divisions did not have higher values in any of the considered variables; and the Southern middle-city division was similar to the outer city, but with high local network integration

4.3.2. Demographic groups

Demographic characteristics can be associated with attitudes and behaviors that influence the sustainability outcomes of sharing, such as a propensity to engage in rebound consumption (Junnila et al., 2018; Ottelin et al., 2020). For this subchapter, the potential to achieve sustainable outcomes is based on the general potential to reduce consumption through sharing, and to reduce transportation impacts of sharing in geographical areas where the demographic groups are prevalent (see considered variables in Table 3, and population statistics in Appendix Table 1.A. – Paper 4).

Generally, individual characteristics had more statistically significant associations with reducing consumption and increasing sharing than household characteristics (Jiménez Encarnación et al., 2024). Furthermore, some characteristics were statistically significant for sharing interest, but almost none was significant for sharing participation. This is likely related to data source limitations but could also indicate attitude-behavior gaps for the groups that present interest in sharing. Finally, some demographic groups were evenly spread throughout the city, while others presented clearer patterns. See summarized demographic results in Figure 8. For details, see Papers 3 and 4.

Table 3 - Variables considered to describe the potential for environmentally sustainable sharing across different demographic groups. The table explains how they have been interpreted in the thesis. Detailed findings for the variables representing the potential of reducing consumption are in Paper 3, and for reducing transport impacts in Paper 4. Note that gender was excluded from the baseline consumption calculations.

Factors	Variable	Interpretation
Reducing consumption through sharing	Higher baseline consumption levels	Consumption could be reduced
	Perception of owning too much	Psychological precedent to reduce consumption
	Very positive attitudes toward reducing consumption	Psychological precedent to reduce consumption
	Very positive attitudes to sharing activities	Psychological precedent to share
Reducing transport impacts in sharing	Higher pedestrian and biking accessibility to SIs in relevant areas	Potential for shorter transportation distances and low-impact transportation modes
	Higher local street network integration in relevant areas	Likelihood of pedestrian activity
	Type of activities offered by SIs in relevant areas	Ownership transfer activities and repair: Potentially lower transport frequency Access-based activities: Potentially increased transport frequency

Gender

Men were less likely than women to want to reduce their consumption through sharing, with significantly negative associations to all variables studied. When considering the demographic distribution of Gothenburg, the percentages of men and women were very similar throughout the city, indicating that opportunities for any particular gender to share sustainably depend on where they are located. For example, the middle-city neighborhood with the largest proportion of men (55%) has good accessibility for SIs related to several products. This means that, although men were less likely to reduce consumption through sharing, they have the opportunity to do so with lower transportation impacts. Similarly, some inner-city neighborhoods with the largest proportion of women (55%) also had high SI accessibility, and especially for SIs offering second-hand shopping. This provides women in these areas, who are likelier to substitute consumption by sharing, the opportunity to do so within short distances, through low-impact transportation modes, and with a reduced number of trips.

Age

As age increases, consumption is likely to be reduced, but sharing becomes less attractive. Additionally, individuals with 65 years of age or older (i.e., 65+) were less likely to act as peer-providers despite potentially having larger product stocks at home that could be shared. In Gothenburg, the largest proportion of 65+ individuals (26%) was seen in a middle city neighborhood with SI accessibility similar to the outer city. This means that for those 65+ populations, there is a lower potential to reduce consumption through sharing, and to so with lower transport impacts. Nonetheless, if these groups decided to share, they would have a lower likelihood of increasing consumption through sharing as their asset accumulation phase has passed (Gourinchas & Parker, 2002). At the same time, these groups may not be a relevant target to act as consumers in the SE, rather to act as providers by offering their product stock.

Conversely, some middle-city neighborhoods, which had the highest proportions of individuals below 65 years of age (82%), also share characteristics with the inner city. Thus, these younger populations who are positive toward sharing have opportunities to do so with lower transportation impacts. These groups, however, are less likely to reduce their consumption even if they engage in sharing.

Education level

The potential for replacing consumption with sharing increased alongside education levels, due to a high perception of ownership and positive attitudes toward sharing. Education levels also showed the largest variations throughout the city among the demographic groups considered. The lowest educational levels were seen in a neighborhood in the northern middle-city (24%), with varying SI accessibility depending on the product. The highest levels were in the inner city (63%), so highly educated groups in this city division have the potential to engage in sustainable sharing with reduced consumption and lower transportation impacts.

Other demographic characteristics

Other demographic characteristics only presented statistical significance for either consumption or sharing variables. For example, high-income takers were more likely to consume more than their counterparts, contrary to house-dwellers, while both groups had higher concentrations in the outer city. Two-adult households, with higher concentrations in the outer city were likely to have more positive attitudes toward sharing. Households with one child, prevalent in the inner city, were likely to have more positive attitudes toward

access-based sharing. The interplay of these characteristics with the city's demographic makeup is reflected in the geospatial results in Paper 4.

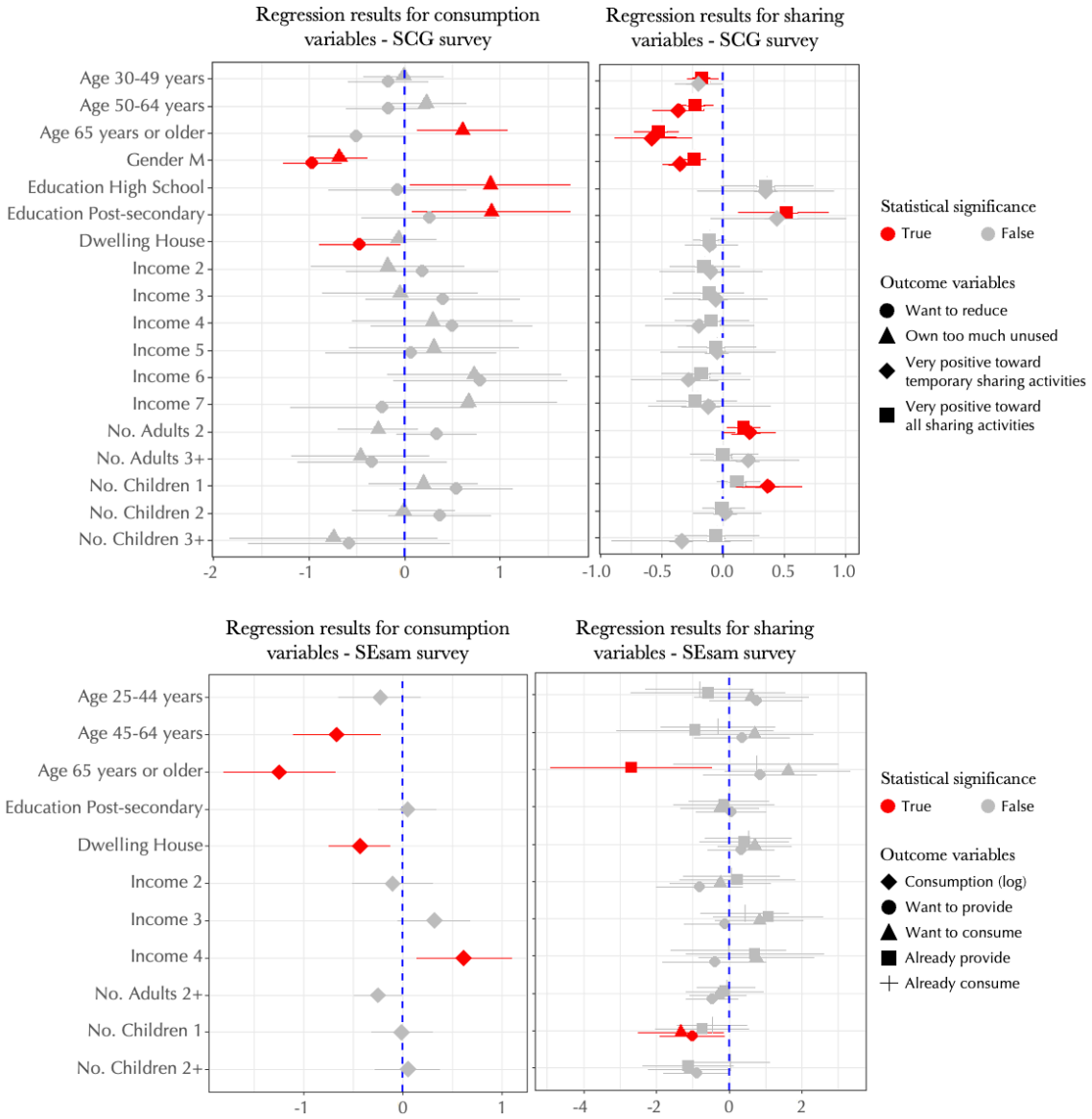

Figure 8 – Results from the statistical analyses from the demographic perspective, adapted from Jiménez Encarnación et al. (2024).

Top left: Regression results for SCG outcome variables associated with attitudes towards own product stock and towards reducing consumption. N = 802-829 depending on outcome variable. Top right: Regression results for SCG outcome variables related to attitude towards sharing activities. N = 829 depending on outcome variable. Bottom left: Regression results for the SEsam outcome variables associated with product consumption during past year. N = 188-271 depending on outcome variable. Bottom right: Logistic regression results for outcome variables regarding current and desired engagement with SE. N = 188-211 depending on outcome variable. Each symbol represents a different outcome, the location of the symbol is the point estimate of the coefficient, and the bars represent the 95% confidence interval of the estimate. Symbols and bars in red are statistically significant at an α = 0.05 level. Note that log (Consumption) is a continuous outcome while the others are binary.

4.3.3. Product groups

The product type is a determining factor for the environmental impacts of consumption due to differences in production impacts, and utilization of energy and resources during the use phase (Martin et al., 2019). Additionally, the product group influences users' interest in sharing (Gullstrand Edbring et al., 2016; Hansmann & Binder, 2023). Here, I describe the potential to share sustainably by considering the potential to reduce consumption through sharing in general and in selected city areas, as well as the potential to reduce transportation and energy use impacts (see considered variables in Table 4).

Generally, the city-level product ownership perceptions, the neighborhood-level baseline product consumption patterns, and the SI spatial distribution were similar independently of product group, with some exceptions explained below. The most significant differences between products were seen for the city-level baseline consumption and interest in sharing. See the city-level results for each product in Figure 9, and how these results manifest throughout Gothenburg´s neighborhoods in Figure 10. For details, see Papers 3 and 4.

Table 4 - Variables considered to describe the potential for environmentally sustainable sharing across different product groups, and how they have been interpreted in the thesis. The table also includes the paper that details the findings for each variable.

Factors	Variable	Detailed findings	Interpretation
Reducing consumption impacts through sharing	Higher baseline consumption levels	Paper 3 (city-level) Paper 4 (neighborhood-level)	Consumption could be reduced
	Perception of owning too much	Paper 3 (city-level) Paper 4 (neighborhood-level)	Psychological precedent to reduce consumption
	Want to share (consumer role) Want to share (provider role) Already share (consumer role) Already share (provider role)	Paper 3	Psychological precedent to share
Reducing transport impacts in sharing	Higher pedestrian and biking accessibility to SIs	Paper 4	Potential for shorter distances and low-impact transportation modes
	Type of activities offered by SIs in relevant areas	Paper 4	Ownership transfer activities and repair: Potentially lower transport frequency Access-based activities: Potentially increased transport frequency
Reducing energy and resource use in sharing	Type of activities offered by SIs in relevant areas	Paper 4	Ownership transfer activities and repair: Potentially lower supporting services Access-based activities: Potentially increased supporting services
	Product type	-	Electric and electronic products might increase electricity use

Clothes and shoes

Clothes had the highest levels of consumption in Gothenburg and the highest perception of ownership, especially in the inner city. However, they were among the least interesting products for sharing from the consumer role. This indicates a lower likelihood to replace consumption by sharing, rather a tendency to provide.

Generally, the neighborhoods with higher clothes consumption and ownership also had high accessibility to SIs. This indicates good possibilities to share with low transportation impacts. Additionally, the predominance of second-hand SIs for clothes (see Appendix Table 2.C – Paper 4) might prevent the repeated trips and additional impacts related to laundry in access-based activities. This means that in key areas, there are the possibilities to share clothes with lower transportation and use phase impacts. However, the likelihood that clothes sharing would lead to reduced consumption is lower.

Tools

Tools displayed the highest interest and participation in sharing, independently of the user role, and had the most significant attitude-behavior gaps, indicating further potential to increase sharing.

Considering the overall low consumption and ownership of tools at the city-level, these variables presented higher values in the outer city. The poor accessibility of tool SIs in these areas might contribute to the attitude-behavior gaps and may also contribute to sharing with more impactful transportation. Additionally, tool-sharing in Gothenburg shows a greater variety of sharing activities than other products (see Paper 4 - Appendix Table 2.C), which means that tools may be shared either through activities that require additional trips, or not. The tool product group includes both electric and non-electric tools, so the potential for increased energy use depends on the specific product and activity, although Sweden´s electricity mix has comparatively low impacts (Martin et al., 2021).

This means that there is good potential to replace tool consumption by sharing, but areas where this is relevant may not facilitate shorter transportation distances or use of low-impact transportation modes. Additional impacts will depend on whether the SI activity implies more frequent trips, involves supporting activities, and on the tool type.

Hobby equipment

Hobby equipment had a similar profile to tools regarding the interest to engage in sharing, albeit with a higher baseline consumption. Thus, there is potential to share hobby equipment, although it is unclear if this may imply replacement behavior. Geospatially, hobby equipment SIs were the most accessible throughout the city, but this refers mainly to city libraries. When libraries are removed from the SI sample, the accessibility in outer-city neighborhoods, which displayed higher values in consumption and ownership, is considerably reduced. Additionally, hobby equipment SIs present a variety of activities, so frequency of trips and supporting activity impacts depend on the chosen activity. The category excludes electrical products, thus eliminating the risk of increased energy impacts from sharing.

This implies that there is interest to share hobby equipment, but it is unclear whether this would generally imply lower consumption. Additionally, when city libraries are excluded, there is a lower potential to engage in low-impact transportation for sharing. The impact of additional

trips and supporting services will depend on the SI activity, while energy use impacts will not increase.

Other products

Less pronounced trends were seen for the product groups of electronics, furniture, and kitchen and children's equipment:

Electronics present city-level results similar to clothes, but in lower proportions. Geospatially, the profile is similar to hobby equipment in their high SI accessibility due to the city libraries, which might be lower when these are removed from the sample. Additionally, they may be vulnerable to increased energy use and supporting services impacts.
Kitchen equipment also presented results similar to clothes, though with lower consumption values. The higher ownership levels and higher values for the providing role point toward a higher interest in sharing as a peer-provider rather than in reducing consumption. Unlike clothes, the geospatial analyses indicate that the accessibility to kitchen equipment SIs might be limited, but this is probably related to data source limitations.

Children´s equipment presented relatively lower values in all variables considered. Higher ownership of this product group is concentrated in the outer city, which, according to our sample, has poor SI accessibility.

Furniture and decoration also presented lower values in the variables considered while showing slightly higher values for the providing role. The geospatial profile showed more accessibility in the inner city, but pedestrian and biking distances may only be relevant for decoration, as furniture tends to be bulky and hard to carry.

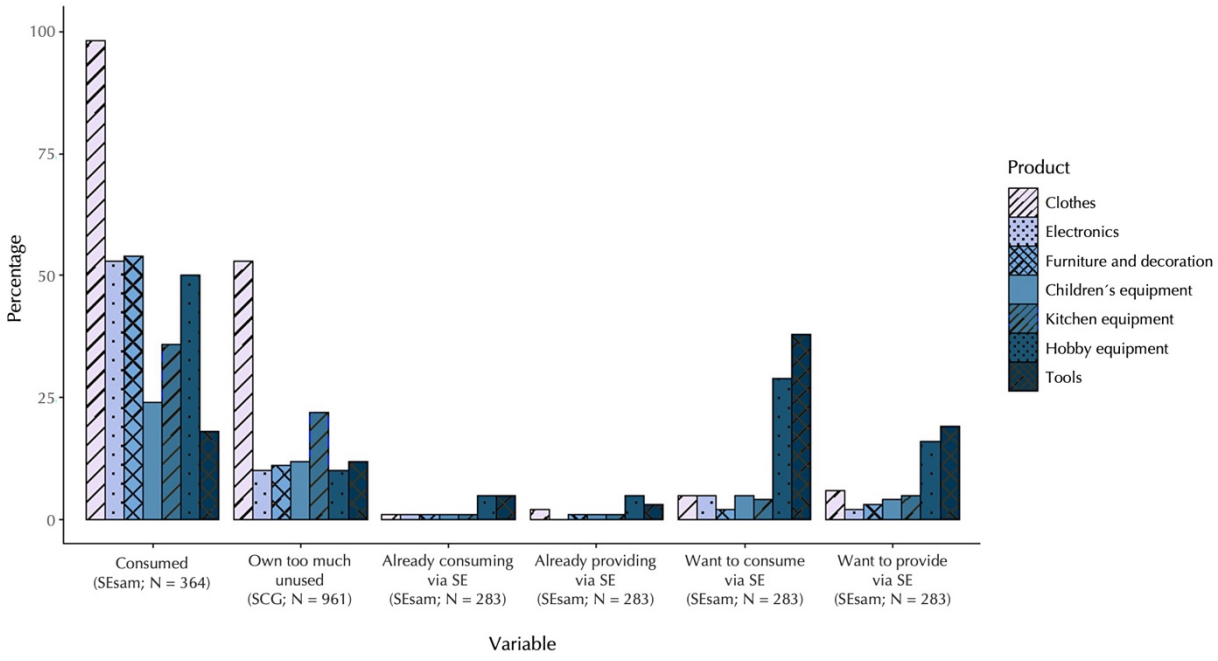

Figure 9 – Variables related to substituting consumption with sharing, adapted from Jiménez Encarnación et al. (2024).

Note the mixture of variables from the SEsam and SCG datasets and the changing sample sizes. The bar chart depicts the product groups of clothes [12 product types], electronics [11 product types], furniture and decoration [5 product types], children's equipment [11 product types], kitchen equipment [8 product types], hobby equipment [10 product types] and tools [3 product types].

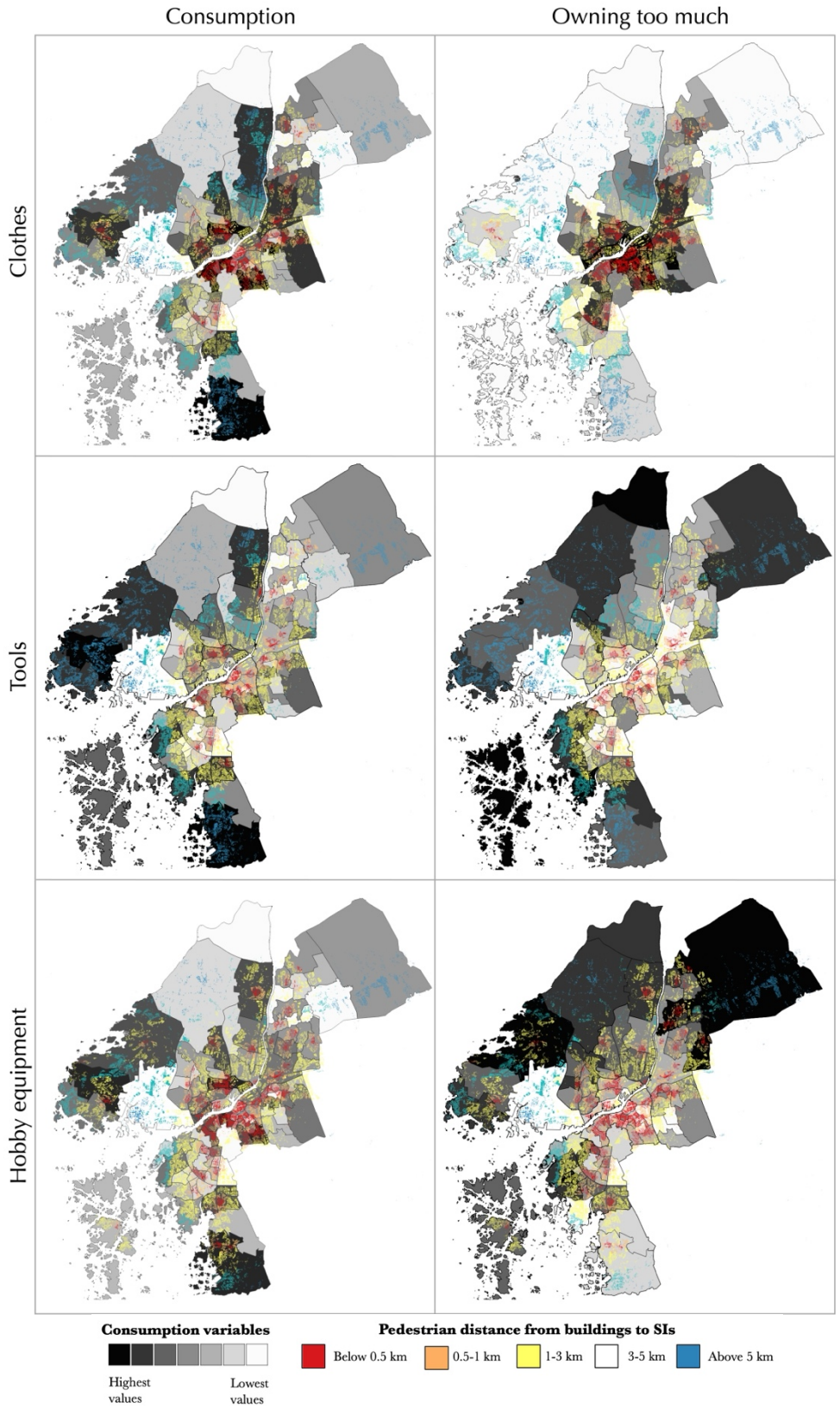

Figure 10 - Geographic results for clothes, hobby equipment, and tools, adapted from Paper 4. Overlay of consumption reduction factors (neighborhood layer) and accessibility of SIs (building layer) for sharing. The neighborhood color scale represents the result hierarchy, from highest (Black) to lowest values (White). The building layer color scale represents the distance to the nearest SI, from shortest (Red) to longest (Blue) distances. Results are shown for the variables of baseline consumption (left) and owning too much (right), including the product groups of clothes (top), tools (middle), and hobby equipment (bottom). Note that the results from the neighborhood layer are based on an extrapolation from national and city level data.

5. Discussion

In this chapter, I discuss the findings considering the extant literature. Further, I delineate my academic contributions, reflect upon the research process, explain the thesis's limitations, and suggest future research.

The research presented in this thesis was based on the following premises: First, high-income contexts are important targets for reducing environmental impacts at the household level. Household consumption related to housing, transportation, and food has garnered attention in the governance and academic sphere, but tangible and durable household products have been studied to a lesser extent. At the same time, the impacts of household products are more important in these high-income contexts than in their counterparts. Additionally, while the SE has been proposed for enabling environmental sustainability, the academic discourse has started questioning the certainty of a "sustainable SE". Within the field, there is a gap for sustainability studies, especially for household products.

Consequently, this thesis set out to advance knowledge on the environmental sustainability potential of sharing, with a focus on tangible and durable household products. The aim was addressed through three research questions. The first two questions, (1) "What factors influence whether sharing household products is more environmentally sustainable than purchasing new products?", and (2) "In which ways can consumption reduction play a role in the environmental sustainability of sharing household products?", were addressed qualitatively. The third question, (3) "What is the potential of different geographic areas, demographic groups, and product groups, to achieve sustainable outcomes through sharing?" was approached quantitatively and resulted in a city diagnostic of Gothenburg, Sweden. Below, I discuss how the thesis contributes to addressing the RQs:

5.1. What factors influence whether sharing household products is more environmentally sustainable than purchasing new ones?

The research led to compiling 29 factors that can influence the environmental sustainability of sharing household products, as measured or discussed by quantitative environmental assessments. Throughout the research process, it was observed that the consideration of factors throughout the study sample was uneven. For example, some studies considered only one factor (e.g., use intensity, Tahara et al., 2018), while others mentioned and/or measured factors throughout all relevant life-cycle stages (e.g., Johnson & Plepys, 2021). In comparison to the latter, my findings added factors such as the quality of the shared product at the time of the transaction (Moon, 2024; Wiprächtiger et al., 2022). Other comprehensive research studied the crucial aspects of replacement rates and rebound effects, but did not discuss the potential impacts related to the provider side and the user transport (Ribera Jemio et al., 2024). While it is not reasonable for each research study to assess all factors possible, the current unevenness supports the narrative that the sustainability potential of the SE is still not fully understood (Mont et al., 2020). This is further reinforced by the types of sharing studied in the sample, where the most common where sharing of clothes in B2C platforms, and online access-based sharing. Therefore, it is necessary to generate more research regarding other products, activities, platform types and infrastructures to fully capture the sustainability potential of sharing household products.

Similar to my research, other reviews and methodological papers aimed to understand the sustainability potential of sharing and which factors might be involved, but within narrower scopes. For instance, Pohl et al. (2019) focused on how user behavior affects LCA results, and also remarked the product use intensity and consumption of additional materials and energy. Within their behavior-related factors, they include induction and spillover effects, which I did not capture in Paper 1 but are partially reflected in Paper 2. Another study focuses on digital sharing for a broad scope of assets, also noting the importance of both consumer and provider factors (Meshulam et al., 2024). The study makes recommendations about a broad set of factors (e.g., stock characteristics, product service life, supporting activities, consumers' psychological motivations, use intensity, provider-consumer transport) that overlap with my conceptual diagram. This suggests that the diagram may be applicable to assets such as accommodation and mobility, though with varying importance for specific factors (e.g., use-phase factors might be more important for mobility than for household products). Finally, a study focusing on input-output assessments of car sharing recommends generating data on the time availability of users, which can determine their participation rates (Plepys & Singh, 2019). While my results did not capture this due to the exclusion of factors affecting sharing motivations, it highlights that consumers´ motivation and participation ultimately have a determining role in the potential sustainability of sharing.

5.2. In which ways does consumption reduction play a role in the environmental sustainability of sharing?

The factors directly related to consumption reduction are the baseline consumption rates, the replacement rates, the provider stock, whether sharing originates a new need, and diverse types of rebound effects. Here, the study sample also showed various degrees of inclusion of consumption factors, which can be seen in Paper 2 - Table 1. While some studies entirely overlooked certain factors, others excluded them from the quantitative analysis and considered them as an important limitation. Systemic rebounds related to the production systems (Ottelin et al., 2020), as well as provider stock and rebounds (Behrend, 2020), were the least commonly addressed consumption factors. The latter is remarkable, as the product providing stage had the most sustainability factors in the conceptual diagram, as well as considering the dominance of the business perspective in the SE field (Laurenti et al., 2019). Crucial factors, such as replacement rates, are often assigned assumed values that the authors of the studies themselves consider unrealistic (Claudelin et al., 2022; Kerdlap et al., 2021). Consumer rebound effects were the most acknowledged limitation in quantitative environmental assessments of sharing (Amasawa et al., 2023; Amasawa et al., 2020; Claudelin et al., 2022), but were also often studied empirically (Harris et al., 2021; Junnila et al., 2018; Ottelin et al., 2020; Ribera Jemio et al., 2024). Despite the lack of inclusion of other consumption-related factors, the relatively common empirical study of rebound effects demonstrates an advancement in the field, given initial worries about its poor understanding (Frenken & Schor, 2017).

A main finding is that all sustainability factors directly or indirectly relate to production impacts, transport impacts, and energy during the use-phase impacts. If the competing factors increase during sharing, in comparison to consumption-reduction factors, then the impact-savings from sharing may be reduced or offset. Many other authors agree that transport impacts compete with the production impact savings (e.g., Sandin & Peters, 2018), and energy-use impacts are otherwise acknowledged by studies on products that use electricity. For this part, the CLD in my study contributes to these arguments by clearly articulating how sustainability factors throughout the temporality of sharing connect to one or several of the impact types, and

how tensions might arise from these interactions (e.g., use intensity might increase product replacement but increase transport and energy-use).

Finally, my results categorize factors into pre-, during, and post-sharing, contextual and consumer-related themes, as well as according to the influence of different stakeholders. Considering the crucial role of consumption-reduction factors for the sustainability of the sharing, the location of these factors along a contextual and temporal scale, as well as throughout different loci of responsibility, supports the belief that the SE is complex (Gurău & Ranchhod, 2020), that its sustainability requires the coordinated action of several different stakeholders (Ma 2018), and that studies need to integrate a variety of life-cycle stages and corresponding data to make proper environmental assessments.

5.3. What is the potential to achieve sustainable outcomes through sharing? A city diagnostic from three perspectives

5.3.1. Geographic perspective

My findings assessed the potential to share sustainability in different areas of Gothenburg, based on neighborhood-level results. Since no other studies have done this with a high degree of geospatial granularity, comparisons can be made based on the specific variables considered (i.e., consumption amounts, the sharing consumer attitudes and interests, and the pedestrian accessibility of SIs).

Generally, the findings revealed similar geospatial consumption patterns for all household products, with high values spread throughout the city. The former is corroborated by a study with a similar methodology that used 44 highly-specific household profiles (Dawkins et al., 2024), unlike the emissions results for other consumption categories. It is thus possible that relatively uniform levels of disposable income in Sweden lead to such consumption patterns, over the influence of other demographic characteristics (Eurostat, 2025). Conversely, the attitudes regarding consumption and sharing presented more distinct geospatial patterns, which may mean that attitudes are more influenced by other demographic characteristics than the consumption behavior. Furthermore, this difference in patterns may be a representation of the areas with the highest attitude-behavior gaps (e.g., where attitudes vary throughout the city divisions, but the consumption does not), or of "ineffective" sharing that does not accomplish a consumption reduction (e.g., sustainable consumption behaviors are adopted, but cancelled out through non-replacement or rebound effects), which should be further investigated.

On this topic, inner-city neighborhoods had more positive attitudes toward access-based sharing activities than other areas. The interest in temporary transactions in these neighborhoods could be supported by a higher population density, which makes it easier to find providers and to access and return items (Affolderbach & de Chardon, 2021). However, the preference for access-based sharing activities poses the risk of increased transport impacts. Although my results suggest that the inner city has good opportunities for sharing with sustainable transport forms, the degree of adoption of such habits is unknown. Otherwise, a noteworthy result in the inner city was the higher levels of clothes ownership. The variable comes from the survey question "In what area do you own too many products that you do not use?", which has a negative connotation. I therefore interpret this as a precedent for either reducing clothes consumption or providing clothes in sharing. Further, areas with higher

population densities (e.g., city centers) have been related to more positive attitudes toward clothes sharing (Herold & Prokop, 2023). A possibly higher interest in clothes sharing in the center, in combination with a potential consumption reduction, implies more potential for sustainable clothes sharing than in the rest of the city. Nonetheless, it is also possible that the ownership variable might instead indicate a pattern of continued consumption despite the lack of use, which could also lead to non-replacement and rebound effects.

Outer-city neighborhoods had limited availability of SIs. Similar results have been seen for mobility and task sharing in suburban areas, where geographical biases made sharing more expensive and less available (Thebault-Spieker et al., 2017). While the scope of that study is limited to P2P sharing of tasks and mobility, certain concepts might be applicable to the sharing of household products, such as the impact of population density on the availability of sharing providers. Coll-Martínez and Méndez-Ortega (2023) also found a greater agglomeration and co-agglomeration of shared co-working spaces in central areas of Barcelona, unlike outskirt areas. For my results, it is also possible that co-agglomeration effects (i.e., closeness of shared spaces to other types of services) reduce the amount of SIs in the outer city, given the generally lower availability of shops and services. Thus, the potential to share sustainably in these areas hinges on people´s transportation choices regarding mode and transport efficiency (i.e., using logistic services or combining trips). Appendix Figure 4.W. – Paper 4 included a brief assessment of possibilities to share using public transportation, but the actual transport mode choices and transport efficiency of sharers in these areas are unknown. Otherwise, the outer-city neighborhoods might have higher levels of intra-household sharing (Ala-Mantila et al., 2017), especially for products that do not subscribe to personal preference such as tools.

5.3.2. Demographic perspective

Individual characteristics, particularly age, gender, and education level, were more relevant for the potential to share sustainably. Various studies conducted in North America and Europe also found that women, younger individuals, and those with higher levels of education were more inclined to share (Böcker & Meelen, 2017; Buda et al., 2020; Jelinkova et al., 2021; Lindblom & Lindblom, 2017). This suggests that the demographic results related to sharing have a wider applicability in the Global North. Otherwise, some small differences were seen between the results of these studies and mine. For instance, several identified age as having the strongest effects on the considered variables, while gender did in my results. Additionally, some studies found positive attitudes and intentions to share in higher-income groups, including in Sweden (e.g., Hansmann & Binder, 2023). The reason for this difference is unclear and may be linked to the geographical scope of the surveys (i.e., national vs. city-level). However, these studies rarely assessed the potential to reduce consumption in conjunction with sharing, as I did in my research. One relevant study found that younger and highly educated groups in Finland had both positive attitudes toward sharing and reducing consumption, though women were only associated with sharing behavior (Lindblom & Lindblom, 2017). These de-ownership intentions were not seen in my results, while sharing participation was not measured for gender. Except for that, the positive attitudes in younger groups were congruent with my results.

While the former discussion mostly refers to attitudes and intentions, the behavioral results showed that as age increases, people were more likely to reduce their consumption. Other studies indicate that women, younger individuals, and highly educated individuals made additional purchases despite having greater engagement with sharing activities (Ottelin et al., 2020). This suggests non-replacement and/or rebound behaviors for groups that are otherwise

motivated to share. Yet, a large-scale study found that high education levels, in combination with sharing behavior and urbanization, had overall positive environmental effects (Yin et al., 2021). It is thus possible that in this type of setting, rebound effects might not be enough to cancel out other environmental benefits of sharing and/or other sustainability measures. These results underline the differences between attitudes, intentions, and behaviors, where many groups may not fulfill their potential for sustainable sharing due to a lack of knowledge on replacement rates and rebound effects. Particularly, Junnila et al. (2018), Ottelin et al. (2020) and Ribera Jemio et al. (2024) explored the relationships between growing income and rebound effects, which is important given the attitudes toward sharing for high-income groups in other contexts.

My findings also considered the different demographic groups' possibilities to share at accessible distances, according to their distribution throughout Gothenburg. Gathering data on behaviors is crucial, considering that potential might differ from actual behaviors. However, information about travelling patterns according to demographic characteristics in Gothenburg is limited. In Swedish national statistics, men and women engaged in foot, bicycle, and public transportation in similar proportions, while women traveled by car less than men (Transport Analysis, 2021). While specific travelling patterns varied according to age, all groups traveled much more by car than by other means. Although it is unclear how well these statistics reflect Gothenburg´s travelling patterns, this pattern could compromise the potential to share sustainably. Otherwise, research from 2021 in Sweden indicates that environmental motivations and network accessibility influence people to walk and bike more (Ek et al., 2021). This suggests that the potential to share sustainably may be more fulfilled by groups who live in areas with high local integration (e.g., inner city and some parts of the middle city, see Appendix Figure 4.U. – Paper 4) and also have environmental motivations for sharing (e.g., women and highly educated individuals, Ertz et al., 2017; Jelinkova et al., 2021).

5.3.3. Product perspective

Clothes, tools, and hobby equipment had the most important results for the potential to share sustainably, with different profiles for each. Coincidentally, these were also among the products with the most environmental assessments in the sample for Paper 1, meaning that their sustainability potential has also garnered attention in the academic field.

In my findings, clothes were consumed in high amounts, but there was little potential to share as a consumer, implying a low chance of purchase replacement. The extant literature coincides in several ways. Clothes sharing may face barriers regarding hygiene due to being a textile-based product used close to the body (Gullstrand Edbring et al., 2016; Hazée et al., 2019), and may experience lower acceptability for sharing in some contexts (Laurenti & Acuña, 2020; Moon, 2024). Besides, they are significantly vulnerable to lower replacement rates due to being an “insatiable” consumer demand, especially in high-income countries (Wiprächtiger et al., 2022). The replacement rates vary according to the users´ profiles, where user types with the highest replacement rates are the minority amongst sharers (Johnson & Plepys, 2021). From the few studies comparing the environmental impacts of clothes sharing with other products, it was seen that clothes sharing only reduced 15% of environmental impacts compared to purchasing, whereas furniture sharing reduced impacts by 70% (Wiprächtiger et al., 2022). The abundance of clothes SIs in Gothenburg presents potential for impact savings, but the user´s internal factors suggest that they might not fulfill this potential.

Tools had higher levels of interest for sharing, with generally lower consumption and ownership levels. Extant literature also indicates good acceptability for tools sharing, independently of the transaction price and the user role (Böcker & Meelen, 2017; Gullstrand Edbring et al., 2016; Ribera Jemio et al., 2024). In comparison to clothes, sharing tools might be favored due to being a "satiable" demand and presenting fewer concerns related to hygiene. Additionally, results for university students showed high participation in tools sharing, suggesting that the life stage of users might influence tool sharing use (Ribera Jemio et al., 2024). Otherwise, some studies with data collected from SIs saw that tools had a medium to low number of transactions, probably because they are used sparsely (Claudelin et al., 2022; Martin et al., 2019). This, combined with their relatively lower production impacts, results in modest impact savings through sharing which are vulnerable to the replacement rates (Martin et al., 2019; Schneider et al., 2019). While I saw replacement potential as unclear besides the outer city; in access-based activities the most important factor seems to be transport (Martin et al., 2021). This makes the location of SIs essential, while my results show little accessibility in key areas, reducing the potential to share tools with lower transportation impacts. Additionally, Ribera Jemio et al. (2024) found that tools sharing contributed to rebound effects.

Hobby equipment results resembled tools, with better attitudes toward sharing and lower consumption levels. While this product group was commonly addressed by literature, comparability is difficult due to the heterogeneity of the specific products. Regarding sharing interest, Swedish university students had moderate interest in consuming and providing shared hobby equipment (Laurenti & Acuña, 2020), while Hansmann and Binder (2023) found more participation in providing them. Others saw that the number of transactions varied greatly according to the specific product, with some being very used (e.g., ski gear, camping tent, hiking backpack) while others barely (e.g., tennis racket) (Claudelin et al., 2022; Martin et al., 2019; Ribera Jemio et al., 2024). In general, hobby equipment saved average to low levels of carbon emissions through sharing due to their lower production impacts, but products like barbecue grills had amongst the highest water, air and land impacts compared to other products (Amasawa et al., 2020; Claudelin et al., 2022; Martin et al., 2019; Schneider et al., 2019). Depending on the production impacts and the sharing activity, transport impacts might be determining (Amasawa et al., 2020; Martin et al., 2019). This highlights the issue with the possibly lower accessibility to hobby equipment SIs throughout Gothenburg.

5.4. Academic contributions

The continued growth of the SE field is needed to understand and support what a sustainable SE entails (Mont et al., 2020). This thesis has expanded the knowledge on the sustainability potential of sharing tangible, durable/semi-durable household products, an area that has been overshadowed by research on large platforms for sharing accommodation and mobility (Laurenti et al., 2019).

An issue within the SE field is its high degree of fragmentation, starting from how it´s defined to the objects of study throughout academic studies (Gurău & Ranchhod, 2020). The comprehensive scope of my SE definition focuses on activities that can facilitate consumption reduction, unlike definitions focusing on the activities' ownership structures, the level of monetization, or the types of platforms and infrastructure. This perspective, although inspired by other studies, is uncommon in the field. Bringing the potential for consumption-reduction to the forefront of the definition can stimulate the emerging academic field of SE sustainability, rather than engaging in "less urgent debates" about precise definitions (Laurenti et al., 2019).

Theoretically, the thesis also contributes to a comprehensive understanding of the factors that can influence the environmental sustainability of sharing household products. This can facilitate future consideration of these factors by other academic studies, as well as reflection on the part of practitioners and users. This contribution is concretized through the conceptual diagram of sustainability factors and the CLD, where the results support including factors pre- and post-sharing related to consumption, and the consumer perspective, in environmental assessments of sharing. Further, the diagrams are based on, to my knowledge, the only literature review exclusively focused on environmental assessments of sharing household products. The review contributes to a better understanding of the gaps related to environmental impact assessments of sharing household products and encourages addressing these gaps.

Through the city diagnostic, the thesis elaborates a representation of the potential to share sustainably in Gothenburg and unpacks conditions to further said sustainability for a collection of products, areas, and demographic groups. This is done through a consistent methodology and a wide scope that allows for revealing, comparing, and inferring the nuances of each case, bypassing the need for time- and data-intensive case studies throughout the city. The methodology highlights the crucial role of user consumption-reduction in supporting the sustainability of sharing household products, which is sometimes neglected in the field. The study of variables related to consumption (e.g., perception of product ownership, attitudes toward reducing consumption) contributes to understanding how consumption-reduction potential manifests in a real-life context. Overall, the broad scope of the diagnostic contributes to painting a complex picture of what a sustainable SE might entail in a city. The variations in the results show how each geographic area, demographic group, and product group might require targeted interventions, and provides information for crafting them.

The thesis also contributes to the SE field by taking inspiration from diverse disciplines beyond the business and marketing fields. I emphasize the relevance of industrial ecology methods in assessing the sustainability potential of the SE, spatial analysis methods in both understanding current potential for a sustainable SE and supporting interventions, and behavioral science concepts in understanding and supporting the creation of sustainable behavior interventions. On the latter, an important contribution is the theoretical and methodological consideration of the interplay between internal and external factors in fostering sustainable consumption habits, inspired by the attitude-behavior model by Kollmuss and Agyeman (2002). This is reflected on the analysis of user behaviors and attitudes (i.e., internal factors), while considering that these may be influenced by external factors (e.g., local governance and planning, transport infrastructure, and accessibility of SIs). Thus, the thesis contributes to the field by expanding the use of behavioral models beyond the prevalence of the TPB (Camacho-Otero et al., 2018).

Overall, the thesis results rest upon methodological development. The application of the extrapolation method contributes to advancing estimations of consumption and attitudes at a neighborhood level using readily accessible national-level data. Few studies have calculated product consumption behaviors and attitudes at the neighborhood level, while this scale can be relevant for governance to adapt strategies to the local contexts (Hunka & Habibi, 2023; Whetstone et al., 2020). Based on the extrapolation, a methodological framework including spatial analyses was created to assess how demand for sharing may be met by accessible sharing supply with a high geospatial granularity. The geospatial approach is rare in the SE field, especially for household products, while studying how SIs are located throughout a city, and how to optimize their location, has strong implications for minimizing transportation impacts in some sharing forms (Martin et al., 2021).

5.5. Reflections on the research process

The research followed a mixed-methods, abductive, exploratory design with a transdisciplinary character. These aspects had implications for how the research process developed chronologically and for how the results should be interpreted, as explained below.

As stated in subchapter 1.3., the first part of the thesis was carried out under the SEsam project, in a partnership with SCG facilitated by Gothenburg Municipality representatives. Since the testbed was in its final stages when my PhD project was initiated, in the first part of the thesis, I prioritized collaborative project tasks, supporting the transdisciplinary character of the research. The collaborative approach was suitable due to the indications in the SE sustainability literature of the need for effective local governance and multi-stakeholder collaborative approaches (Ma et al., 2018; Voytenko Palgan et al., 2021). As such, the transdisciplinary research results have a higher chance of being applied to the societies they are produced in (Kiatkoski Kim et al., 2022), but might be less applicable to other contexts.

Simultaneously, the aim of the SEsam project was to develop a quantitative SE sustainability assessment method based on the UMFA (Whetstone et al., 2020). The scope of the UMFA influenced my focus on household products, and the method´s capability to extrapolate product consumption amounts per household motivated my focus on activities that could enable consumption-reduction. In this quantitative phase of the thesis, the development of the method was constrained by data availability, which motivated an inductive and exploratory approach; based on following "where the data leads you" (Bell et al., 2018). In this stage, extant theory was an accessory to the development of the research aims and the discussion of results.

After this collaborative, inductive, and quantitative phase in the research, the insights generated called for further insertion in the SE literature. Still situated in a quantitative approach, I started to construct a library of environmental impact assessments of sharing household products to continue developing the assessment methodology through the ECLECTIC project. This process elucidated the complexity of factors that could contribute to or prevent a sustainable SE, as well as the heterogeneity in the empirical consideration of these factors in the quantitative assessments. Comparing results in the library would, therefore, lead to inconsistent results. This motivated a transition toward a qualitative phase in the project.

The qualitative phase facilitated an abductive approach by using the newfound theoretical aspects to analyze and contextualize previous quantitative results. Initially, the quantitative findings focused solely on consumption reduction, but integrating qualitative insights allowed for the exploration of potential impacts on transportation and energy use. Furthermore, the thesis often used secondary data sources (e.g., SCG, HBS, Smart Map), which typically entails additional data processing to adapt to the required analyses. In this case, the additional data processing was supported qualitatively. Overall, abductive reasoning introduced a certain level of subjectivity, as demonstrated by my interpretation of the reduction-consumption variables from secondary sources (e., owning too much, attitudes towards reducing consumption). This aligns with the principles of abductive reasoning, which generates the best available explanations when data is incomplete (Thagard & Shelley, 1997), while potentially affecting the validity of the results.

Otherwise, the exploratory approach led to many iterations throughout the research process, for instance, transitioning from only using household characteristics for the demographic perspective to considering individual characteristics; from a group category prioritization standpoint to a comparison standpoint (Paper 3), from focusing on local governance (Paper 3) as an audience to expanding implications for SIs and users (remaining Papers), from potential for dematerialization (Paper 3) to potential for broader environmental sustainability (remaining Papers) and from a library of impacts to identification of factors and their interrelationships (Papers 1 and 2).

5.6. Limitations and assumptions

The thesis has limitations in matters of generalizability, data sources, analysis assumptions, and the conceptualization of sustainable sharing. Since these aspects have been detailed in the Papers, here I summarize the main limitations.

Generalizability of the results

The results related to the sustainability factors may be considered generalizable for the context of sharing household products due to the neutral way in which they have been articulated (e.g., "energy mix" is included due to its international applicability, even if in the geographical context of some study samples it did not play a role). To a certain extent, the results may apply to the sharing of other tangible assets, such as space and mobility, while some aspects may vary in importance (e.g., use-phase impacts and supporting services). Here, the limitations related to the systematized approach must still be considered, but theoretical saturation points to the richness of the sample regarding sustainability factors.

The results from the statistical and spatial analyses apply only to Gothenburg, Sweden. One of the data sources had a small, non-probability sample (i.e., SEsam survey), which limits the generalizability of the city-level results for the demographic and product perspectives. Nonetheless, the methodology employed a quota sampling strategy and post-stratified survey data to correct sampling biases. Additionally, many of the insights match results from the United States, Canada, Finland, Netherlands and Hungary, among others (Böcker & Meelen, 2017; Buda et al., 2020; Ertz et al., 2017; Leland et al., 2023; Lindblom & Lindblom, 2017), so the findings likely reflect the realities of cities with similar demographic, socio-cultural, and/or physical infrastructure contexts. The neighborhood-level results are not affected by the non-probability sample, as they were based on the HBS and SCG surveys instead.

Data sources and assumptions

Some limitations arise from the data collection methods, and some others from the assumptions used for their analysis.

For the city diagnostic, many of the findings were based on survey collection methods. Although questionnaire surveys are recognized for their flexibility and standardization (Blair et al., 2013), it is possible that self-reporting leads to over- or underestimations in the consumption results and social desirability biases in the measured attitudes (Beegle et al., 2012; Jones et al., 2016). Especially, the web format of the SEsam survey may also induce sampling biases. Besides this, the data collection methods for the HBS changed for 2021, so the SCB recommends caution in interpreting the results. Finally, the Smart Map is based on self-reported data by SIs, so it is to be seen as a non-comprehensive data source that excludes informal SIs, temporary SIs, P2P sharing without the involvement of SIs, digital sharing forms,

SIs that have not registered themselves within the database, and SIs that do not comply with the Smart Map´s sustainability criteria (Smarta Kartan, 2023a). This represents a limitation in fully capturing the opportunities for sharing throughout the city.

As previously mentioned, many of the data sources were secondary and not collected for the purposes of the thesis. This implied additional processing to harmonize the product groups, demographic groups, and geographical areas used in the different data sources. The issue is also symptomatic of the consumption and spatial analysis fields, with product categorizations being called "arbitrary" (Tukker & Jansen, 2006), and the "modifiable area unit problem" being recognized in geospatial analyses (Buzzelli, 2020). To ensure comparability with other studies, I made assumptions anchored on the categorizations used by national and city statistics, but these assumptions might affect the reliability of the measures for each group. It is also possible that the most significant results correspond to groups with fairly homogeneous characteristics, especially considering the self-reporting format of the surveys (e.g., respondents may easily identify what is included in the category of "clothes" but may misunderstand "children´s equipment").

Limitations are also related to the combination of findings obtained from several independent surveys (i.e., HBS, SEsam, SCG), as the results concern different respondents. To correct for this, all surveys underwent post-stratification to match Gothenburg demographic statistics. Further, since the surveys utilized different measurements for the variables (e.g., units, Swedish crowns, percentages), I used the visual Jenks natural breaks classification algorithm to normalize between them (Jenks, 1967). By utilizing a similar methodology for all group categories, details may have been missed that could have been revealed in either qualitative samples or in quantitative research with a narrower scope.

As for the time of data collection, most data sources refer to the year 2021, so the findings represent the potential to share sustainably at a snapshot in time. However, the data collection occurred during the COVID-19 pandemic, which carried changes in attitudes and behaviors related to both consumption and sharing (Esposti et al., 2021; Holmberg, 2021). Additionally, since the product perspective is addressed through consumption in a single year, the consumption results are biased toward products that are bought more frequently, independently of their specific environmental impacts.

Greatest potential for minimal impact sharing

A challenge arising from the large scope of the research was the extensive amount of data obtained. As a heuristic tool, I focused the analysis on the relative maximum (e.g., highest consumption, most positive attitudes toward sharing activities) or minimum (i.e., shortest transportation distances) values. As a result, the highlighted findings could represent the "greatest potential for minimum impact". This counteracts social desirability bias for the results related to people's attitudes and behaviors, as it assesses groups with the greatest likelihood to replace consumption by sharing. However, when assessing their possibilities to share sustainably in the city, the use of minimal transportation distances induces a bias toward physical ownership-transfer sharing activities and excludes other sustainable transportation modes such as public transport. It is thus important to consider that other results that were not classified as a maximum or minimum might still indicate potential for sustainable sharing that was not addressed in the thesis.

Finally, throughout the thesis I conceptualize sustainable sharing as sharing that leads to decreased environmental impacts, in comparison to purchasing newly manufactured household products. It is posed that reduced net user consumption, reduced transportation distances, and, when relevant, reduced energy and resource use, would lead to decreased impacts. However, this assumes that there is no burden shifting in terms of impact categories, and that factors that depend on other stakeholders (e.g., producers, providers, end-of-life actors) do not lead to equal or increased impacts, which is a simplification (Junnila et al., 2018).

5.7. Practical implications

A variety of actors must be involved to realize the potential for environmentally sustainable sharing in a city. As such, the research findings are relevant for governance, practice, and households. Below, I present implications for these actors. While some recommendations are general, the group-specific recommendations are summarized in Table 5.

Governance actors
Urban governance and planning are essential in ensuring a sustainable SE. Coming back to the behavioral model by Kollmuss and Agyeman (2002), findings from the Gothenburg diagnostic provide actionable knowledge to enable sustainable sharing through a catalogue of interventions for improving internal (e.g., attitudes) and/or external (e.g., available infrastructure) factors (see Table 5). In summary, interventions for internal factors might be crafted for men to shift their perspectives on consumption and sharing; similar to older individuals who might also be addressed with physical infrastructures that facilitate social sharing; and SIs could also be promoted close to locations where high levels of education prevail. For groups with overall positive factors, such as younger individuals and women, their propensity to not reduce consumption should be addressed. Knowledge campaigns and support for mediated clothes sharing could be provided, as well as the provision of infrastructure and/or funds for tools sharing in relevant areas. Overall, support for SIs would be necessary in the outer city, while facilitating diverse sharing activities in the inner city. The implementation of these interventions should be prefaced by in-depth, category-specific investigations. It is also recommended to conduct follow-up studies, since the post-implementation effects of sharing interventions are not well documented (Zoli & Congiu, 2024). The role of national institutions should not be forgotten, where it is recommended to produce more rigorous national statistics about participation in sharing activities, which could facilitate further assessments. Ultimately, SE governance has gained traction in many cities besides Gothenburg, such as Amsterdam, Berlin, London and Toronto (Voytenko Palgan et al., 2021). Thus, the similarity between my demographic and geographic results and those in other contexts could inform the application of similar measures internationally.

Sharing providers
Both my results and the extant literature identify that product providers have an important role in ensuring the sustainability of sharing (Curtis & Mont, 2020). For formal SIs with environmental motivations, findings from the conceptual diagram could be used to guide improvements in their business models by, for example, optimizing the stock size and variety in B2C initiatives, providing product delivery options to improve transport efficiency, optimizing the configuration of supporting activities, such as choosing facilities nearby, or even providing recommendations to their users regarding treatment and use of products. Further, SIs are encouraged to exchange data with academia on their operations and clientele, to support more precise empirical studies. The findings from the CLD could also be used by these SIs as

a quick tool for self-assessment when it is not possible to conduct LCA studies on their SIs. For actors wishing to initiate formal SIs or become peer-providers, the demographic results in the city diagnostic provide information on their most likely users and potential challenges. The product results indicate which products to focus on if wanting to support sustainable sharing, and the geographic results reveal areas where their operations might be more successful. The interplay between factors can inform suitable courses of action – for example, selecting products with high production impacts if their initiative facilitates temporary transactions. Actions by SIs might also be supported by market analysis studies, which have been common for recognized SE actors Uber and AirBnB (Laurenti et al., 2019).

Sharing consumers

For consumers, which have been in focus throughout the thesis, the findings on sustainability factors call for reflection on which actions can help them sustain sustainable sharing. Consumers might learn about the relevance of their consumption behaviors pre- and post-sharing, as well as habits during sharing that help reduce impacts, such as good product treatment, improving transport behavior, and increasing utilization rates.

Table 5 – Group-specific recommendations according to the highlighted results in the thesis. The target audience for the recommendations is also included.

Perspective	Area/Group	Recommendations	Target audience
Geographic	**Inner city**	While the availability of SIs for different products can facilitate sharing with low-transport impacts, the potential to reduce consumption, should be investigated and promoted.	Governance actors and researchers
		The availability of SIs for diverse activities should be confirmed and increased.	Governance actors, researchers and providers
	Outer city	The transport mode and efficiency of sharing participants in the outer city should be investigated, to better understand potential transport impacts. Transport efficiency could also be promoted and improved, by for example, implementation of delivery logistics.	Researchers and providers
		Accessibility to SIs should be improved, especially in the well-integrated locations shown in Paper 4. Expanding the product variety of city libraries is also a good starting point.	Governance actors and providers
Demographic	**Gender**	Since women have potential to replace consumption with sharing, their potential to engage in rebound consumption should be investigated and addressed.	Governance actors and researchers
		Men´s lack of consumption-reduction and sharing intentions should be investigated and addressed.	Governance actors and researchers
	Age	Conditions for 65+ individuals to become sharing providers should be improved, both regarding their tendency to not want to share, and regarding the SI availability in areas when they predominate.	Governance actors, researchers, and providers
		Younger individuals have suitable internal and external conditions in the areas where they predominate, but they should be informed and encouraged to engage in replacement-behaviors and prevent rebounds.	Governance actors and researchers
	Education	The attitude-behavior gaps should be investigated and counteracted, given that highly educated groups have suitable internal and external factors. Potential improvements to external factors are establishing SIs close to educational sites.	Governance actors, researchers, and providers
Products	**Clothes**	It is necessary to further understand and address the population´s hindrances to acting as consumers in sharing, and to promote replacement behaviors.	Governance actors, researchers, and providers

Tools	To address attitude-behavior gaps, the accessibility of tool SIs in the outer city should be improved. When establishing new SIs, the product types should be adapted to the sharing activities (e.g., newer electrical tools products are better suited to access-based activities, while low-production impact and low-energy use tools are suited to ownership-transfer activities).	Governance actors and providers
Hobby	Given the positive internal factors, the accessibility to hobby equipment throughout the city should be improved, potentially though the existing city libraries.	Governance actors and providers

5.8. Future research

My future research recommendations concern further expansion of the SE sustainability field, methodological development to support such an expansion, and further studies in Gothenburg:

SE sustainability perspectives
Studies comparing the attitudes and environmental impacts across different sharing activities are relatively uncommon, including examples from Amasawa et al. (2020), Kerdlap et al. (2021) and Gullstrand Edbring et al. (2016). While sharing activities were not one of the perspectives considered in the city diagnostic, in the findings it was observed that interest, participation, and potential impacts did not vary according to the activity per se, but to the ownership structure of the activity, the user roles, and the SI platform type (e.g., geospatial attitude patterns varied according to the ownership structure). I thus recommend making more rigorous categorizations of sharing activities at an academic level, by including these characteristics, and directly investigating their impact on the potential to share sustainably. Overall, more needs to be known about informal sharing practices, which might be amongst the biggest contributors to sustainable consumption (Ribera Jemio et al., 2024).

Similarly, it would be useful to identify product characteristics that affect consumer behavior and attitudes, but also the impacts (e.g., expected lifetime, materials, use intensity, functionality, and size), and develop new product groups accordingly. The categorizations could build upon studies such as the one by Fortuna and Diyamandoglu (2016). This could help obtain more precise results for product categories that are very heterogeneous. For instance, kitchen equipment includes electric machines like food processors, which might be more desirable than sharing forks, but may also increase energy use impacts. This means that the grouping of these into the category of "kitchen equipment" hinders obtaining precise results.

Additionally, sustainability factors that have been captured in the conceptual diagram, but are generally not addressed empirically (e.g., user treatment of products, transportation distances) should be investigated. This would contribute to more precise assessments of the sustainability potential of sharing.

Methodological development and use
From a methodological standpoint, the extrapolation method and geospatial supply-demand framework in Paper 4 can be applied in other contexts with similar data sources (e.g., city-level surveys on sharing, household budget surveys, SI location data, street network data). They may also be adapted to include important manifestations of the SE, such as online and P2P/P2B2P sharing, and by connecting to environmental assessment values for products, such as CO_2 footprints. It is also recommended to develop environmental assessment methodologies (e.g., numerical models), and expand the use of existing ones that directly consider consumption-reduction factors such as replacement rates and rebounds (e.g., environmentally extended input-output analyses).

Future research should involve a quantitative assessment of the sustainability factors identified in the thesis, determining which factors are more influential in the environmental impacts of sharing, to what extent, and for which impact categories.

Gothenburg´s potential

Future research on the sustainability potential of sharing household products in Gothenburg should prioritize deductive approaches. Highlighted categories (i.e., clothes, tools, hobby equipment, gender, age, educational level, inner and outer city) should be addressed in more detail, utilizing both quantitative and qualitative methods that allow for confirmation of the findings reached through abductive reasoning. For this, it is essential that primary data is gathered, for instance, survey data obtained through probability sampling methods and direct exploration of variables related to consumption reduction and competing factors (e.g., replacement rates, rebound effects, treatment of products, transport modes, efficiency, and distances). These measures could expand results from the "maximum potential for minimal impact" approach. For the research to be generalizable, archetypes could be identified and compared against other geographical contexts.

6. Conclusion

In the SE field, environmental sustainability research is growing but still lacking development, while the household products sector is substantially neglected compared to accommodation and mobility. Consequently, this thesis aimed to advance knowledge on the environmental sustainability potential for household product sharing in an urban context, mainly regarding the potential reduction of consumption associated with sharing.

This involved compiling the factors influencing whether sharing household products is more sustainable than the purchase of new products, clarifying the role of consumption reduction in the sustainability of sharing, and making a city diagnostic considering the potential of different geographic areas, demographic groups, and product groups to achieve sustainable outcomes through sharing. The research used a mixed-methods design, where qualitative parts involved a literature review, thematic coding, and a causal loop diagram, and quantitative parts involved survey methodology, statistical and spatial analysis of selected variables representing the sustainability factors, and the adaptation and application of a method to extrapolate consumption and sharing variables to the neighborhood level.

The findings elucidated a set of 29 sustainability factors across the temporal dimension of sharing. The factors apply to a broad scope of household products, sharing activities, and platform models and infrastructures, whereas related literature has only focused on specific assets (e.g., cars or clothes), or narrow definitions of the SE (e.g., peer-to-peer digital sharing). The comprehensive collection of factors contributes to the academic field by facilitating the reflection on, and inclusion of, relevant factors in future sustainability assessments of sharing household products. Further, the relationships between these factors are mapped, revealing how they interact to either increase or decrease production impacts, and potentially increase transportation and use-phase energy utilization in the context of sharing. The factors are also classified according to the actors that can influence them, including consumers, providers, and supporting services providers. These findings, overall, support the growing narrative that the sustainability potential of the sharing economy is complex, while making suggestions on how to address said complexity.

The city diagnostic of Gothenburg, Sweden, assessed the current potential of different geographical areas, demographic groups, and product groups to engage in sustainable sharing. By quantifying and analyzing baseline consumption levels, attitudes related to consumption reduction and sharing, and accessibility to sharing initiatives through low-impact transportation modes, as well as inferring potential impacts depending on the product and sharing activity type, it was possible to construct a nuanced picture of the sustainability potential of the studied groups. In the results, certain groups presented opposite values in their potential (e.g., inner versus outer city), while others differed in several aspects (e.g., the demographic results). Many of the findings coincided with extant literature developed in international contexts, for example, the potential for sustainable sharing in the city center, and the significance of age, gender, and education level for the intentions to share and reduce consumption. Ultimately, it is shown that the potential to share sustainably in the city of Gothenburg depends on both internal and external factors and requires targeted interventions addressing either users´ attitudes and behaviors, or the accessibility of sharing initiatives in the city. As such, the thesis has practical implications for governing the SE toward sustainable outcomes.

The research for the city diagnostic also exemplified an approach to reduce the fragmentation in the field, by assessing the sustainability potential with a consistent methodology over a broad scope. The approach could be replicated in other settings, involving the development of methodological frameworks such as the extrapolation method and the supply-demand sharing model, which produce results at the neighborhood level.

Limitations in the thesis concern the generalizability of the results due to the characteristics of the data sources and collection methods, as well as the assumptions made for the analysis, such as focusing on extreme values for the variables considered. Future research involves the continued development of the utilized methodological frameworks, collecting data relevant to consumption-reduction factors, a deeper exploration of the potential of sustainable sharing through more diverse sharing activities, and elaborating activity and product categorization frameworks that facilitate future approaches with similarly large scopes. Additionally, the generalizability of the results should be improved with probability data sampling approaches and deductive research.

References

Acquier, A., Daudigeos, T., & Pinkse, J. (2017). Promises and paradoxes of the sharing economy: An organizing framework. *Technological Forecasting and Social Change*, *125*, 1-10. https://doi.org/10.1016/j.techfore.2017.07.006

Affolderbach, J., & de Chardon, C. M. (2021). Just transitions through digitally enabled sharing economies? [Article]. *Erde*, *152*(4), 244-259. https://doi.org/10.12854/erde-2021-569

Ajzen, I. (1991). The Theory of planned behavior. *Organizational Behavior and Human Decision Processes*. https://doi.org/10.1016/0749-5978(91)90020-T

Ala-Mantila, S., Ottelin, J., Heinonen, J., & Junnila, S. (2017). Reprint of: To each their own? The greenhouse gas impacts of intra-household sharing in different urban zones. *Journal of Cleaner Production*, *163*, S79-S90. https://doi.org/10.1016/j.jclepro.2017.05.138

Allenby, B. (2006). The ontologies of industrial ecology? *Progress in Industrial Ecology, An International Journal*, *3*(1-2), 28-40. https://doi.org/10.1504/PIE.2006.010039

Amasawa, E., Brydges, T., Henninger, C. E., & Kimita, K. (2023). Can rental platforms contribute to more sustainable fashion consumption? Evidence from a mixed-method study. *Cleaner and Responsible Consumption*, *8*, 100103. https://doi.org/10.1016/j.clrc.2023.100103

Amasawa, E., Shibata, T., Sugiyama, H., & Hirao, M. (2020). Environmental potential of reusing, renting, and sharing consumer products: Systematic analysis approach. *Journal of Cleaner Production*, *242*, 118487. https://doi.org/10.1016/j.jclepro.2019.118487

Andersson, D., & Nässén, J. (2023). Measuring the direct and indirect effects of low-carbon lifestyles using financial transactions. *Journal of Cleaner Production*, *386*, 135739. https://doi.org/10.1016/j.jclepro.2022.135739

Árnadóttir, Á., Abdirova, T., Olson, S., Heinonen, J., & Czepkiewicz, M. (2024). Does higher climate concern lead to a smaller carbon footprint? A study among the Nordic country residents. *Resources, Conservation and Recycling*, *205*, 107543. https://doi.org/10.1016/j.resconrec.2024.107543

Arrigo, E. (2021). Collaborative consumption in the fashion industry: A systematic literature review and conceptual framework. *Journal of Cleaner Production*, *325*, 129261. https://doi.org/10.1016/j.jclepro.2021.129261

Axelsson, K., Dawkins, E., Rahmati-Abkebar, M., & Broekhoff, D. (2022). *Konsumtionskompassen: ett digitalt verktyg för att förstå klimatpåverkan från konsumtion på lokal nivå* (SEI Brief, Issue 1).

Bardhi, F., & Eckhardt, G. M. (2012). Access-based consumption: The case of car sharing. *Journal of Consumer Research*, *39*(4), 881-898. https://doi.org/10.1086/666376

Beegle, K., De Weerdt, J., Friedman, J., & Gibson, J. (2012). Methods of household consumption measurement through surveys: Experimental results from Tanzania. *Journal of Development Economics*, *98*(1), 3-18. https://doi.org/10.1016/j.jdeveco.2011.11.001

Behrend, M. (2020). Buying versus renting: On the environmental friendliness of item-sharing. *Transportation Research Part D: Transport and Environment*, *87*, 102407. https://doi.org/10.1016/j.trd.2020.102407

Belk, R. (2014). You are what you can access: Sharing and collaborative consumption online. *Journal of Business Research*, *67*(8), 1595-1600. https://doi.org/10.1016/j.jbusres.2013.10.001

Bell, E., Bryman, A., & Harley, B. (2018). *Business research methods*. Oxford university press.
Benkler, Y. (2004). Sharing nicely: On shareable goods and the emergence of sharing as a modality of economic production. *Yale LJ*, *114*, 273. https://openedreader.org/chapter/sharing-nicely-on-shareable-goods-and-the-emergence-of-sharing-as-a-modality-of-economic-production/
Benoit, S., Baker, T. L., Bolton, R. N., Gruber, T., & Kandampully, J. (2017). A triadic framework for collaborative consumption (CC): Motives, activities and resources & capabilities of actors. *Journal of Business Research*, *79*, 219-227. https://doi.org/10.1016/j.jbusres.2017.05.004
Bernardi, M., & Diamantini, D. (2018). Shaping the sharing city: An exploratory study on Seoul and Milan. *Journal of Cleaner Production*, *203*, 30-42. https://doi.org/10.1016/j.jclepro.2018.08.132
Blair, J., Czaja, R. F., & Blair, E. A. (2013). *Designing surveys: A guide to decisions and procedures*. Sage Publications.
Bocken, N., Jonca, A., Södergren, K., & Palm, J. (2020). Emergence of Carsharing Business Models and Sustainability Impacts in Swedish Cities. *Sustainability*, *12*(4), 1594. https://www.mdpi.com/2071-1050/12/4/1594
Böcker, L., & Meelen, T. (2017). Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation. *Environmental Innovation and Societal Transitions*, *23*, 28-39. https://doi.org/10.1016/j.eist.2016.09.004
Borenstein, S. (2015). A microeconomic framework for evaluating energy efficiency rebound and some implications. *The Energy Journal*, *36*(1), 1-22. http://www.jstor.org/stable/24695011
Botsman, R. (2013). The Sharing Economy Lacks A Shared Definition. *The Sharing Economy Lacks a Shared Definition*.
Botsman, R., & Rogers, R. (2010). What's mine is yours. *The rise of collaborative consumption*.
Buda, G., Pethes, B., & Lehota, J. (2020). Dominant consumer attitudes in the sharing economy-a representative study in Hungary. *Resources*, *9*(1). https://doi.org/10.3390/resources9010001
Buzzelli, M. (2020). Modifiable areal unit problem. *International encyclopedia of human geography*, 169-173. https://doi.org/10.1016/B978-0-08-102295-5.10406-8
Camacho-Otero, J., Boks, C., & Pettersen, I. N. (2018). Consumption in the circular economy: A literature review. *Sustainability (Switzerland)*, *10*(8), Article 2758. https://doi.org/10.3390/su10082758
Cheng, M. (2016). Sharing economy: A review and agenda for future research. *International Journal of Hospitality Management*, *57*, 60-70. https://doi.org/10.1016/j.ijhm.2016.06.003
Claudelin, A., Tuominen, K., & Vanhamäki, S. (2022). Sustainability Perspectives of the Sharing Economy: Process of Creating a Library of Things in Finland. *Sustainability*, *14*(11), 6627. https://www.mdpi.com/2071-1050/14/11/6627
Cohen, B., & Muñoz, P. (2016). Sharing cities and sustainable consumption and production: towards an integrated framework. *Journal of Cleaner Production*, *134*, 87-97. https://doi.org/10.1016/j.jclepro.2015.07.133
Coll-Martínez, E., & Méndez-Ortega, C. (2023). Agglomeration and coagglomeration of co-working spaces and creative industries in the city [Article]. *European Planning Studies*, *31*(3), 445-466. https://doi.org/10.1080/09654313.2020.1847256
Curtis, S. K., & Lehner, M. (2019). Defining the sharing economy for sustainability. *Sustainability*, *11*(3), 567. https://doi.org/10.3390/su11030567

Curtis, S. K., & Mont, O. (2020). Sharing economy business models for sustainability. *Journal of Cleaner Production*, *266*, Article 121519. https://doi.org/10.1016/j.jclepro.2020.121519
Dalton, R. C. (2003). The Secret Is To Follow Your Nose:Route Path Selection and Angularity. *Environment and Behavior*, *35*(1), 107-131. https://doi.org/10.1177/0013916502238867
Dawkins, E., Rahmati-Abkenar, M., Axelsson, K., Grah, R., & Broekhoff, D. (2024). The carbon footprints of consumption of goods and services in Sweden at municipal and postcode level and policy interventions. *Sustainable Production and Consumption*, *52*, 63-79. https://doi.org/10.1016/j.spc.2024.10.013
de Boer, F., Ekander, J., Frendberg, T., & Wiksten, K. (2021). *Delningsekonomins potentiella påverkan på utsläpp från hushållskonsumtion i Göteborg* Chalmers University of Technology].
De las Heras, A., Relinque-Medina, F., Zamora-Polo, F., & Luque-Sendra, A. (2021). Analysis of the evolution of the sharing economy towards sustainability. Trends and transformations of the concept. *Journal of Cleaner Production*, *291*, 125227. https://doi.org/10.1016/j.jclepro.2020.125227
Demailly, D., & Novel, A.-S. (2014). The sharing economy: make it sustainable. *Studies*, *3*(14.1).
Dhanorkar, S. (2019). Environmental benefits of internet-enabled C2C closed-loop supply chains: A quasi-experimental study of Craigslist. *Management Science*, *65*(2), 660-680. https://doi.org/10.1287/mnsc.2017.2963
Ek, K., Wårell, L., & Andersson, L. (2021). Motives for walking and cycling when commuting – differences in local contexts and attitudes. *European Transport Research Review*, *13*(1), 46. https://doi.org/10.1186/s12544-021-00502-5
Ertz, M., Lecompte, A., & Durif, F. (2017). Dual roles of consumers: Towards an insight into collaborative consumption motives [Article]. *International Journal of Market Research*, *59*(6), 725-748. https://doi.org/10.2501/IJMR-2017-040
Esposti, P. D., Mortara, A., & Roberti, G. (2021). Sharing and sustainable consumption in the era of covid-19. *Sustainability (Switzerland)*, *13*(4), 1-15. https://doi.org/10.3390/su13041903
European Commission. (2016a). Collaborative economy - factsheet. In.
European Commission. (2016b). *A European agenda for the collaborative economy*
Eurostat. (2022). *Actual individual consumption per capita in 2021* https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220620-1
Eurostat. (2025). *Gini coefficient of equivalised disposable income*. https://doi.org/10.2908/TESSI190
Fortuna, L. M., & Diyamandoglu, V. (2016). A novel method for material characterization of reusable products. *Waste Management*, *52*, 14-24. https://doi.org/10.1016/j.wasman.2016.03.037
Frenken, K., & Schor, J. (2017). Putting the sharing economy into perspective. *Environmental Innovation and Societal Transitions*, *23*, 3-10. https://doi.org/10.1016/j.eist.2017.01.003
Geissinger, A., Laurell, C., Öberg, C., & Sandström, C. (2019). How sustainable is the sharing economy? On the sustainability connotations of sharing economy platforms. *Journal of Cleaner Production*, *206*, 419-429. https://doi.org/10.1016/j.jclepro.2018.09.196
GLD. (2025). *Governance and Local Development Institute*. Retrieved April from https://gld.gu.se/en
Goedkoop, M. (1999). *Product Service systems, Ecological and Economic Basics*.

Göteborg Stad. (2021). *Kartläggning Göteborgs Stads budgetmål och övergripande styrning i förhållande till Agenda 2030 - Globala målen för hållbar utveckling*. https://goteborg.se/wps/wcm/connect/e1ea8873-d1f9-4bc9-847b-e48e825f34c1/Kartläggning+2021+Agenda+2030.pdf?MOD=AJPERES
Göteborg Stad. (2025). *Demokrati och medborgarservice*. Retrieved April from https://goteborg.se/wps/portal/start/kommun-och-politik/kommunens-organisation/forvaltningar-och-namnder/demokrati-och-medborgarservice
Göteborg Statistik och Analys. (2021). Göteborgsbladet 2021 - områdesfakta. In Göteborg Statistik och Analys (Ed.).
Göteborgs Stad. (2020). *Göteborgs Stads miljö-och klimatprogram 2021–2030: Remissversion*. https://www4.goteborg.se/prod/Stadsledningskontoret/LIS/Verksamhetshandbok/Forfattn.nsf//6B3CA866EF066429C12586B200449D53/$File/C12574360024D6C7WEBVDBX37N.pdf?OpenElement
Göteborgs Stad. (2022). *Översiktsplan*. Retrieved April from https://oversiktsplan.goteborg.se
Göteborgs Stad. (2024). *Uppföljning av miljö- och klimatprogrammets strategier 2024*. https://goteborg.se/wps/wcm/connect/de7bd301-5d88-48f0-b730-d0bc06a21e0f/R800_2024_15+Uppföljning+av+miljö-+och+klimatprogrammets+strategier+2024.pdf?MOD=AJPERES
Göteborgs Stad Statistik och Analys. (2022). *Statistikdatabasen*. Retrieved June 15 from https://goteborg.se/wps/portal/enhetssida/statistik-och-analys/goteborgsbladet/hamta-statistik/statistikdatabas
Göteborgsregionen. (2020). *Göteborgsregionen minskar avfallet - Avfallsplan för tretton kommuner till 2030*. https://goteborgsregionen.se/download/18.36d7d7c217bde52a1534924/1631633127488/Göteborgsregionen%20minskar%20avfallet_tillgänglig%20FINAL1.pdf
Gourinchas, P.-O., & Parker, J. A. (2002). Consumption Over the Life Cycle. *Econometrica*, *70*(1), 47-89. https://doi.org/10.1111/1468-0262.00269
Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information & Libraries Journal*, *26*(2), 91-108. https://doi.org/10.1111/j.1471-1842.2009.00848.x
Gullstrand Edbring, E., Lehner, M., & Mont, O. (2016). Exploring consumer attitudes to alternative models of consumption: Motivations and barriers [Article]. *Journal of Cleaner Production*, *123*, 5-15. https://doi.org/10.1016/j.jclepro.2015.10.107
Gurău, C., & Ranchhod, A. (2020). The sharing economy as a complex dynamic system: Exploring coexisting constituencies, interests and practices. *Journal of Cleaner Production*, *245*, 118799. https://doi.org/10.1016/j.jclepro.2019.118799
Guttentag, D. (2019). Progress on Airbnb: a literature review. *Journal of Hospitality and Tourism Technology*, *10*(4), 814-844. https://doi.org/10.1108/JHTT-08-2018-0075
Hagberg, J., Hansson, L., Holmberg, U., Sörum, N., Hauff, J., & Mellander, E. (2022). Konsumtionsrapporten 2022. https://hdl.handle.net/2077/74444
Halonen, V., Claudelin, A., Uusitalo, V., Levänen, J., & Konsti-Laakso, S. (2024). The potential of individuals to reduce greenhouse gas emissions through their own actions: a case of a suburb in Finland. *Discover Sustainability*, *5*(1), 191. https://doi.org/10.1007/s43621-024-00407-y
Hamari, J., Sjöklint, M., & Ukkonen, A. (2016). The sharing economy: Why people participate in collaborative consumption. https://doi.org/10.1002/asi.23552
Hansmann, R., & Binder, C. R. (2023). Promoting synergies for sustainability through peer-to-peer sharing: an analysis of drivers and barriers [Article]. *International Journal of*

Sustainable Development and World Ecology, *30*(7), 792-813. https://doi.org/10.1080/13504509.2023.2205831
Harris, S., Mata, É., Plepys, A., & Katzeff, C. (2021). Sharing is daring, but is it sustainable? An assessment of sharing cars, electric tools and offices in Sweden. *Resources, Conservation and Recycling*, *170*, 105583. https://doi.org/10.1016/j.resconrec.2021.105583
Hazée, S., Van Vaerenbergh, Y., Delcourt, C., & Warlop, L. (2019). Sharing Goods? Yuck, No! An Investigation of Consumers' Contamination Concerns About Access-Based Services. *Journal of Service Research*, *22*(3), 256-271. https://doi.org/10.1177/1094670519838622
Hedenus, F., Persson, M., & Sprei, F. (2022). *Sustainable Development - Nuances and Perspectives*. Studentlitteratur AB.
Heinrichs, H. (2013). *Sharing economy: A potential new pathway to sustainability*. https://doi.org/10.14512/gaia.22.4.5
Henry, M., Schraven, D., Bocken, N., Frenken, K., Hekkert, M., & Kirchherr, J. (2021). The battle of the buzzwords: A comparative review of the circular economy and the sharing economy concepts. *Environmental Innovation and Societal Transitions*, *38*, 1-21. https://doi.org/10.1016/j.eist.2020.10.008
Herold, P. I., & Prokop, D. (2023). Is fast fashion finally out of season? Rental clothing schemes as a sustainable and affordable alternative to fast fashion. *Geoforum*, *146*, 103873. https://doi.org/10.1016/j.geoforum.2023.103873
Hertwich, E. (2005). Consumption and the rebound effect: An industrial ecology perspective [Conference paper]. *Journal of Industrial Ecology*, *9*, 85-98. https://doi.org/10.1162/1088198054084635
Hertwich, E. G. (2005). Life Cycle Approaches to Sustainable Consumption: A Critical Review. *Environmental Science & Technology*, *39*(13), 4673-4684. https://doi.org/10.1021/es0497375
Hertwich, E. G., & Peters, G. P. (2009). Carbon Footprint of Nations: A Global, Trade-Linked Analysis. *Environmental Science & Technology*, *43*(16), 6414-6420. https://doi.org/10.1021/es803496a
Hillier, B., & Iida, S. (2005). Network and Psychological Effects in Urban Movement. Spatial Information Theory, Berlin, Heidelberg.
Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. (1993). Natural Movement: Or, Configuration and Attraction in Urban Pedestrian Movement. *Environment and Planning B: Planning and Design*, *20*(1), 29-66. https://doi.org/10.1068/b200029
Holmberg, U. (2021). *Konsumtionsrapporten 2021* (2002-8156). https://www.gu.se/sites/default/files/2021-12/TE_konsumtionsrapporten%202021_korr.pdf
Hossain, M. (2020). Sharing economy: A comprehensive literature review. *International Journal of Hospitality Management*, *87*, 102470. https://doi.org/10.1016/j.ijhm.2020.102470
Hult, A., & Bradley, K. (2017). Planning for Sharing–Providing Infrastructure for Citizens to be Makers and Sharers [Article]. *Planning Theory and Practice*, *18*(4), 597-615. https://doi.org/10.1080/14649357.2017.1321776
Hunka, A. D., & Habibi, S. (2023). What drives demand for paid access to a sharing box with underused items? A choice experiment with Swedish consumers [Article]. *Journal of Cleaner Production*, *393*, Article 135793. https://doi.org/10.1016/j.jclepro.2022.135793
Hygglo. (2023). *Hygglo*. Retrieved January from https://www.hygglo.se

Institutet för kvalitetsindikatorer AB. (2021). *Teknisk rapport: Attitydundersökning om delningsekonomin i Göteborgs Stad [Techical report: Survey of attitudes about the sharing economy in Gothenburg City]*.

Ivanova, D., Stadler, K., Steen-Olsen, K., Wood, R., Vita, G., Tukker, A., & Hertwich, E. G. (2016). Environmental Impact Assessment of Household Consumption. *Journal of Industrial Ecology*, *20*(3), 526-536. https://doi.org/10.1111/jiec.12371

Jackson, T. (2005). *Motivating Sustainable Consumption: a review of evidence on consumer behaviour and behavioural change; a report to the Sustainable Development Research Network*. https://www.euro-ciss.eu/fileadmin/user_upload/Redaktion/Seco@home/nachhaltiger_Energiekonsum/Literatur/entscheidungen_haushalte/motivating_sustainable_consumption_by_jackson.pdf

Jankiewicz, M. (2024). Changes in the European Union households' consumption structure and the sustainable development. *Journal of Cleaner Production*, *481*, 144138. https://doi.org/10.1016/j.jclepro.2024.144138

Jelinkova, M., Tetrevova, L., Vavra, J., & Munzarova, S. (2021). The sharing economy in the context of sustainable development and social responsibility: The example of the Czech Republic [Article]. *Sustainability (Switzerland)*, *13*(17), Article 9886. https://doi.org/10.3390/su13179886

Jenks, G. F. (1967). The data model concept in statistical mapping. *International yearbook of cartography*, *7*, 186-190.

Jiménez Encarnación, D. (2023). *From consumption to sharing: Generating knowledge to support urban governance of the sharing economy* Chalmers University of Technology]. Gothenburg, Sweden. https://research.chalmers.se/en/publication/535743

Jiménez Encarnación, D., Metheney, E. A., Thuvander, L., Kalmykova, Y., & Rosado, L. (2024). Revealing patterns in household product consumption and sharing: An approach to support urban governance towards a sustainable sharing economy. *Sustainable Production and Consumption*, *45*, 244-264. https://doi.org/10.1016/j.spc.2024.01.009

Jin, S. T., Kong, H., Wu, R., & Sui, D. Z. (2018). Ridesourcing, the sharing economy, and the future of cities [Article]. *Cities*, *76*, 96-104. https://doi.org/10.1016/j.cities.2018.01.012

Johnson, E., & Plepys, A. (2021). Product-Service Systems and Sustainability: Analysing the Environmental Impacts of Rental Clothing. *Sustainability*, *13*(4), 2118. https://www.mdpi.com/2071-1050/13/4/2118

Jones, M. K., Calzavara, L., Allman, D., Worthington, C. A., Tyndall, M., & Iveniuk, J. (2016). A comparison of web and telephone responses from a national HIV and AIDS survey. *JMIR public health and surveillance*, *2*(2), e5184. https://doi.org/10.2196/publichealth.5184

Junnila, S., Ottelin, J., & Leinikka, L. (2018). Influence of reduced ownership on the environmental benefits of the circular economy. *Sustainability (Switzerland)*, *10*(11). https://doi.org/10.3390/su10114077

Kalmykova, Y., Sadagopan, M., & Rosado, L. (2018). Circular economy–From review of theories and practices to development of implementation tools. *Resources, Conservation and Recycling*, *135*, 190-201. https://doi.org/10.1016/j.resconrec.2017.10.034

Karupiah, P. (2022). Positivism. In M. R. Islam, N. A. Khan, & R. Baikady (Eds.), *Principles of Social Research Methodology* (pp. 73-82). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-5441-2_6

Kerdlap, P., Gheewala, S. H., & Ramakrishna, S. (2021). To Rent or Not to Rent: A Question of Circular Prams from a Life Cycle Perspective. *Sustainable Production and Consumption*, *26*, 331-342. https://doi.org/10.1016/j.spc.2020.10.008

Kiatkoski Kim, M., Douglas, M. M., Pannell, D., Setterfield, S. A., Hill, R., Laborde, S., Perrott, L., Álvarez-Romero, J. G., Beesley, L., Canham, C., & Brecknell, A. (2022). When to Use Transdisciplinary Approaches for Environmental Research [Conceptual Analysis]. *Frontiers in Environmental Science*, *Volume 10 - 2022*. https://doi.org/10.3389/fenvs.2022.840569

Kim, D. (2018). *Guidelines for drawing causal loop diagrams*. Retrieved March from https://thesystemsthinker.com/guidelines-for-drawing-causal-loop-diagrams-2/

Kjaer, L. L., Pigosso, D. C. A., Niero, M., Bech, N. M., & McAloone, T. C. (2019). Product/Service-Systems for a Circular Economy: The Route to Decoupling Economic Growth from Resource Consumption? *Journal of Industrial Ecology*, *23*(1), 22-35. https://doi.org/10.1111/jiec.12747

Kollmuss, A., & Agyeman, J. (2002). Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239-260. https://doi.org/10.1080/13504620220145401

Laurenti, R., & Acuña, F. M. B. (2020). Exploring antecedents of behavioural intention and preferences in online peer-to-peer resource sharing: A Swedish university setting [Article]. *Sustainable Production and Consumption*, *21*, 47-56. https://doi.org/10.1016/j.spc.2019.10.002

Laurenti, R., Singh, J., Cotrim, J. M., Toni, M., & Sinha, R. (2019). Characterizing the Sharing Economy State of the Research: A Systematic Map. *Sustainability*, *11*(20), 5729. https://www.mdpi.com/2071-1050/11/20/5729

Leland, S. M., Pinka, R., & Boyer, R. H. W. (2023). Who shares? Participation in the sharing economy in the U.S [Article]. *Journal of Urban Affairs*. https://doi.org/10.1080/07352166.2023.2221438

Lindblom, A., & Lindblom, T. (2017). De-ownership orientation and collaborative consumption during turbulent economic times [Article]. *International Journal of Consumer Studies*, *41*(4), 431-438. https://doi.org/10.1111/ijcs.12336

Livoreil, B., Glanville, J., Haddaway, N. R., Bayliss, H., Bethel, A., de Lachapelle, F. F., Robalino, S., Savilaakso, S., Zhou, W., Petrokofsky, G., & Frampton, G. (2017). Systematic searching for environmental evidence using multiple tools and sources. *Environmental Evidence*, *6*(1), 23. https://doi.org/10.1186/s13750-017-0099-6

Ma, Y., Lan, J., Thornton, T., Mangalagiu, D., & Zhu, D. (2018). Challenges of collaborative governance in the sharing economy: The case of free-floating bike sharing in Shanghai. *Journal of Cleaner Production*, *197*, 356-365. https://doi.org/10.1016/j.jclepro.2018.06.213

Maczionsek, M. I. J. H., Dillman, K. J., & Heinonen, J. (2023). Linking perception and reality: Climate-sustainability perception and carbon footprints in the Nordic countries. *Journal of Cleaner Production*, *430*, 139750. https://doi.org/10.1016/j.jclepro.2023.139750

Magnusson, D., & Palm, J. (2019). Come together—the development of Swedish energy communities. *Sustainability*, *11*(4), 1056. https://doi.org/10.3390/su11041056

Magrabi, F. M., Chung, Y. S., & Cha, S. S. (1991). *The economics of household consumption*. Greenwood Publishing Group.

Martin, C. J. (2016). The sharing economy: A pathway to sustainability or a nightmarish form of neoliberal capitalism? *Ecological Economics*, *121*, 149-159. https://doi.org/10.1016/j.ecolecon.2015.11.027

Martin, C. J., Upham, P., & Budd, L. (2015). Commercial orientation in grassroots social innovation: Insights from the sharing economy. *Ecological Economics*, *118*, 240-251. https://doi.org/10.1016/j.ecolecon.2015.08.001

Martin, M., Heiska, M., & Björklund, A. (2021). Environmental assessment of a product-service system for renting electric-powered tools. *Journal of Cleaner Production*, *281*, 125245. https://doi.org/10.1016/j.jclepro.2020.125245

Martin, M., Lazarevic, D., & Gullström, C. (2019). Assessing the Environmental Potential of Collaborative Consumption: Peer-to-Peer Product Sharing in Hammarby Sjöstad, Sweden. *Sustainability*, *11*(1), 190. https://www.mdpi.com/2071-1050/11/1/190

Meshulam, T., Font-Vivanco, D., Blass, V., & Makov, T. (2023). Sharing economy rebound: The case of peer-to-peer sharing of food waste. *Journal of Industrial Ecology*, *27*(3), 882-895. https://doi.org/10.1111/jiec.13319

Meshulam, T., Goldberg, S., Ivanova, D., & Makov, T. (2024). The sharing economy is not always greener: a review and consolidation of empirical evidence. *Environmental Research Letters*, *19*(1), 013004. https://doi.org/10.1088/1748-9326/ad0f00

Miles, M. B., Huberman, A. M., & Saldana, J. (2019). *Qualitative Data Analysis: A Methods Sourcebook*.

Mont, O., Palgan, Y. V., Bradley, K., & Zvolska, L. (2020). A decade of the sharing economy: Concepts, users, business and governance perspectives. *Journal of Cleaner Production*, *269*, 122215. https://doi.org/10.1016/j.jclepro.2020.122215

Moon, D. (2024). Promoting sustainable practices: Exploring secondhand clothing consumption patterns and reductions in greenhouse gas emissions in Japan. *Sustainable Production and Consumption*, *45*, 294-305. https://doi.org/10.1016/j.spc.2024.01.007

Morone, P., Falcone, P. M., Imbert, E., & Morone, A. (2018). Does food sharing lead to food waste reduction? An experimental analysis to assess challenges and opportunities of a new consumption model. *Journal of Cleaner Production*, *185*, 749-760. https://doi.org/10.1016/j.jclepro.2018.01.208

Muñoz, P., & Cohen, B. (2017). Mapping out the sharing economy: A configurational approach to sharing business modeling. *Technological Forecasting and Social Change*, *125*, 21-37. https://doi.org/10.1016/j.techfore.2017.03.035

Noh, Y., Ro, J. Y., & Jeong, D. K. (2020). A study on users' perception of the role of library in the sharing economic era in Korea. *Library Hi Tech*, *38*(3), 654 - 677. https://doi.org/10.1108/LHT-01-2019-0015

Öhrwall, E. (2021). *Göteborgarna & delningsekonomin*. https://goteborg.se/wps/wcm/connect/a5a8a992-1e1d-4221-bae4-ad4e9e194d82/Göteborgarna+och+delningsekonomin_2021.pdf?MOD=AJPERES

Ottelin, J., Cetinay, H., & Behrens, P. (2020). Rebound effects may jeopardize the resource savings of circular consumption: evidence from household material footprints. *Environmental Research Letters*, *15*(10). https://doi.org/10.1088/1748-9326/abaa78

Ottelin, J., Heinonen, J., Nässén, J., & Junnila, S. (2019). Household carbon footprint patterns by the degree of urbanisation in Europe. *Environmental Research Letters*, *14*(11), 114016. https://doi.org/10.1088/1748-9326/ab443d

Pickering, C., Grignon, J., Steven, R., Guitart, D., & Byrne, J. (2015). Publishing not perishing: how research students transition from novice to knowledgeable using systematic quantitative literature reviews. *Studies in Higher Education*, *40*(10), 1756-1769. https://doi.org/10.1080/03075079.2014.914907

Pielke Jr, R. A. (2007). *The honest broker: making sense of science in policy and politics*. Cambridge University Press.

Plepys, A., & Singh, J. (2019). Evaluating the sustainability impacts of the sharing economy using input-output analysis. In *A research agenda for sustainable consumption governance*. Edward Elgar Publishing. https://doi.org/10.4337/9781788117814.00013
Plewnia, F., & Guenther, E. (2018). Mapping the sharing economy for sustainability research. *Management Decision*, *56*(3), 570-583. https://doi.org/10.1108/MD-11-2016-0766
Pohl, J., Suski, P., Haucke, F., Piontek, F. M., & Jäger, M. (2019). Beyond Production—the Relevance of User Decision and Behaviour in LCA. In F. Teuteberg, M. Hempel, & L. Schebek (Eds.), *Progress in Life Cycle Assessment 2018* (pp. 3-19). Springer International Publishing. https://doi.org/10.1007/978-3-030-12266-9_1
Pouri, M. J., & Hilty, L. M. (2018). Conceptualizing the Digital Sharing Economy in the Context of Sustainability. *Sustainability*, *10*(12), 4453. https://www.mdpi.com/2071-1050/10/12/4453
Puschmann, T., & Alt, R. (2016). Sharing economy. *Business & Information Systems Engineering*, *58*(1), 93-99. https://doi.org/10.1007/s12599-015-0420-2
Rahimi, S., & Khatooni, M. (2024). Saturation in qualitative research: An evolutionary concept analysis. *International Journal of Nursing Studies Advances*, *6*, 100174. https://doi.org/10.1016/j.ijnsa.2024.100174
Ribera Jemio, P., Merino-Saum, A., Hansmann, R., & Binder, C. R. (2024). Is the sharing economy a sustainable mode of consumption? An empirical case study of sharing of household goods and environmental rebound effects in a university context. *Cleaner and Responsible Consumption*, *14*, 100210. https://doi.org/10.1016/j.clrc.2024.100210
Robson, C. (2002). *Real world research: A resource for social scientists and practitioner-researchers*. Wiley-Blackwell.
Roskenrollmusis. (2017). *Göteborgs stadsdelar 170511* Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Göteborgs_stadsdelar_170511.svg
Sahari, E., Salo, M., & Sandman, N. (2024). The role of socio-demographic and psychological factors in shaping individual carbon footprints in Finland. *Scientific Reports*, *14*(1), 27984. https://doi.org/10.1038/s41598-024-75302-7
Sánchez-Vergara, J. I., Ginieis, M., & Papaoikonomou, E. (2021). The emergence of the sharing city: A systematic literature review to understand the notion of the sharing city and explore future research paths. *Journal of Cleaner Production*, *295*, 126448. https://doi.org/10.1016/j.jclepro.2021.126448
Sandin, G., & Peters, G. M. (2018). Environmental impact of textile reuse and recycling – A review. *Journal of Cleaner Production*, *184*, 353-365. https://doi.org/10.1016/j.jclepro.2018.02.266
SCB. (2013). *Hushållens utgifter 2012: Beskrivning av statistiken*. https://www.scb.se/contentassets/90c71dbdb84c4fb5abb66896f3a478e6/he0201_do_2012.pdf
Schaefers, T., Wittkowski, K., Benoit, S., & Ferraro, R. (2016). Contagious effects of customer misbehavior in access-based services. *Journal of Service Research*, *19*(1), 3-21. https://doi.org/10.1177/1094670515595047
Schneider, P., Folkens, L., Meyer, A., & Fauk, T. (2019). Sustainability and Dimensions of a Nexus Approach in a Sharing Economy. *Sustainability*, *11*(3), 909. https://www.mdpi.com/2071-1050/11/3/909
Schor, J. (2016). Debating the sharing economy. *Journal of Self-Governance and Management Economics*, *4*(3), 7-22.
Schor, J. B., & Vallas, S. P. (2021). The Sharing Economy: Rhetoric and Reality. *Annual Review of Sociology*, *47*(Volume 47, 2021), 369-389. https://doi.org/10.1146/annurev-soc-082620-031411

Scoppa, M. D., & Peponis, J. (2015). Distributed attraction: the effects of street network connectivity upon the distribution of retail frontage in the City of Buenos Aires. *Environment and Planning B: Planning and Design*, *42*(2), 354-378. https://doi.org/10.1068/b130051p
Shams Esfandabadi, Z., Diana, M., & Zanetti, M. C. (2022). Carsharing services in sustainable urban transport: An inclusive science map of the field. *Journal of Cleaner Production*, *357*, 131981. https://doi.org/10.1016/j.jclepro.2022.131981
Sharing Cities Sweden. (2021). *Sharing Cities Sweden*. Retrieved June 13 from https://www.sharingcities.se
Shittu, O. (2020). Emerging sustainability concerns and policy implications of urban household consumption: A systematic literature review. *Journal of Cleaner Production*, *246*, 119034. https://doi.org/10.1016/j.jclepro.2019.119034
Shmidt, M. (2019). The sharing economy and its paradoxes: A sociological study of sharing communities in Russia. *Mir Rossii*, *28*(2), 148-171. https://doi.org/10.17323/1811-038X-2019-28-2-148-171
Si, H., Shi, J.-g., Wu, G., Chen, J., & Zhao, X. (2019). Mapping the bike sharing research published from 2010 to 2018: A scientometric review. *Journal of Cleaner Production*, *213*, 415-427. https://doi.org/10.1016/j.jclepro.2018.12.157
Skjelvik, J. M., Erlandsen, A. M., & Haavardsholm, O. (2017). *Environmental impacts and potential of the sharing economy* (Vol. 2017554). Nordic Council of Ministers.
Smarta Kartan. (2023a). *Kriterier*. https://www.smartakartan.se/kriterier/
Smarta Kartan. (2023b). *Smarta Kartan / Göteborg*. Retrieved April from https://www.smartakartan.se/goteborg/
Spatial Morphology Group. (2024). *Spatial Morphology Group - Chalmers University of Technology - Architecture and Civil Engineering*. Retrieved July from https://smog.chalmers.se
Ståhle, A., Marcus, L., & Karlström, A. (2005). Place Syntax: Geographic accessibility with axial lines in GIS. Fifth international space syntax symposium,
Statistics Sweden. (2024). *Household budget survey (HBS)*. Retrieved April from https://www.scb.se/en/finding-statistics/statistics-by-subject-area/household-finances/household-expenditures/household-budget-survey-hbs/
Stavroulaki, G., Berghauser Pont, M., & Fitger, M. (2023). *PSTDocumentation v3.2.4-3.2.5_20230110*. https://doi.org/10.13140/RG.2.2.23168.51208
Strulak-Wójcikiewicz, R., & Wagner, N. (2021). Exploring opportunities of using the sharing economy in sustainable urban freight transport. *Sustainable Cities and Society*, *68*(0). https://doi.org/10.1016/j.scs.2021.102778
Styr & Ställ. (2023). *Styr & Ställ*. Retrieved January from https://styrochstall.se/sv/
SurveyMonkey. (2023). *SurveyMonkey*. Retrieved April from https://www.surveymonkey.com
Sutherland, W., & Jarrahi, M. H. (2018). The sharing economy and digital platforms: A review and research agenda. *International Journal of Information Management*, *43*, 328-341. https://doi.org/10.1016/j.ijinfomgt.2018.07.004
System Mapping Academy. (2025). *System Mapping Toolkit*. https://miro.com/miroverse/system-mapping-toolkit/
Tahara, K., Shimizu, H., Nakazawa, K., Nakamura, H., & Yamagishi, K. (2018). Life-cycle greenhouse gas emissions of e-books vs. paper books: A Japanese case study. *Journal of Cleaner Production*, *189*, 59-66. https://doi.org/10.1016/j.jclepro.2018.03.321
Thagard, P., & Shelley, C. (1997). Abductive reasoning: Logic, visual thinking, and coherence. Logic and Scientific Methods: Volume One of the Tenth International Congress of Logic, Methodology and Philosophy of Science, Florence, August 1995,

Thebault-Spieker, J., Terveen, L., & Hecht, B. (2017). Toward a geographic understanding of the sharing economy: Systemic biases in UberX and TaskRabbit [Article]. *ACM Transactions on Computer-Human Interaction*, *24*(3), Article 21. https://doi.org/10.1145/3058499

Tian, P., Zhong, H., Chen, X., Feng, K., Sun, L., Zhang, N., Shao, X., Liu, Y., & Hubacek, K. (2024). Keeping the global consumption within the planetary boundaries. *Nature*, *635*(8039), 625-630. https://doi.org/10.1038/s41586-024-08154-w

Transport Analysis. (2021). *Travel survey*. Retrieved April from https://www.trafa.se/en/transportation-trends/travel-survey/

TUBS. (2011). *Italy in Europe* Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Italy_in_Europe_%28-rivers_-mini_map%29.svg

Tukker, A., & Jansen, B. (2006). Environmental Impacts of Products: A Detailed Review of Studies. *Journal of Industrial Ecology*, *10*(3), 159-182. https://doi.org/10.1162/jiec.2006.10.3.159

Tulinayo, F. P. F., Van Bommel, P. P., & Proper, H. A. E. (2012). From a system dynamics causal loop diagram to an object-role model: A stepwise approach [Article]. *Journal of Digital Information Management*, *10*(3), 174-186. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84866459829&partnerID=40&md5=128968f0bcab0a3bc3ebee5e3d62926e

Tversky, A., & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *science*, *185*(4157), 1124-1131. https://www.jstor.org/stable/1738360

UNEP. (2010). *ABC of CSP. Clarifying Concepts on Sustainable Consumption and Production*. https://sustainabledevelopment.un.org/content/documents/945ABC_ENGLISH.pdf

Vogt, W. (2005). Dictionary of Statistics & Methodology. In (3 ed.). SAGE Publications, Inc. https://doi.org/10.4135/9781412983907

Voytenko Palgan, Y., Mont, O., & Sulkakoski, S. (2021). Governing the sharing economy: Towards a comprehensive analytical framework of municipal governance. *Cities*, *108*, 102994. https://doi.org/10.1016/j.cities.2020.102994

Wheeldon, J., & Åhlberg, M. (2014). Mapping Mixed-Methods Research: Theories, Models, and Measures. In J. Wheeldon & M. Åhlberg (Eds.), *Visualizing Social Science Research: Maps, Methods, & Meaning*. SAGE Publications, Inc. https://doi.org/10.4135/9781483384528.n5

Whetstone, A., Kalmykova, Y., Rosado, L., & Lavers Westin, A. (2020). Informing sustainable consumption in urban districts: A method for transforming household expenditures into physical quantities. *Sustainability*, *12*(3), 802. https://doi.org/10.3390/su12030802

Willig, C., Terry, G., Rogers, W., Hayfield, N., Clarke, V., Braun, V. (2017). Thematic Analysis. In SAGE Publications Ltd (Ed.), *The SAGE Handbook of Qualitative Research in Psychology*. https://doi.org/10.4135/9781526405555.n2

Wiprächtiger, M., Rapp, M., Hellweg, S., Shinde, R., & Haupt, M. (2022). Turning trash into treasure: An approach to the environmental assessment of waste prevention and its application to clothing and furniture in Switzerland. *Journal of Industrial Ecology*, *26*(4), 1389-1405. https://doi.org/10.1111/jiec.13275

Xiang, D., Jiao, G., Sun, B., Peng, C., & Ran, Y. (2022). Prosumer-to-customer exchange in the sharing economy: Evidence from the P2P accommodation context. *Journal of Business Research*, *145*, 426-441. https://doi.org/10.1016/j.jbusres.2022.02.077

Yates, L. (2018). Sharing, households and sustainable consumption. *Journal of Consumer Culture*, *18*(3), 433-452. https://doi.org/10.1177/1469540516668229

Yin, W., Kirkulak-Uludag, B., & Chen, Z. (2021). Is the Sharing Economy Green? Evidence from Cross-Country Data. *Sustainability*, *13*(21), 12023. https://www.mdpi.com/2071-1050/13/21/12023

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*, 1368-1375. https://doi.org/10.1016/j.jclepro.2017.06.128

Zoli, M., & Congiu, L. (2024). *Individual behaviour and circular economy policies: Opportunities in Italy* (OECD Environment Working Papers No. 242, Issue.

Additional Material

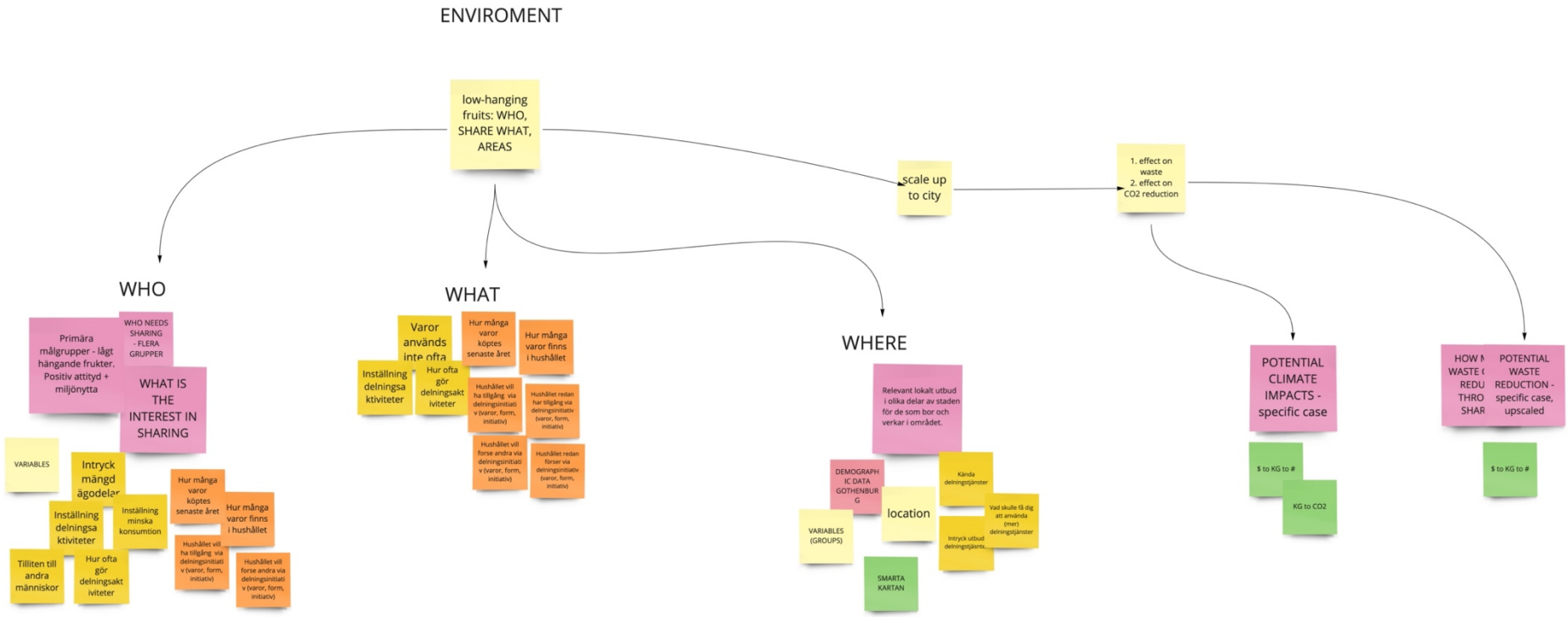

Figure A.1 – One outcome of the workshop held with the SCG representative. Here, the words outside boxes are perspectives about which the city would like to obtain information, included in RQ3 (WHO – demographic groups, WHAT – product groups, WHERE – geographical areas). The pink notes represent the needs underlined by the SCG project. The dark yellow notes represent variables available in the SCG survey, while the orange ones represent the variables available in the SEsam survey. Green notes refer to additional data available to the research team. This process focuses on the environmental sustainability of sharing. A similar procedure was done for social sustainability.