DOCTORAL (PhD) DISSERTATION

JULIUS RAETHER

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

KAPOSVÁR CAMPUS

2025

HUNGARIAN UNIVERSITY OF AGRICULTURE AND LIFE SCIENCES

SUSTAINABILITY CHALLENGES AND CONSUMER BEHAVIOUR IN OMNICHANNEL RETAILING: EMPIRICAL EVIDENCE FROM THE CONSUMER ELECTRONICS SECTOR

DOI: 10.54598/006930

JULIUS RAETHER

KAPOSVÁR, HUNGARY

2025

The PhD School

Name: Doctoral School of Economic and Regional Sciences
Discipline: Management and Organizational Sciences

Head: Prof. Dr. Zoltán Bujdosó, PhD
Full professor
Institute of Rural Development and Sustainable Economy
Hungarian University of Agriculture and Life Science

Supervisor: Prof. Dr. Viktória Szente, PhD
Full Professor
Faculty of Agriculture and Food Economics
Hungarian University of Agriculture and Life Science

....

Approval of the School Leader Approval of the Supervisor

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF FIGURES ABBREVIATIONS

CB-SEM	Covariance-Based Structural Equation Modelling
CFI	Comparative Fit Index
CI	Channel Integration
CO2	Carbon Dioxide
CS	Customer Satisfaction
CV	Curriculum Vitae
EA	Environmental Awareness
FMCG	Fast Moving Consumer Goods
GBI	Green Brand Identity
GPI	Green Purchase Intention
IT	Information Technology
OCR	Omnichannel Retailer
PLS-SEM	Partial Least Squares Structural Equation Modelling
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RMSEA	Root Mean Square Error of Approximation
SEM	Structural Equation Modelling
SM	Sustainability Measures
TBL	Triple Bottom Line
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behaviour
USD	United States dollar

1 INTRODUCTION

1.1 Background and motivation

The digital transformation has fundamentally reshaped the retail industry in recent years (Hänninen et al., 2021). A key development has been the transition from traditional multi-channel approaches to omnichannel retailing, where physical and digital sales channels are seamlessly integrated (Verhoef et al., 2015). From the customer perspective, a high degree of channel integration enhances a consistent shopping experience (Lemon & Verhoef, 2016). On the corporate side, this requires addressing increased strategic and operational complexity in coordinating distribution, logistics, and communication functions (Asmare & Zewdie, 2022).

However, the increasing integration of different sales and communication channels in omnichannel retailing not only poses technological challenges but also illustrates a direct interrelation with a growing emphasis on sustainability (Fahim et al., 2025). Companies are increasingly required to implement sustainability measures throughout the entire value chain while aligning their business practices with the principles of environmental, social, and economic responsibility (J. Chen & Liu, 2020). While omnichannel concepts enhance service availability and consumer convenience, they are simultaneously associated with additional CO2 emissions. Complex logistics chains, increasing return rates and the use of resource-intensive packaging significantly impact the environmental footprint (Sousa et al., 2021).

This is particularly evident in omnichannel retail with consumer electronics, which comprises products such as smartphones, notebooks, and household appliances. The consumer electronics industry not only records a comparatively high share of online sales (Olaf Roik, 2023) but also raises significant environmental concerns regarding scarce resource use, energy-intensive manufacturing, short product lifespans, and limited recycling potential (Althaf et al., 2021; J. Li et al., 2015). In light of this trade-off, the omnichannel retail sector for consumer electronics constitutes a particularly relevant empirical context for analysing consumer decision-making processes with regard to sustainability.

Against this background, the present dissertation examines how sustainability factors influence consumer behaviour in omnichannel retailing for electronic products**.** It adopts a multi-stage research design combining a systematic literature review on sustainability-related challenges in omnichannel retailing, and two complementary empirical investigations in the consumer electronics sector. The first empirical stage is a pilot study testing hypotheses on the influence

of individual and organisational factors on sustainable purchase intentions using structural equation modelling. The second stage expands this analysis with a larger sample and an extended model. Both empirical stages address the same core research model, with the second building directly on the first.

The motivation for this dissertation project is further strengthened by the authors professional experience in consumer electronics retailing, which has provided practical insights into the challenges arising at the intersection of omnichannel strategies and sustainability. By integrating conceptual, empirical, and practice-oriented perspectives within a single, coherent framework, the study aims to contribute both to academic understanding and to actionable recommendations for industry.

1.2 Research problem and relevance

The academic discourse on sustainability in omnichannel retailing has intensified in recent years. Nevertheless, a systematic examination of the associated sustainability challenges remains absent. The relevance of this research stems from the lack of comprehensive reviews that address the environmental, economic, and social dimensions of these challenges. Accordingly, the first part of this dissertation aims to address this research gap by conducting a systematic literature review in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009; Page et al., 2021). Through this review, existing knowledge on sustainability in the omnichannel context is synthesized, and open research questions are identified.

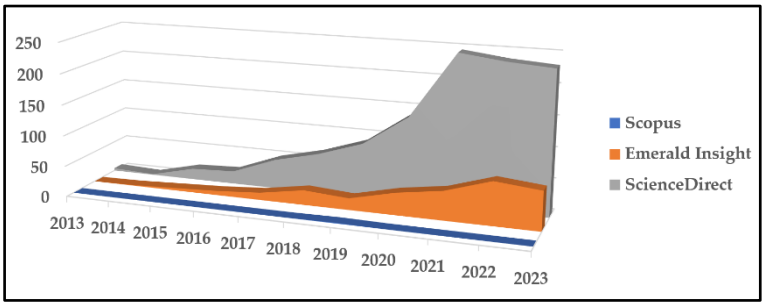


Figure 1. Increasing numbers of publications in omnichannel retail with sustainability context on ScienceDirect, Scopus, and Emerald Insight

Building on this theoretical foundation, the empirical part of the dissertation consists of two interrelated studies, a pilot study and a follow-up study, which are presented in an integrated manner in the results chapter. Both studies empirically investigate how sustainability-related factors influence consumer behaviour in the consumer electronics sector. While existing

literature highlights increasing environmental awareness among consumers, there is a lack of robust empirical evidence on which individual (e.g., environmental awareness) and organisational factors (e.g., channel integration) actually drive purchasing decisions for consumer electronics in an omnichannel retail environment. This research problem is addressed through a hypothesis-driven structural equation modelling (SEM) approach, which examines both direct and indirect causal relationships between individual and organisational factors. The consumer electronics sector is particularly relevant as a field of investigation, as it combines high online sales shares with substantial environmental impacts.

The economic dimension further highlights the relevance of the underlying research problem. With a market volume of €28.91 billion, the consumer electronics sector represents one of the key transformational industries within the German economy (Massanneck, 2025). Against this backdrop, this dissertation addresses the research problem by identifying sustainability-related challenges and empirically examining the factors that influence consumer purchasing decisions in omnichannel retailing for consumer electronics. The findings offer a structured foundation for the formulation of practice-oriented recommendations to support the development of sustainable strategies in the omnichannel retail environment.

The dissertation is therefore structured along two complementary but independent strands of research. The systematic literature review establishes the broader context by structuring ecological, economic, and social sustainability challenges in omnichannel retailing. The empirical part builds on a separate theory and literature base on consumer behaviour to develop and test a structural model of sustainability-related purchase decisions in the consumer electronics sector. The two approaches are methodologically different and pursued independently, but are linked by their shared focus on sustainability in omnichannel retailing. The systematic literature review provides the general contextual foundation, whereas the empirical studies examine consumer-related factors. Together, they ensure a coherent treatment of the topic across different levels of analysis.

1.3 Structure of the dissertation

The dissertation brings together all research components in a unified and continuous narrative, combining theoretical foundations, a systematic literature review, and empirical investigations within a coherent overall framework.. It is organised into nine main chapters, each of which contributes to the overarching objective of analysing sustainability-related challenges and their

influence on consumer behaviour in omnichannel retailing, with a particular emphasis on the consumer electronics sector.

Chapter 1 (INTRODUCTION) introduces the research topic, outlines the background and motivation, defines the research problem, and presents the contribution to both academic research and managerial practice. This opening chapter positions the work within the broader discourse on sustainability and omnichannel retailing, thereby establishing the conceptual framework from which the subsequent chapters emerge. Chapter 2 (OBJECTIVES TO ACHIEVE) specifies the objectives of the dissertation in detail, including the formulation of research questions. Chapter 3 (LITERATURE OVERVIEW) provides a comprehensive discussion on sustainability challenges in omnichannel retailing, sustainable consumer decision-making, the specific characteristics of the consumer electronics sector, and relevant theoretical perspectives. The chapter concludes with a synthesis of existing research findings, which serves as the basis for identifying research gaps for further scientific investigation. Chapter 4 Chapter 4 (RESEARCH MODEL AND HYPOTHESES) introduces the conceptual research model and specifies the hypotheses for empirical testing. It integrates theoretical frameworks such as the Triple Bottom Line and the Theory of Planned Behaviour with sector-specific determinants, distinguishing between individual and organisational factors. Chapter 5 (MATERIALS AND METHODS) outlines the methodological approach, describing the research design, data sources, sampling procedures, and analytical techniques. It presents the multi-stage research process, consisting of a systematic literature review and two complementary empirical studies, designed to build on each other, while addressing the overarching research questions.. Chapter 6 (RESULTS AND DISCUSSION) constitutes the central part of the dissertation, presenting the results and discussion. The findings from the literature review and the empirical studies are presented together, with cross-references indicating how the review offers contextual framing, while the empirical analyses provide evidence at the consumer level. Chapter 7 (CONCLUSIONS AND RECOMMENDATIONS) draws overarching conclusions, summarising the theoretical and practical implications of the research and offering recommendations for both, research and practice. Chapter 8 (NEW SCIENTIFIC RESULTS) highlights the original contributions of the dissertation, encompassing both empirical insights and methodological advances. Finally, Chapter 9 (SUMMARY) provides a concise synthesis of the introduction, literature review, results, conclusions, and recommendations. Supplementary materials are included in the appendices, comprising a list of publications, and the survey questionnaires used in the empirical studies.

In Conclusion, this structure ensures a clear progression from background to findings (see Figure 1).

Table 1. Overview of the structure of the dissertation

Chapter	Title	Description
Chapter 1	INTRODUCTION	Introduces the topic, background, motivation, research problem, and contribution.
Chapter 2	OBJECTIVES TO ACHIEVE	Defines objectives and research questions.
Chapter 3	LITERATURE OVERVIEW	Reviews literature on sustainability challenges, consumer behaviour, electronics sector, and theories; identifies gaps.
Chapter 4	RESEARCH MODEL AND HYPOTHESES	Develops the conceptual research model and formulates hypotheses based on theory.
Chapter 5	MATERIALS AND METHODS	Outlines research design, data sources, methods; describes literature review and empirical studies.
Chapter 6	RESULTS AND DISCUSION	Presents and discusses results from literature review and empirical studies.
Chapter 7	CONCLUSIONS AND RECOMMENDATIONS	Summarises conclusions and practical recommendations.
Chapter 8	NEW SCIENTIFIC RESULTS	Highlights new empirical and methodological contributions.
Chapter 9	SUMMARY	Summarises the work

1.4 Methodological approach

This dissertation follows a dual methodological approach that combines a systematic literature review and two empirical studies.

A systematic literature review is conducted in accordance with the PRISMA guidelines (Moher et al., 2009; Page et al., 2021). Relevant studies published between 2013 and 2023 were identified and analysed thorugh the databases ScienceDirect, Scopus, and Emerald Insight. The analysis focuses on the three dimensions of sustainability, aiming to identify key ecological, economic, and social sustainability challenges in the context of omnichannel retailing.

In the second step, a pilot study followed, involving 125 participants who completed a standardised online questionnaire. Following a structured multi-step approach (Al-Emran et al., 2019), the data were analysed using partial least squares structural equation modelling (PLS-SEM) with the SmartPLS software. The primary objective was to test initial hypotheses concerning the influence of individual factors (e.g., environmental awareness) and

organisational factors (e.g., channel integration) on consumer behaviour and sustainable purchase intentions.

Finally, the pilot study is extended by drawing on a larger sample of 358 respondents and implementing a more advanced methodological approach. While the questionnaire remained unchanged, the analysis was conducted using covariance-based structural equation modelling (CB-SEM) via the R packages lavaan (Rosseel, 2012) and semTools (D. J. Bauer & Curran). This method enables a more detailed examination of both direct and indirect effects, as well as a comprehensive assessment of model fit using fit indices such as the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Root Mean Square Error of Approximation (RMSEA).

By combining these different methodological approaches, the dissertation provides a well-founded analysis of sustainability-related challenges and the factors influencing sustainable consumer behaviour in omnichannel retailing, with a particular focus on the consumer electronics sector.

1.5 Contribution to research and practice

A clear and structured theoretical contribution to research is pursued at the interface of sustainability research, consumer behaviour, and omnichannel retail integration. Through a systematic review of the existing literature, with a particular emphasis on sustainability challenges, the dissertation identifies contextual challenges, while the empirical studies develop and validate a theory-driven explanatory model of consumer behave. This approach contributes to a deeper understanding of the relevance of individual and organisational factors in sustainable consumption decisions within the context of omnichannel retailing. This methodological approach integrates qualitative and quantitative methods while accounting for both exploratory and confirmatory modelling procedures.

On a practical level, this dissertation seeks to contribute to the development of evidence-based recommendations for omnichannel retailers in the consumer electronics sector aiming to foster sustainable consumption more effectively. Central to this is the identification of relevant factors such as brand identity, channel integration, or environmental awareness that can serve as levers to encourage ecologically responsible purchasing decisions.

This dissertation positions itself as a bridge between research and practice, and contributes to the ongoing academic and practical discourse, with a particular focus on the consumer electronics industry. It aims to identify key sustainability challenges and to develop a deeper

understanding of how sustainability influences consumer behaviour in the context of omnichannel retailing.

2 OBJECTIVES TO ACHIEVE

2.1 Research objectives

The objective of this dissertation is to develop a deeper understanding of sustainability-related consumer behaviour in the context of omnichannel retailing, with a particular focus on the consumer electronics sector. The core focus lies on analysing the determinants of sustainable purchase intentions and how these individual and organisational factors interact.

The first objective is to systematically capture and structure the current state of research on sustainability challenges in omnichannel retailing. A systematic literature review identifies ecological, economic, and social challenges across the entire value chain. This is essential to provide conceptual clarity and to highlight areas where consumer-related perspectives are still missing.

The second objective is to develop a theory-driven structural model that reflects the key determinants of sustainable purchasing intentions in omnichannel retailing. Based on the findings of the literature review, the model addresses central sustainability challenges and examines how individual factors (environmental awareness and customer satisfaction) and organisational factors (green brand identity, channel integration and sustainability measures) are associated with purchasing behaviour in the consumer electronics sector.

The third objective is to validate both the direct and indirect relationships between individual and organisational factors, thereby clarifying the conditions under which they influence green purchase intention. To quantitatively examine the complex interplay of sustainability-related factors on consumer behaviour in omnichannel retailing within the consumer electronics sector, hypothesis-driven structural equation modelling is applied. In this way, the dissertation offers robust empirical evidence on the interplay of sustainability-related factors in consumer decision-making and complements existing conceptual discussions with quantitative insights.

The fourth objective is to expand sustainability research by focusing on the consumer electronics retail sector. This sector is particularly relevant due to its substantial environmental impact and distinct omnichannel usage patterns. Nevertheless, it remains largely underexplored with regard to systematic analyses of sustainability-oriented consumer decision-making. Concentrating on this industry therefore helps to address a pressing practical challenge while advancing sector-specific academic knowledge

The fifth objective is to derive practice-oriented implications for omnichannel retailers in the consumer electronics sector based on the theoretical and empirical findings of this dissertation. These insights aim to deepen the understanding of sustainable consumer behaviour and to support the effective alignment of sustainability strategies with consumer needs in the omnichannel retail context.

2.2 Research questions

The research questions (see Table 2) are derived from the identified research gaps and objectives and provide the thematic framework for this dissertation.

Table 2. Research Questions

	Research Questions	Context
1	What are the main sustainability challenges in omnichannel retailing from a consumer perspective, and how are these challenges addressed in the existing academic literature?	Addressed through a systematic literature review, structuring existing research on sustainability in omnichannel retail.
2	Which individual and organisational factors influence sustainable purchase intentions in the context of omnichannel retailing?	Explored in the empirical analyses. Factors such as environmental awareness, customer satisfaction, green brand identity, channel integration, and sustainability measures are examined.
3	To what extent do these individual and organisational factors influence consumer behaviour and sustainability-related purchasing behaviour?	Analysed in the empirical studies: Structural models analyse direct and indirect effects among influencing factors using structural equation modelling (SEM).
4	How do sector-specific characteristics of the consumer electronics industry shape sustainability-related consumer decision-making in omnichannel retail contexts?	Covered in the empirical studies: Only participants who had purchased a consumer electronics device within the last 24 months were eligible to take part in the survey.
5	How can the empirical findings in the consumer electronics sector be translated into practice-oriented recommendations for omnichannel retailers?	Derived from the discussion of findings from the in the empirical studie and formulated in the recommendations section.

3 LITERATURE OVERVIEW

This chapter reviews the relevant literature and establishes the conceptual foundation for the dissertation. It combines two complementary but independent components. The first part in Chapter 3.1 addresses sustainability challenges in omnichannel retailing and sets out the rationale for conducting a systematic literature review. The second part in Chapter 3.2 focuses on consumer behaviour and sustainable decision-making, identifying the determinants that form the conceptual basis of the empirical analysis, with a particular emphasis on the consumer electronics sector. Both parts are embedded in established theoretical frameworks. Together, they provide both the broader sustainability challenges in omnichannel retailing and the conceptual grounding for analysing consumer behaviour, forming the basis for the subsequent development of the research model. The analytical procedure of the systematic literature review is described in Chapter 5.1 (MATERIALS AND METHODS), and its results are presented in Chapter 6.1 (RESULTS AND DISCUSION). The chapter concludes with a synthesis of findings and the identification of research gaps.

3.1 Sustainability in omnichannel retailing

The following section provides the contextual foundation for the dissertation by examining sustainability challenges in omnichannel retailing and positioning them within the Triple Bottom Line framework. It also establishes the rationale for conducting a systematic literature review, which consolidates fragmented insights into sustainability challenges and thereby clarifies the contextual background for the empirical analyses in Chapter 3.2.

3.1.1 Background and relevance

Omnichannel retailing poses significant sustainability challenges for companies (Iglesias-Pradas & Acquila-Natale, 2023; Jena & Meena, 2022). Complex supply chains, high return rates, and the use of multiple packaging materials lead to increased emissions and greater resource consumption (Bosona, 2020; Halldórsson & Wehner, 2020; Sousa et al., 2021). The so-called last mile, referring to the final stage of delivery to the end customer, is widely regarded as particularly emission-intensive and represents a key contributor to CO2 emissions within omnichannel retail logistics (Buldeo Rai, 2019; Pourmohammadreza et al., 2025). Fragmented shopping baskets, flexible delivery options, and extended transport routes further contribute to increased energy use and resource consumption (Buldeo Rai et al., 2019b; Escursell et al., 2021; Giuffrida et al., 2019). From a strategic management perspective, implementing sustainability in omnichannel retailing requires the seamless integration of logistics, digital infrastructure and

customer-oriented processes (Briel, 2018; X. He et al., 2023). Effective sustainability measures, such as low-emission delivery options, integrated return systems, and environmentally friendly packaging, must be systematically implemented along the entire value chain (X. He et al., 2023; Kayikci, 2018; Sousa et al., 2021). These developments underscore the need for an integrative framework to structure the discussion of challenges.

3.1.2 Conceptual lens: Triple Bottom Line (TBL)

The Triple Bottom Line (TBL) (Figure 2) provides such a framework, offering a comprehensive theoretical foundation by treating economic, environmental and social aspects as equally relevant dimensions of sustainable business management (Barbier, 1987; Kleindorfer et al., 2005). Ecological aspects in omnichannel retail are particularly visible in emissions, packaging waste and energy consumption along supply chains, especially on the last mile (Buldeo Rai, 2019), while economic aspects address the balance between efficiency and costs, and social aspect emphasize, for example, fair working conditions (Gimenez et al., 2012) or transparent communication and the active inclusion of consumers in responsible purchasing processes. Overall, sustainable omnichannel retailing requires the systematic integration of all three dimensions of the Triple Bottom Line along the entire value chain.

The systematic literature review undertaken in this dissertation provides the basis for structuring sustainability challenges along the environmental, economic, and social dimensions of the Triple Bottom Line in the context of omnichannel retailing. At the same time, the TBL framework serves as a unifying lens for interpreting these challenges and for positioning the individual and organisational factors considered in the empirical studies.

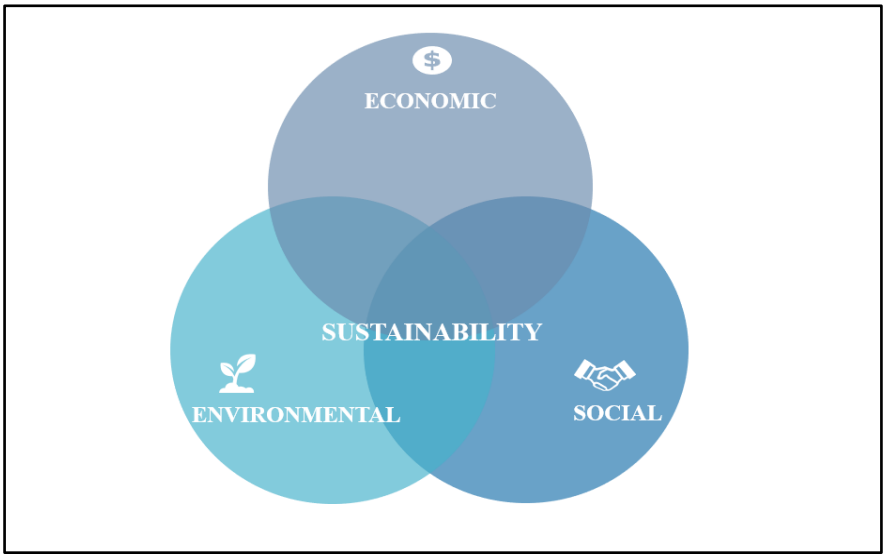


Figure 2. Interconnections of the three pillars of sustainability.
Source: Author's own elaboration, based on Sikdar (2003)

3.1.3 Core sustainability challenges in omnichannel retailing

Advances in digital technologies have transformed sales channels (Verhoef et al. 2021). Omnichannel has become the new standard in retail (Y. Chen et al., 2018; Cocco & De-Juan-Vigaray, 2022; Verhoef et al., 2015). This development has been further accelerated by the impact of the COVID-19 pandemic (Timotuis, 2021; Verhoef, 2021; L. Zhang & Hänninen, 2022). In omnichannel retailing, the individual sales and communication channels are merged (Cummins et al., 2016). This ensures a consistent, channel-overlapping customer approach (Cai & Lo, 2020; Verhoef et al., 2015). The high degree of channel integration enhances the shopping experience (Lemon & Verhoef, 2016). However, it is highly complex at different levels from the corporate perspective (Dirsehan, 2021). Major challenges for companies are channel integration and linkage, channel management, data analytics and understanding cross-channel customer behaviour (Briel, 2018; Mirzabeiki & Saghiri, 2020; Simone & Sabbadin, 2017; Ye et al., 2018).

At the same time, sustainability-related challenges are becoming increasingly prominent. The impact of climate change is not only one of the most urgent contemporary challenges for society and politics (Werners et al., 2013), but also for companies (Cai & Choi, 2021). Retailers in the rising field of omnichannel are particularly affected by this development because the nature of the cross-channel business model includes a variety of sustainability-related aspects due to the different digital and physical touchpoints and processes (Sousa et al., 2021). A wide range of corporate activities along the entire value chain is concerned (Adivar et al., 2019). Examples of

the spectrum of sustainability challenges in omnichannel retailing include e-commerce logistics, with its ecological footprint, returns management and the use of eco-friendly materials from a corporate perspective and all these can be traced back the increasing environmental awareness of consumers (Bălan, 2021; Sousa et al., 2021; Tanriverdi & Aydın, 2024).

The literature on sustainability challenges has common overlaps and blurred boundaries between the different dimensions. A dominant research focus on the ecological challenges in omnichannel retailing is the scientific examination of logistics (Elia et al., 2021; Melacini & Tappia, 2018; Muñoz-Villamizar et al., 2021). Although omnichannel retailing allows the customer to choose between different sales channels (e.g. web shop, in-store, click & collect or ship-from-store), the transport of goods, regardless of the delivery or collection option, is in all cases accompanied by CO2 emissions (Buldeo Rai, 2019). Studies have indicated that direct delivery of goods in omnichannel retailing is usually more environmentally friendly than shop pick-up, but only if ambiguous factors such as excessive packaging waste or possible returns are not taken into account (Bertram & Chi, 2018; Escursell et al., 2021). According to Giuffrida et al., the most critical factor influencing sustainability, whether direct shipping or click & collect is more environmentally efficient, depends on the distance between the customer's home and the retail shop (Giuffrida et al., 2019).

The so-called last mile concern is frequently mentioned in the literature as a serious challenge for omnichannel retailers (Bosona, 2020; Lim & Srai, 2018). Factors for an efficient last mile are the avoidance of returns, cooperation with sustainable logistics service providers and the optimisation of fulfilment processes (Buldeo Rai, 2019; Hübner et al., 2016; Lim & Srai, 2018). Taylor et al. recommends that retailers address this challenge with a uniform, agile information technology (IT) system that maps all steps and functions along the entire supply chain (Taylor et al., 2019).

Taken together, the fragmented insights provided by existing studies highlight the need for a systematic consolidation of sustainability challenges in omnichannel retailing.

3.1.4 Consumer awareness and managerial responses

Omnichannel retailers, however, are not the only parties that affect environmental impact. The carbon footprint is also determined by consumer behaviour (Buldeo Rai, 2019). Studies indicate that customer awareness in terms of sustainability has grown, in particular with the advent of the COVID-19 pandemic (Bălan, 2021; Koleva & Chankov, 2022; Švecová et al., 2020). For example, Bălan or Koleva and Chankov demonstrate a strong scientific interest in

understanding enhanced customer awareness and sustainability-related purchasing behaviour (Bălan, 2021; Koleva & Chankov, 2022).

Even if the above authors' studies represent an enlightening contribution to omnichannel research on sustainability challenges, only one partial aspect is considered (consumer behaviour). Approached from the corporate perspective, studies imply that the challenge of increasing consumer awareness towards greater sustainability can be addressed with more transparency and honest green marketing initiatives (no greenwashing) (Arora, 2019; Harris et al., 2016; Nguyen & Johnson, 2020; Young et al., 2009). However, such initiatives by retailers are only credible if the preconditions in terms of sustainability, e.g. through more sustainable products or business processes, are met (Wiese et al., 2015). Following, credible sustainability communication requires corresponding operational measures.

This link between consumer expectations and corporate responses underlines the importance of first consolidating the overall sustainability challenges through a systematic literature review, before moving on to the analysis of consumer-related factors in the empirical part of this dissertation.

3.1.5 Rationale for the systematic literature review

The increasing number of scientific publications reflects a growing interest in omnichannel retailing from a sustainability point of view. However, structured summaries to provide an overall view of the various aspects of sustainability are lacking in this field of research. The extant literature addresses the different challenges (e.g., transport and logistics). To address this gap, the present dissertation conducts a systematic literature review to identify and structure the current sustainability challenges in omnichannel retailing. Other objectives of this review are to categorise the individual challenges from a business perspective and to analyse and evaluate the screened studies to inform future research areas and directions. In addition, the review establishes the most frequently discussed sustainability dimensions and their specific challenges, as well as the most challenging part of the supply chain.

The systematic literature review therefore consolidates the contextual background of sustainability challenges in omnichannel retailing. However, it does not constitute the direct foundation for the hypotheses developed later in this dissertation. Instead, the hypotheses are derived from the consumer-behaviour literature, which is introduced in the following section. Accordingly, the review serves both as a structured systematisation of sustainability challenges

across ecological, economic, and social dimensions and as a contextual frame for the empirical analyses, while keeping a clear distinction from the theory-driven development of hypotheses.

3.2 Consumer behaviour and sustainable decision-making

There is no uniform definition of sustainable consumption behaviour in scientific literature (Dong et al., 2020). Nevertheless, sustainable consumption is generally defined as a conscious and reflective decision-making and behavioural process that aims to balance individual needs with ecological, economic and social objectives (Peattie & Collins, 2009; Šajn & Nikolina, 2020). Closely related to this is the concept of consumer behaviour, which encompasses the observable decision-making and purchasing behaviour of consumers and includes all cognitive, affective and social factors that influence purchasing intentions and actual buying actions (Solomon et al., 2012). This dissertation adopts these definitions, as a clear conceptual foundation is necessary to systematically classify and analyse the factors that influence sustainable purchasing decisions in omnichannel retailing.

Recent research shows that consumers in omnichannel contexts frequently face conflicting demands (Mahmoud et al., 2022; Malhotra & Srivastava, 2024; Prayoga et al., 2020; Skowron & Sak-Skowron, 2021), for example when balancing convenient and flexible delivery options, price attractiveness and ecological considerations. These tensions illustrate that a high level of environmental awareness alone does not automatically translate into a strong green purchase intention, highlighting the need to examine how consumer behaviour shapes the translation of sustainability-related attitudes into actual purchasing decisions.

Against this background, key factors that explicitly influence consumer behaviour and sustainability-related purchase intentions in omnichannel retailing can be identified from theory and prior research. These factors form the conceptual foundation for the empirical analysis and are introduced in the following discussion.

3.2.1 Determinants of sustainable consumer behaviour

Sustainable consumer behaviour in omnichannel retailing is shaped by multiple determinants that have been highlighted in prior research. On the consumer side, attitudinal orientations and experiential factors play a central role, while on the retailer side, strategic choices and structural practices are of particular importance Together, these dimensions explain how sustainability considerations are translated into actual purchase decisions in the consumer electronics sector. The following section discusses the most relevant determinants highlighted in previous.

3.2.1.1 Environmental awareness

One of the key influencing factors in consumer research is environmental awareness (Wiwik Handayani et al., 2021). Environmental awareness refers to an individual's sensitivity to ecological interconnections and their awareness of the environmental implications of their own consumption behaviour (Gadenne et al., 2009). It can be further differentiated into cognitive elements, referring to knowledge about sustainability challenges and affective elements, capturing values and ethical attitudes towards environmental protection, as well as behavioural dispositions, reflecting the willingness to adapt consumption accordingly (Wiwik Handayani et al., 2021).

Environmental awareness is gaining increasing significance in sustainability research. The scientific debate has noted an enhanced awareness and customers emerging as drivers of sustainable innovation (Buldeo Rai, 2019; Galli et al., 2022; Jena & Meena, 2022). Consumers are placing growing emphasis on environmentally friendly products and sustainable business practices, which are progressively being adopted in omnichannel retailing (Sousa et al., 2021). Previous studies identify several relevant factors influencing sustainable purchasing decisions, including price willingness (A. Bauer, 2021), ecological transport solutions (Buldeo Rai, 2021), consistent channel integration (Z. W. Lee et al., 2019), and transparent and credible sustainability communication (Nguyen & Johnson, 2020).

Empirical studies indicate that environmentally aware consumers are more likely to avoid ecologically harmful products and accept trade-offs such as higher prices or longer delivery times, and actively inform themselves about retailers sustainability practices (Buldeo Rai, 2019; Dunlap et al., 2000; Saari et al., 2021). These behavioural patterns illustrate both the potential and the limitations of environmental awareness as a predictor of actual consumption behaviour.

However, environmental awareness among consumers does not necessarily translate into sustainable consumption practices (H. Cao & Shao, 2021). This divergence between attitudes and actions is known as the attitude-behaviour gap (Boulstridge & Carrigan, 2000; Moraes et al., 2012). A central reason for this gap lies in the higher costs of sustainable business models, which also apply to consumer electronics products. Even if the willingness to pay more for sustainable products is increasing on the consumer side, higher prices can still influence purchasing decisions (A. Bauer, 2021). In addition, sustainability-oriented options are often associated with longer delivery times or reduced convenience. It therefore remains unclear to

what extent consumers' environmental awareness in the context of consumer electronics translates into actual purchasing decisions when such trade-offs are involved.

In industries such as cosmetics and fashion, environmental awareness has been identified as a key driver of sustainable purchasing behaviour (Bilińska-Reformat & Dewalska-Opitek, 2021; Teixeira et al., 2023; Zahid et al., 2018). Although there are different approaches to omnichannel retailing in the consumer electronics industry (Marchet et al., 2017 - 2017; Melacini & Tappia, 2018; Wu et al., 2024), the extent to which environmental awareness translates into sustainable consumption decisions remains insufficiently explored. Initial empirical findings suggests that environmentally aware consumers value ecological aspects within the omnichannel context, for example, when it concerns the return of online-purchased goods to a retail shop (Yao et al., 2024).

In summary, environmental awareness represents an important but not yet fully understood determinant of sustainable consumer behaviour in omnichannel retailing for consumer electronics. While it can stimulate demand for ecological products and services, its translation into actual purchasing behaviour depends strongly on contextual factors such as convenience and industry characteristics. These complexities underline the importance of examining not only environmental awareness in isolation but also its interaction with other determinants such as customer satisfaction. From a theoretical perspective, environmental awareness corresponds to the attitude component of the Theory of Planned Behaviour (Ajzen, 1991), providing a conceptual bridge to the hypotheses developed in Chapter 4.

3.2.1.2 Customer satisfaction

The extent to which a service or product meets the consumer's expectations defines customer satisfaction (Ha & Perks, 2005). In an omnichannel context, customer satisfaction is positively influenced by comfort, trust and convenience (Ng et al., 2021). In addition to the seamless shopping experience, omnichannel research also mentions the successful realisation of the last mile as a positive feature for increasing satisfaction (Tyrväinen & Karjaluoto, 2019). More generally, a stronger degree of omnichannel integration has been shown to positively influence both customer satisfaction and loyalty intentions (Lazaris et al., 2021). Findings from consumer behaviour research also show that customer satisfaction is a key determinant of purchase intention (Kim et al., 2009; V. Lee et al., 2022).

Beyond conventional purchase intentions, research in sustainability-related sectors, such as food, demonstrates the specific role of satisfaction in driving green purchasing behaviour (Y.

Li et al., 2024). Wang et al. reveal that consumer satisfaction positively influences green food purchase intention directly and indirectly (J. Wang et al., 2023). Other research confirms that satisfaction has a strong positive effect on the repurchase intention of organic food among Generation Z consumers (Bhutto et al., 2023). Taken together, these insights suggest that satisfaction mitigates perceived risks, strengthens trust and perceived value, and thereby encourages consumers to choose sustainable products.

While customer satisfaction has been widely examined in general consumer behaviour research and in sustainability-oriented markets such as food, its specific role in shaping sustainable purchasing decisions in the omnichannel consumer electronics sector has so far remained underexplored.

3.2.1.3 Sustainability measures

The critical debate on sustainability solutions in the omnichannel retail sector has increased on the consumer side in recent years (Klein & Popp, 2023; Potter et al., 2024; Sfakianaki et al., 2022). However, the complexity of omnichannel retailing, due to diverse channels, multiple shipping options, and the possibility of digital consumption of physical products (e.g. books, music, or films), often makes it difficult for consumers to fully assess the environmental impact of this retail format (Buldeo Rai, 2021). Although environmental concerns are gaining relevance in consumers' awareness, various studies show that these concerns are not consistently reflected in actual purchasing behaviour (Ebner et al., 2022). For example, Buldeo Rai et al. and Sallnäs et al. observed a limited interest among customers in more environmentally friendly transport options in an omnichannel environment (Buldeo Rai et al., 2019b; Sallnäs & Björklund, 2020). At the same time, other research demonstrates that environmentally friendly measures, such as eco-friendly delivery methods, increase brand visibility and customer loyalty (Kembro & Norrman, 2019; Sousa et al., 2021).

This ambiguity regarding how sustainability measures influence customer behaviour makes it particularly relevant to investigate further. Given the significant environmental footprint of consumer electronics, existing research suggests that sustainability measures such as climate-neutral delivery, sustainable packaging, and take-back systems for old appliances may play a particularly relevant role in shaping consumer perceptions and experiences in this sector. At the same time, their effectiveness depends on the extent to which these measures are consistently embedded across all sales and communication channels. This leads directly to the next

determinant, which has been identified as a critical prerequisite for ensuring a seamless and sustainable shopping experience.

3.2.1.4 Channel integration

In omnichannel retail, the individual sales and communication channels are brought together for a consistent, cross-channel customer approach (Verhoef et al., 2022). A high degree of channel integration positively affects the customer's shopping experience (Lemon & Verhoef, 2016). For omnichannel retailers, this is a complex challenge on several levels. Channel integration, data management and the analysis of cross-channel customer behaviour need to be coordinated (Briel, 2018). This requirement also applies to integrating and coordinating activities to improve sustainability in an omnichannel retail environment. Sustainable shipping options, a take-back system for used goods and electronic waste that can be applied across all channels, or optimising the supply chain to reduce CO2 emissions are just a few examples for environmental initiatives that have to be implemented and coordinated across all channels (X. He et al., 2023; Y. He et al., 2020; Kayikci, 2018).

The quality of channel integration represents a critical success factor in omnichannel retailing (Z. W. Lee et al., 2019; Mirsch et al., 2016). A high level of integration and convenience positively affects customer satisfaction and foster trust in the omnichannel retailer (Buckley et al., 2024; T. Y. Chen et al., 2023; Pereira et al., 2023). Beyond enhancing satisfaction, well-integrated channel systems also influence consumers purchase intentions and can increase willingness to buy (M. Zhang et al., 2018). Prior studies also highlight positive links between channel integration and retailers' sales growth (L. Cao & Li, 2015), underlining its strategic relevance.

Taken together, research highlights the strategic role of channel integration in omnichannel retailing, both for creating a seamless consumer experience and for embedding sustainability measures across channels. However, in the consumer electronics sector, it remains insufficiently explored how integrated approaches such as recycling-oriented return programs, CO2-neutral deliveries or reusable packaging influence customer satisfaction and purchasing behaviour in practice.

3.2.1.5 Green brand identity

According to Tajfel and Turner's Social Identity Theory, people derive part of their identity from the social group (e.g. political parties or sports clubs) to which they belong (Tajfel & Turner, 1986). However, brands can also be a source of identification (Shao & Lassleben, 2021). In this

sense, brands function as identity markers that consumers align with their self-concepts, particularly when brand values are perceived as authentic and value-congruent. Previous research confirms that brands strongly committed to sustainability can build an emotional bond with their customers (Bartels & Hoogendam, 2011). If brands can demonstrate values such as environmental awareness and social responsibility in a credible way, this has a positive impact on customers purchasing decisions (Salnikova et al., 2022). The clothing manufacturer and omnichannel retailer Patagonia is cited in the literature as a positive example of a brand that consumers particularly identify with due to its commitment to environmental protection (Michel et al., 2019; Potter et al., 2024). A strong identity-forming brand attracts customers (Shao & Lassleben, 2021). In order to achieve a high degree of consumer identification with a brand, all activities must be consistently aligned across all channels and touchpoints.

A number of studies in the clothing industry examine how sustainable business practices in omnichannel retailing increase brand reputation and influence customer brand perception, identification, and purchase intentions (Purcărea et al., 2022; Shao & Lassleben, 2021; Vhatkar et al., 2024). In contrast, the research field of omnichannel retailing for consumer electronics remains largely unexplored, despite the sector's high environmental impact and its strategic importance in cross-channel retail.

3.2.2 Classification of determinants

The determinants outlined above can be systematically differentiated into two overarching categories: Individual factors and organisational factors. This classification reflects the theoretical assumption that consumer behaviour in omnichannel contexts is influenced both by personal attitudes and perceptions as well as by retailer-driven strategies and structures.

Individual factors refer to psychological and experiential dimensions (Ejelöv & Nilsson, 2020; Rouzbahani et al.). They describe how customers perceive, evaluate, and respond to sustainability-related stimuli. In this dissertation, environmental awareness captures consumers ecological sensitivity and its behavioural implications, and customer satisfaction reflects the degree to which consumption experiences correspond to or exceed expectations. Both determinants are situated at the individual level, as they are shaped directly by consumer perceptions and evaluations.

Organisational factors, in contrast, arise from strategic and structural decisions on the company side (Augusto & Rodrigues, 2015; J. J. Y. Zhang et al., 2023). They reflect the ways in which business anchor sustainability in their processes, systems, and positioning. Within this category,

sustainability measures represent concrete retailers actions, channel integration reflects the technical and organisational alignment of sales and communication channels, and green brand identity expresses the retailers strategic orientation and value communication.

In this dissertation green brand identity is included as an organisational factor because it is deliberately created, shaped, and communicated by the company (da Silveira et al., 2013). At the same time, its impact only unfolds at the individual level, when consumers perceive and internalise the brand sustainability-related values. The Social Identity Theory (Tajfel & Turner, 1986) helps explaining this dual role: Although brands are strategically managed at the organisational level, they become effective only when they are integrated into the consumers social self-concept. In line with this view, other studies also classify brand identity as an organisational driver in omnichannel and sustainability research, since it originates from corporate strategy and brand management (Shao & Lassleben, 2021).

Taken together, these variables represent the explanatory variables of this dissertation, whereas Green purchase intention, functions as the outcome variable, capturing sustainable purchase intentions in the context of omnichannel retailing, as illustrated in Figure 3.

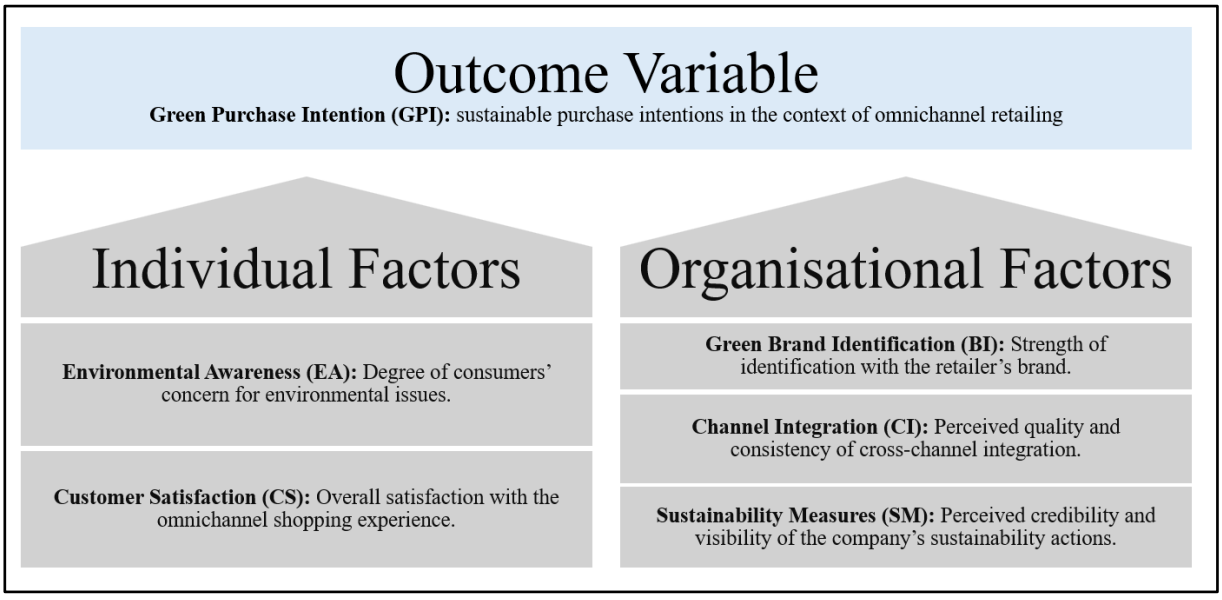


Figure 3. Individual and organisational factors
Source: Author's own elaboration

This conceptual distinction between individual and organisational factors establishes the theoretical basis for analysing sustainable consumer behaviour and gains particular relevance in markets with high ecological footprints and short innovation cycles. The consumer electronics sector represents such a context and is examined in the next part of the dissertation.

3.3 The consumer electronics sector

The consumer electronics sector presents a particularly relevant field for sustainability-related research in omnichannel retailing. It comprises electronic and digital entertainment devices, private telecommunications and IT products such as smartphones or laptops for everyday use by end consumers (Olaf Roik, 2024). In 2023, the German consumer electronics market achieved a turnover of 28.9 billion euros (see Figure 4), this value increased to 28.9 billion euros in 2024, underlining its considerable economic and social significance (Blum, 2025). This positions Germany among the worlds four largest markets and highlights its economic relevance.

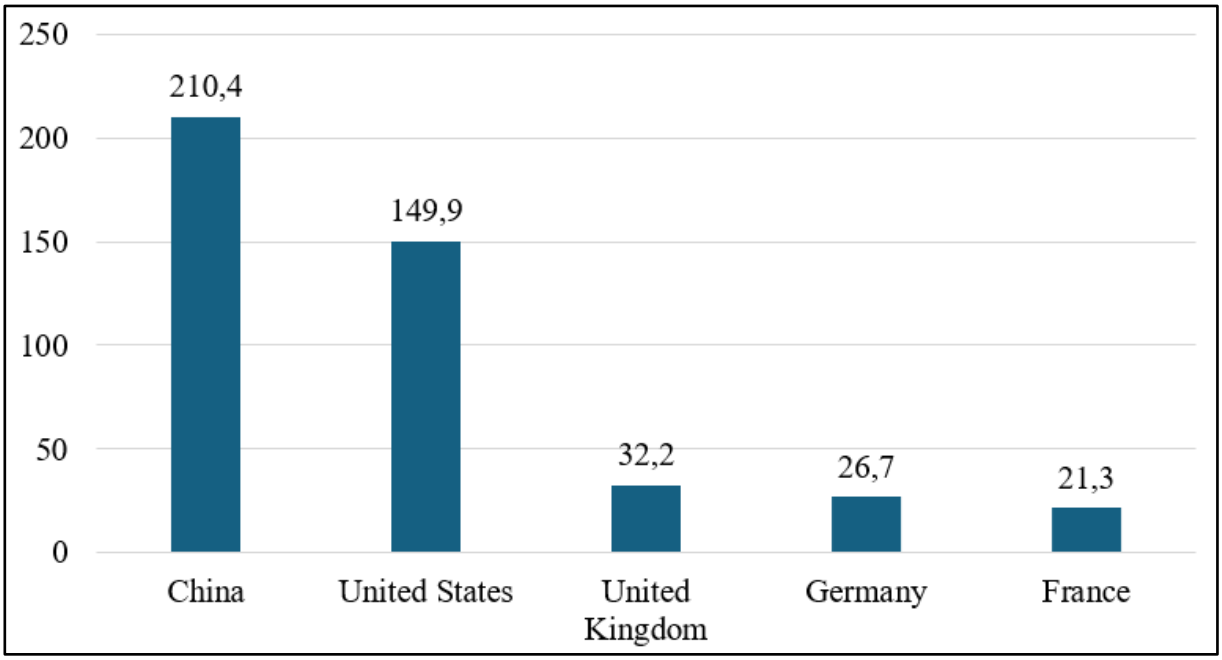


Figure 4. Consumer electronics market comparison with revenue 2023 in billion (USD)
Source: Author's own elaboration, based on Statista (2024)

In order to define the boundaries of the consumer electronics sector, it is important to distinguish between different product categories. The market generally encompasses televisions, radios, and multimedia devices, together with mobile phones, computing equipment such as laptops and tablets, peripheral devices like streaming hardware, and drones (Statista, 2024a). These categories form the central segments of consumer electronics market. In contrast, video game consoles, virtual reality devices, household appliances, and smart remotes or displays are not considered part of this sector. An overview of the sub-segments of the consumer electronics market is provided in Figure 5.

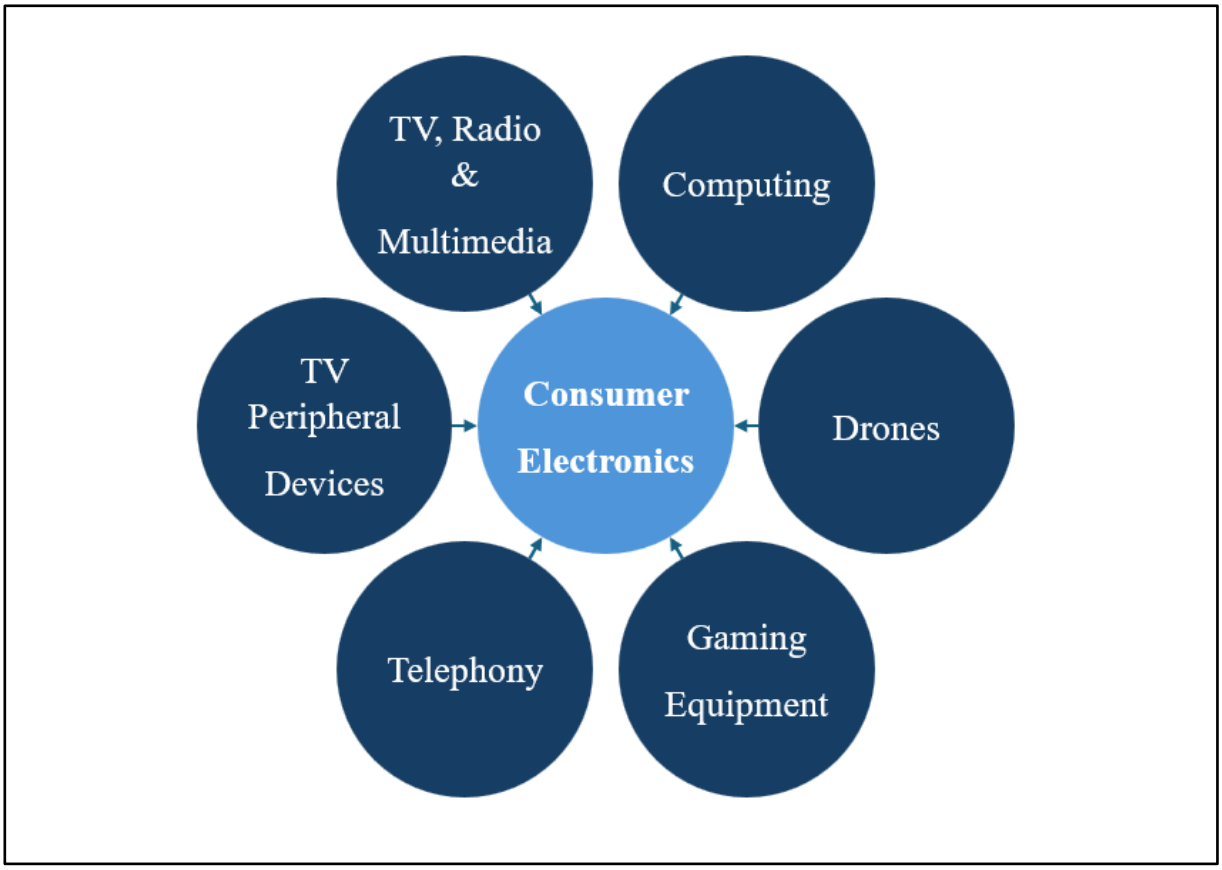


Figure 5. Sub-segments of the consumer electronics market
Source: Author's own elaboration, based on Statista (2024a)

Beyond its structural segmentation, consumer electronics in Germany is further characterised by a pronounced omnichannel orientation. 42 percent of the sales in this sector are primarily purchased online, 29 percent mainly in physical retail stores, and another 29 percent of the consumers use both channels equally (Statista, 2024b). Figure 6 illustrates this distribution, which shows a more balanced integration of digital and offline channels than in any other market sector in Germany. This pattern underscores the relevance of consumer electronics for analysing purchasing behaviour in an omnichannel context, as it combines high online penetration with the continued significance of physical retail stores.

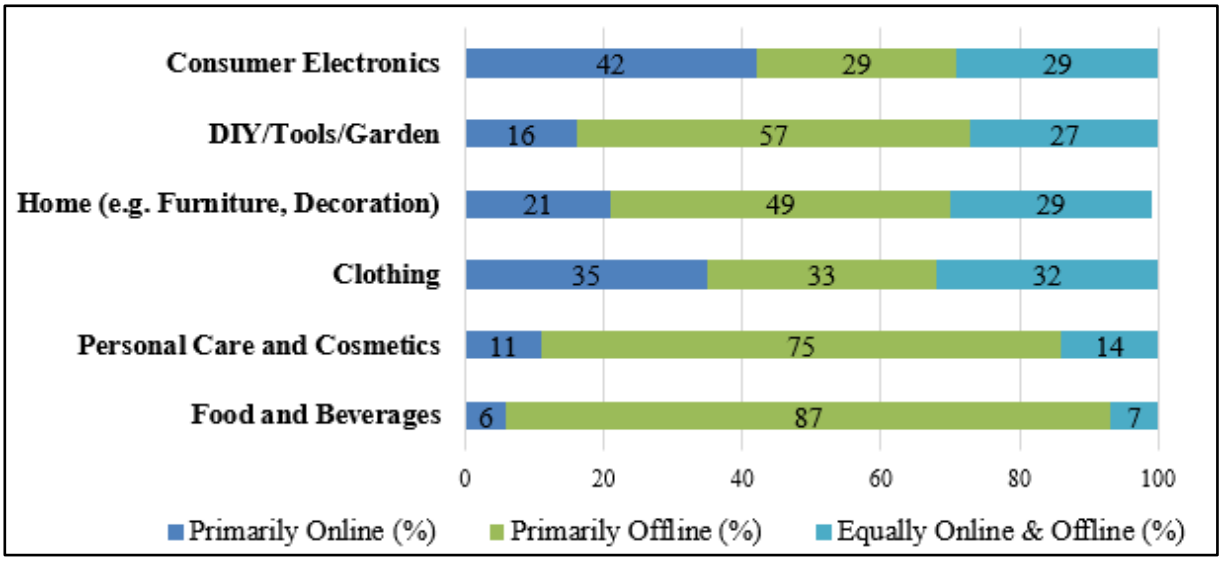


Figure 6. Omnichannel purchasing behaviour in the consumer electronics sector compared to other industries
Source: Author's own elaboration, based on Statista (2024b)

With its high share of online sales, the sector is further characterised by short product life cycles, energy-intensive production, and low recycling rates (Althaf et al., 2021; Olaf Roik, 2024; Ramprasad et al., 2022). Electronic devices cause substantial environmental impacts across both production and disposal stages (Wu et al., 2024). Sustainability challenges in the consumer electronics sector are primarily linked to high resource and energy demands in production and use, the dependence on rare earth elements, and limited product durability, factors that significantly contribute to the rising amount of electronic waste (Althaf et al., 2021; J. Li et al., 2015; Meyer & Katz, 2016; Ramprasad et al., 2022).

At the same time, consumer electronics are central to digital lifestyles and influence purchasing behaviour through innovation cycles, price sensitivity, and cross-channel information use, with 61 percent of consumers researching online before buying in-store (Gerling et al., 2025). The combination of sustainability challenges, substantial market volume and cross-channel driven consumer behaviour highlights the consumer electronics sector as a particularly relevant domain for examining sustainable purchasing decisions in the context of omnichannel retailing, while also underscoring its practical significance for the omnichannel retail sector. In this dissertation, the consumer electronics sector therefore serves as the empirical context in which the identified factors are analysed with regard to their influence on consumer behaviour Green purchase intention.

3.4 Relevant theories

The theoretical foundation of this dissertation is based on several frameworks, some of which are explicitly applied, while others are implicitly justified through conceptual alignment. In the empirical analysis, the structural equation modelling framework (Bagozzi & Yi, 2012) is employed as a key methodological and conceptual approach, providing both an analytical tool and a conceptual basis for model development (Al-Emran et al., 2019).

The Triple Bottom Line (TBL) framework (Elkington, 1994; Kleindorfer et al., 2005) serves as the conceptual basis for the systematic categorisation of ecological, economic, and social sustainability dimensions in the literature review part and its influence extends to the empirical analyses (see section 3.1.2). In this dissertation, the TBL provides not only the conceptual basis for the systematic literature review but also a point of reference for the empirical model to cluster the different factors.

Tajfel and Turner's Social Identity Theory provides an additional theoretical perspective by suggesting that individuals derive behavioural orientation from their identification with social groups (Tajfel & Turner, 1986). In the context of sustainable consumption, the empirical analysis integrates this perspective by examining brand identity as a key factor influencing purchase intentions in omnichannel retailing.

The determinants of the empirical analysis, derived and substantiated by the literature, are conceptually structured into individual and organisational factors. To complement this classification, the Theory of Planned Behaviour (TPB) (Ajzen, 1991) provides an additional theoretical perspective for explaining consumer behaviour as shown in Figure 7. It assumes that attitudes, subjective norms, and perceived behavioural control determine behavioural intentions, which in turn represent the most immediate predictors of actual behaviour.

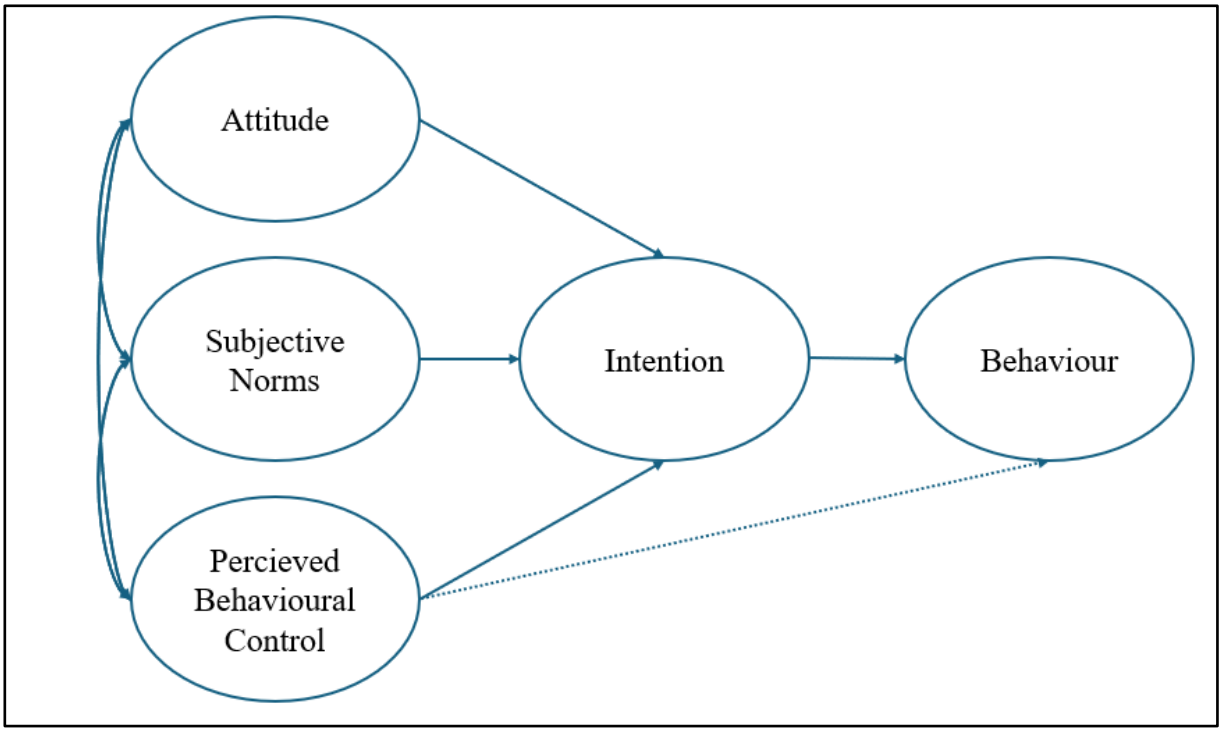


Figure 7. Theory of Planned Behaviour
Source: Author's own elaboration, based on Ajzen (1991)

In the context of this dissertation, the TPB is adapted to the omnichannel setting: environmental awareness is understood as the attitudinal component, green brand identity serves as an indirect expression of subjective norms, and organisational enablers such as channel integration and sustainability measures capture perceived behavioural control. Green purchase intention corresponds to the intention element of the TPB. Although the constructs are not applied in their classical operationalization, this contextual adaptation reinforces the theoretical foundation of the model and demonstrates how individual and organisational determinants interact in shaping sustainable consumer behaviour.

The attitude-behaviour gap highlights the discrepancy between pro-environmental attitudes and actual consumer behaviour (Carrigan & Attalla, 2001; Zhuo et al., 2023). This phenomenon is reflected in the dissertation through the finding that increased environmental awareness does not necessarily lead to sustainable consumption. Together, these theories provide a robust orientation for the analysis of sustainability-related challenges and consumer behaviour in the omnichannel context.

3.5 Synthesis of literature findings

Based on the introductory review of the literature, this section summarises the findings from existing research to consolidate the state of knowledge and to identify research gaps.

In recent years, academic discourse on sustainability in omnichannel retailing has intensified. Existing research highlights that sustainability in this context is a multidimensional construct encompassing ecological, economic, and social dimensions (Barbier, 1987; Hansmann et al., 2012; Kaklauskas & Kaklauskiene, 2022; Kleindorfer et al., 2005; Purvis et al., 2019). The literature on sustainability challenges reveals that previous research has predominantly addressed these dimensions in isolation. Most studies concentrate on ecological and economic challenges, whereas social aspects have received comparatively limited attention. Particular emphasis has been placed on transport, logistics, packaging, and returns, as these components significantly contribute to increased resource consumption in omnichannel retailing (Elia et al., 2021; Melacini & Tappia, 2018; Muñoz-Villamizar et al., 2021; Sallnäs & Björklund, 2020; Sousa et al., 2021). The so-called last mile is consistently described as particularly emission-intensive and poses a major sustainability-related challenge (Bosona, 2020; Buldeo Rai, 2019).

From a consumer perspective, the relevance of sustainability is also steadily increasing. Growing environmental awareness among consumers is increasingly positioning them as key drivers of sustainable innovation, leading to a broader implementation of environmentally responsible practices in omnichannel retailing (Galli et al., 2022; Jena & Meena, 2022; Sousa et al., 2021). While a relationship between environmental awareness and consumption behaviour has been empirically demonstrated in industries such as fashion and cosmetics (Teixeira et al., 2023; Zahid et al., 2018), its relevance to the consumer electronics sector remains underexplored. However, the consumer electronics sector is of particular interest, as its high share of online sales (Olaf Roik, 2023; Statista, 2025), rapid innovation cycles, and limited recycling infrastructure pose specific sustainability challenges (Althaf et al., 2021; Meyer & Katz, 2016; Ramprasad et al., 2022). At the same time, consumer behaviour in this market is characterised by extensive cross-channel search and purchase activities (Gerling et al., 2025)., further intensifying the complexity of sustainability-related decision-making.

In addition, the review of consumer behaviour literature indicates that determinants such as environmental awareness, customer satisfaction, sustainability measures, channel integration, and brand identity play an important role in shaping purchase decisions. Yet, existing research has either examined these factors in isolation or in different industry contexts, leaving their

interplay in omnichannel consumer electronics retailing insufficiently explored. Following, the reviewed literature thus provides a broad yet fragmented picture that underlines the need for a more integrative perspective.

Building on these findings, the next section outlines the central research gaps that arise from the existing literature.

3.6 Identification of research gaps

The reviewed literature reveals that sustainability in omnichannel retailing represents a complex and multifaceted research area that has so far been addressed predominantly in a fragmented manner. While numerous studies address individual sustainability dimensions, there is a lack of integrative approaches that simultaneously consider ecological, economic, and social aspects. In particular, comprehensive systematic reviews that consolidate existing findings on sustainability-related challenges in omnichannel contexts remain scarce. Existing research tends to prioritise isolated aspects, especially economic and ecological challenges in logistics, while the social and consumer-centred dimensions are rarely addressed.

Furthermore, empirical evidence on consumer perceptions of sustainability within omnichannel retail environments remains limited. Although increased environmental awareness among consumers is widely acknowledged, it is insufficiently understood under which conditions this awareness leads to sustainable purchasing behaviour, particularly in the consumer electronics sector. There is also a lack of comprehensive analyses examining the combined effects of factors such as environmental awareness, customer satisfaction, green brand identity, channel integration, and sustainability measures. While some determinants have been explored individually, integrated modelling approaches capable of capturing their mutual interactions are largely absent, with only few examples existing in other sectors, such as the apparel industry (Shao & Lassleben, 2021). Especially in the consumer electronics sector, a significant research gap persists. Despite its high environmental impact, this sector has received limited attention in terms of sustainability-oriented consumer decision-making.

These research gaps highlight the need for both a structured synthesis of existing research and an empirical investigation of the interplay between individual and organisational factors in the context of omnichannel retail. In particular, the consumer electronics sector provides a relevant domain in which these dynamics can be analysed, given its high environmental impact and distinct omnichannel usage patterns. These insights form the foundation for the research

objectives already outlined in Chapter 2 and provide the conceptual starting point for the development of the research model and hypotheses in Chapter 4.

4 RESEARCH MODEL AND HYPOTHESES

Building on the identified research gaps, the conceptual research model is developed and the hypotheses for empirical testing are formulated. The model integrates individual and organisational determinants of sustainable consumer behaviour in omnichannel retailing, with a particular focus on the consumer electronics sector. By linking theoretical foundations such as the Triple Bottom Line (TBL) and the Theory of Planned Behaviour (TPB) with sector-specific challenges, the chapter establishes a structured framework that explains how environmental awareness, customer satisfaction, green brand identity, channel integration, and sustainability measures jointly influence green purchase intention.

4.1 Hypotheses development and theoretical justification

The importance of sustainability in omnichannel retail is reflected in the increased examination of the topic in academic literature. However, previous studies on sustainability and consumer behaviour have mainly focused on omnichannel retailing in general or particular fields of business, such as the clothing industry. The influence of sustainability on consumer decisions in an omnichannel retailing environment for consumer electronics is largely unexplored. However, the consumer electronics segment is highly relevant. It has, alongside the clothing industry, the highest online share of all retail sectors (Statista, 2025) and resource-intensive products with a tendency towards a poor environmental balance (Nayak et al., 2020).

In order to adress this gap, hypotheses are formulated in the following section to investigate how sustainability influences consumers' purchasing decisions in the omnichannel retailing of electronic goods. The hypotheses are derived from the theoretical background and prior research. They are build on an integrated view of individual and organisational factors influencing consumer behaviour in an omnichannel retail environment. The presumed individual factors in this study are environmental awareness and customer satisfaction, whereas channel integration quality, brand identity and sustainable measures are examined as the organisational factors. This approach, with a focus on investigating the effects of consumer (individual) and channel characteristics (organisational), has been established and has already been applied in consumer research (Shao & Lassleben, 2021).

4.1.1 Individual factors influencing consumer behaviour

4.1.1.1 Environmental awareness

Environmental awareness is firmly grounded in sustainability and consumer behaviour research as a central determinant of pro-environmental decision-making (Miquel-Romero et al., 2025; Yao et al., 2024). Within the adapted framework of the Theory of Planned Behaviour (Ajzen, 1991), it corresponds to the attitude component, reflecting cognitive evaluations, values, and ethical orientations towards environmental protection.

Although prior studies, especially in the fashion and cosmetics sectors, have identified environmental awareness as a strong driver of sustainable consumer behaviour (Shao & Lassleben, 2021; Teixeira et al., 2023; Zahid et al., 2018), findings in the omnichannel consumer electronics sector remain limited, despite the short product life cycles and significant ecological footprint associated with this industry. Moreover, omnichannel settings often confront consumers with trade-offs, such as higher costs or longer delivery times for sustainable options, which can weaken the translation of awareness into behaviour.

Against this theoretical and empirical background, environmental awareness is expected to shape consumers' perceptions of sustainability measures, influence their satisfaction with the shopping process, and positively affect green purchase intention. This leads to the following hypotheses:

H1: Environmentally aware consumers (EA) perceive sustainable measures (SM) more positively.

H2: Environmental awareness (EA) has a positive influence on customer satisfaction (CS).

H3: Environmental awareness (EA) affects green purchase intention (GPI).

4.1.1.2 Customer satisfaction

Customer satisfaction describes the degree to which consumer expectations are fulfilled or exceeded and is a well-established determinant of purchase behaviour (Ha & Perks, 2005). In omnichannel retailing, satisfaction is particularly shaped by seamless cross-channel interactions, trust, and convenience, but also by logistical performance, such as delivery reliability (Ng et al., 2021; Tyrväinen & Karjaluoto, 2019). Previous studies in consumer behaviour confirm that satisfaction represents a central driver of purchase intentions (Kim et al., 2009).

Beyond general purchase behaviour, evidence from the food industry indicates that customer satisfaction strengthens green purchase intention (Bhutto et al., 2023; J. Wang et al., 2023). These findings suggest that satisfaction reduces perceived risks, builds trust, and enhances the perception of added value, thereby fostering favourable conditions for sustainability-related decisions. Applied to the consumer electronics context, it can therefore be assumed that in an omnichannel environment for consumer electronics, increased customer satisfaction positively influences green purchase behaviour. This leads to the following hypothesis:

H4: Customer satisfaction (CS) positively influences green purchase intention (GPI).

4.1.2 Organisational factors influencing consumer behaviour

4.1.2.1 Sustainable measures

Sustainability measures represent organisational initiatives such as climate-neutral delivery, sustainable packaging, or take-back systems for electronic devices. Prior research has shown mixed evidence. Some studies indicate limited consumer interest in sustainable options such as green delivery (Buldeo Rai et al., 2019b; Sallnäs & Björklund, 2020), while others highlight their positive influence on brand visibility and customer loyalty (Kembro & Norrman, 2019; Sousa et al., 2021).

Given the significant environmental footprint of consumer electronics, it is therefore particularly relevant to examine the influence of sustainable measures, such as climate-neutral delivery, sustainable packaging or take-back systems for old appliances, on consumer behaviour and satisfaction and leads to the following assumption:

H5: Sustainable measures (SM) in omnichannel retail with consumer electronics products positively influence customer satisfaction (CS).

4.1.2.2 Channel integration

Channel integration is widely recognised as a critical success factor in omnichannel retailing retailing (Z. W. Lee et al., 2019; Mirsch et al., 2016). Empirical research shows that a high degree of integration and convenience enhances customer satisfaction and strengthens trust in the retailer (Buckley et al., 2024; T. Y. Chen et al., 2023; Pereira et al., 2023). In addition to satisfaction, well-integrated systems can also increase purchase intentions (M. Zhang et al., 2018). In this context, channel integration is particularly important because fragmented initiatives (e.g. standardised take-back system, reusable packaging, climate-neutral deliveries) may lose credibility if they are not consistently implemented across sales and communication

channels. For consumer electronics, where environmental concerns are pronounced, seamless integration of such measures is therefore expected to strengthen customer satisfaction and increase green purchase intention. This leads to the following hypotheses:

H6: Channel integration (CI) has a positive influence on customer satisfaction (CS).

H7: Channel integration (CI) has a positive influence on green purchase intention (GPI).

4.1.2.3 Green brand identity

Brands can function as identity markers when their values are perceived as authentic and congruent with consumers self-concepts (Shao & Lassleben, 2021; Tajfel & Turner, 1986). Prior research has shown that sustainable brands can foster strong emotional bonds and positively influence purchasing decisions (Michel et al., 2019; Potter et al., 2024). Building on this evidence, it can be assumed that credible sustainability positioning also enables brands to build strong emotional bonds with consumers in an omnichannel environment in the consumer electronics sector. This leads to the following hypotheses:

H8: Green brand identity (GBI) increases consumers' green purchase intention (GPI).

H9: Green brand identity (GBI) positively influences customer satisfaction (CS).

4.2 Development of the structural model

Based on the theoretical foundations and the literature synthesis presented in the previous part, a structural model was developed to analyse the determinants of sustainability-oriented purchasing decisions in omnichannel retailing, with a particular emphasis on the consumer electronics sector. The model differentiates between individual factors (environmental awareness and customer satisfaction), and organisational factors (sustainability measures, channel integration and green brand identity). These individual and organisational factors are brought together in an integrated framework (see Table 3 and Figure 8) to analyse consumer behaviour and sustainability-related purchasing intentions.

The individuel factor environmental awareness reflects the sensitivity of consumers to envrionmetal challenges such as energy-intensive production processes, the generation of electronic waste and the limited recycling potential of devices. This awareness forms an important motivational basis for sustainable purchasing behaviour. Customer satisfaction, in contrast, refers to the evaluative outcome of the shopping experience across both digital and physical channels and is is widely recognised as a central driver of loyalty and purchasing

behaviour. Particularly in markets such as clothing and food, but it is insufficiently researched in the cosumer electronic sector.

The organisational dimension encompasses sustainability measures, channel integration and green brand identity. Sustainability measures in omnichannel retail include initiatives such as carbon neutral shipping, environmentally friendly packaging or recycling programmes for used devices. Channel integration describes the seamless coordination of online and offline channels and enhances a consistent shopping experience. This aspect is highly relevant in consumer electronics retailing, where many products require detailed information and advice before purchase. Green brand identity refers to the emotional and cognitive connection between consumers and the brand and is closely linked to the credibility and authenticity of sustainability communication.

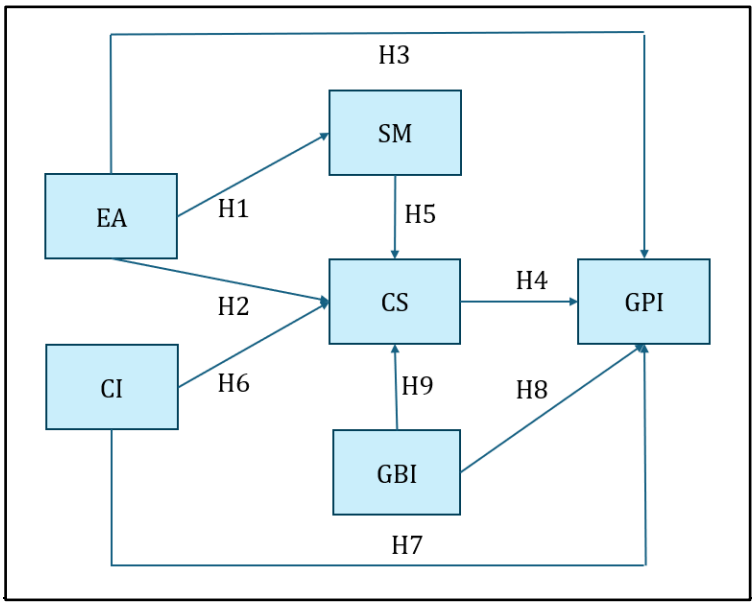


Figure 8. Structural model and the relationship of the hypotheses
Source: Author's own elaboration

Table 3. Overview of the structural components of the model and their relationship

Factor	**Variable**	**Hypothesis**	**Influencing**	**Explanation**
Individual	Environmental Awareness (EA)	H1, H2, H3	Sustainability Measures (SM) Customer Satisfaction (CS) Green Purchase Intention (GPI)	Environmentally aware consumers tend to perceive sustainable measures more positively. Environmental awareness also increases the customer satisfaction and the green purchase intention.
	Customer Satisfaction (CS)	H4	Green Purchase Intention (GPI)	Satisfied customers have a higher green purchase intention.
Organizational	Sustainability Measures (SM)	H5	Customer Satisfaction (CS)	Sustainability measures increase the customer satisfaction.
	Channel Integration (CI)	H6, H7	Customer Satisfaction (CS) Green Purchase Intention (GPI)	Seamless integration of channels increases the customer satisfaction and influences green purchase intention.
	Green Brand Identity (GBI)	H8, H9	Green Purchase Intention (GPI) Customer Satisfaction (CS)	A strong brand identity increases the customer satisfaction and influences green purchase intention.
Final Outcome	Green Purchase Intention (GPI)	-	-	Final outcome variable based on influencing factors.

The proposed model assumes that both sets of determinants are interconnected and jointly influence sustainable purchasing behaviour. Environmental awareness is expected to have a positive effect on perceptions of sustainability measures and customer satisfaction. In turn, customer satisfaction, the quality of channel integration and green brand identity are anticipated to directlyt increase green purchase intention.

In summary, the model conceptualises green purchase intention in the consumer electronics sector as the outcome of a multidimensional decision-making process in which individual

factors interact with organisational determinants. This integrated approach captures the complexity of sustainability related consumer behaviour in omnichannel retailing and provides a robust framework for empirical testing in both the pilot study and the main study.

4.3 Theoretical positioning of determinants

The determinants derived from established literature on consumer behaviour can be theoretically positioned within the Triple Bottom Line (TBL) and the Theory of Planned Behaviour (TPB) to strengthen the conceptual foundation. Both perspectives provide orientation for structuring the factors, even though neither of them is fully applied in its classical form.

The TBL framework (Elkington, 1994; Kleindorfer et al., 2005) structures sustainability into three equally relevant dimensions: ecological, economic, and social. This categorisation was already used in the literature review and also provides a useful structuring lens for the determinants included in the empirical model as shown in Figure 9. Environmental awareness and sustainability measures refer to the ecologic dimension, as they address environmental challenges such as CO2 emissions, packaging waste, and recycling. Customer satisfaction and channel integration capture performance-related aspects of omnichannel retailing that influence efficiency, perceived value, and service quality. And green brand identity reflects the social dimension by capturing consumers alignment with brand values and their integration into social identities.

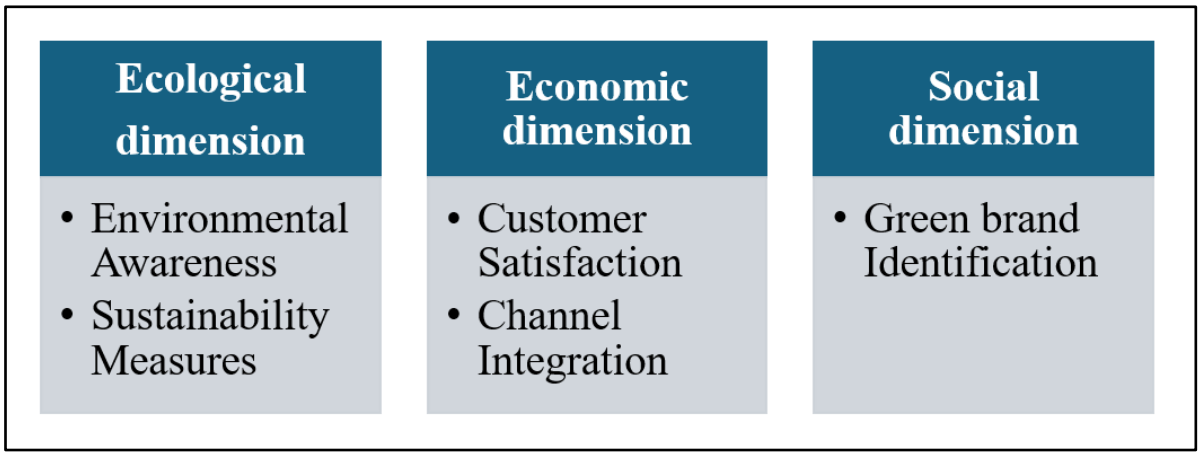


Figure 9. TPB in the Context of the Empirical Study
Source: Author's own elaboration

This classification is not used as a rigid clustering tool for the empirical model, but rather as a conceptual background that ensures visibility of all three dimensions of sustainability within the empirical analysis.

The TPB framework (Ajzen, 1991) provides a complementary perspective by explaining how attitudes, subjective norms, and perceived behavioural control shape behavioural intentions, which in turn represent the most immediate predictor of behaviour. In this dissertation, the constructs are adapted to the omnichannel retail context in Table 4 and visualised in Figure 10.

Table 4. Contextual adaptation of the Theory of Planned Behaviour

TPB Component	Variable	Explanation
Attitude	Environmental Awareness	Attitude is represented by EA, reflecting individual pro-environmental values and orientations.
Subjective Norm	Green Brand Identity	Subjective norms are not measured in their classical form but approximated through BI,which can be interpreted as an indirect social norm.
Perceived Behavi-oural Control	Channel Integration Sustainability Measures	SM and CI represent organisational enablers that increase or restrict consumers ability to act sustainably.
Intention	Green Purchase Intention	Purchase intention corresponds directly to the intention component of the TPB and is empirically measured.
Behaviour	Not directly measured	Actual purchasing behaviour is not measured, but theoretically follows from intention.

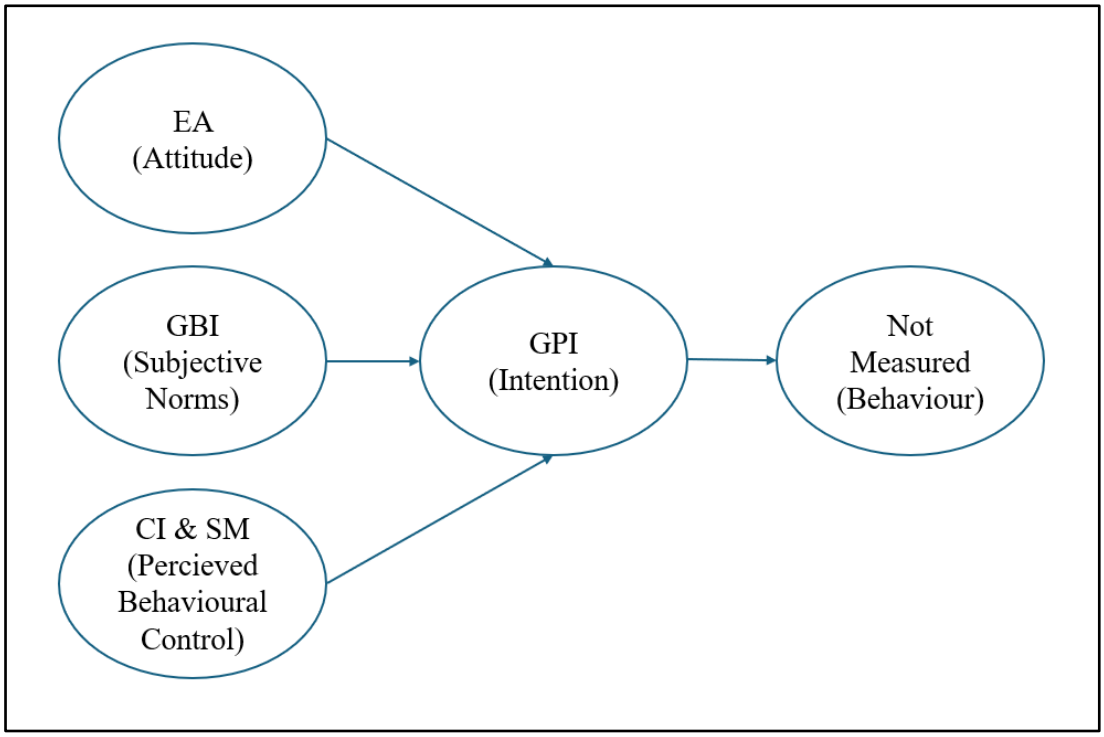


Figure 10. Adaptation of the Theory of Planned Behaviour (TPB)
Source: Author's own elaboration based on Ajzen (1991)

This mapping shows that the TPB is a useful interpretative tool, even not all constructs are operationalised in their traditional form and subjective norms and perceived control are not measured with the classical items. Nevertheless, the adapted framework supports the theoretical grounding of the model.

The integration of the determinants into the TBL and TPB frameworks shows that they are both anchored in sustainability theory and grounded in consumer behaviour research. Even though the application of these frameworks in this dissertation is adapted and not comprehensive, they offer a transparent and theoretically consistent foundation for interpreting the empirical model and its hypotheses.

5 MATERIALS AND METHODS

This chapter describes the methodological approach of this dissertation. The research design follows a multi-method approach that combines a systematic literature review with quantitative analyses to examine sustainability-related consumer behaviour in omnichannel retailing, with a particular focus on the consumer electronics sector.

The starting point is a systematic literature review, conducted in accordance with the PRISMA guidelines (Moher et al., 2009), aimed at synthesising the state of research on sustainability challenges in omnichannel retailing. The literature review identifies key sustainability challenges and provides an initial conceptual foundation for the empirical investigations. However, the hypotheses developed in the subsequent studies are not directly derived from the findings of this systematic literature review. Instead, they are based on theoretical assumptions from existing models as well as empirical studies addressing the influencing factors of environmental awareness, customer satisfaction, green brand identity, channel integration, sustainability measures, and green purchase intention.

The second strand comprises the empirical analysis, based on two interrelated studies. In a pilot study, hypotheses were systematically formulated for the first time and tested within a structural model. The subsequent main study validated and extended these relationships by drawing on a larger sample size and applying more advanced analytical techniques. Both studies explicitly focus on the consumer electronics sector in order to analyse sustainable purchasing decisions within this empirically relevant market segment in greater depth.

The following sections detail the methodological procedures applied in both strands, covering the design of the systematic literature review as well as the empirical studies, including research design, measurement instruments, sampling, and analytical techniques.

5.1 Methodology of the systematic literature review

The systematic literature review was conducted in accordance with the PRISMA framework. The aim of this review was to identify, categorise, and synthesise the existing knowledge on sustainability challenges in omnichannel retailing from a consumer perspective.

5.1.1 Databases searched

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009; Page et al., 2021). Scopus, ScienceDirect, and Emerald Insight databases were accessed to search for articles published in

journals, primarily in the fields of retailing, e-commerce, distribution and transport. The search was conducted on 29th September, 2023. The search period was limited to the period from January 2013 to September 2023. The title, abstracts, names of authors and journals, and years of publication were exported to a Microsoft Excel spreadsheet.

5.1.2 Eligibility criteria

To be included in the study, the published articles had to meet the pre-defined criteria. The selection criteria stated that the articles should be available in full length and published in the English language (see Table 5). Further, only research articles, dissertations and conference papers were to be selected. Thus, publications in books, book series, and chapters in books were excluded.

Table 5. Eligibility criteria

Design

- Availability in full length
- Published in English language
- Only research articles, dissertations and conference proceedings
- No inclusion of books, book series and chapters in books

Search String

sustainability

AND

omni-channel retailing OR omni-channel retail

OR

omnichannel retailing OR omnichannel retail

AND

consumer

5.1.3 Information sources

A comprehensive search was carried out in three selected databases. Using Boolean operators, the search string was produced. The title, abstract and keywords of the articles were considered in the search. Because the search was about "sustainability" in the context of "omnichannel retailing", both terms were included in the search string. The terms “multi-channel” and “cross-channel” are similar to “omnichannel”, but they represent different concepts and deviate in terms of content and were therefore not included in the search string. In addition, the search

term "consumer" was added to also cover customer (view) dimensions in the search (see Table 6).

Table 6. Search string used in databases

Database	Keywords
Scopus	" sustainability AND omni-channel retailing OR omni-channel retail OR omnichannel retailing OR omnichannel retail AND consumer"
ScienceDirect	" sustainability AND omni-channel retailing OR omni-channel retail OR omnichannel retailing OR omnichannel retail AND consumer"
Emerald Insight	" sustainability AND omni-channel retailing OR omni-channel retail OR omnichannel retailing OR omnichannel retail AND consumer"

5.1.4 Study selection

The selection of the identified studies was based on the PRISMA flow diagram (Page et al., 2021). First, the identified studies from the different databases were recorded in CITAVI and then exported cumulatively to an Excel spreadsheet. The dataset included basic information such as author(s) name, publication year, title or journal name. Subsequently, the articles were selected based on the pre-defined eligibility criteria. If an article was initially screened successfully, the full text of the paper was evaluated and information about research-related topics, methods or the author(s) was recorded. Thereafter, the extracted articles were carefully read and recorded in an Excel spreadsheet containing, for instance, information on the author’s name, year of publication, title of the article, journal name, digital object identifier (DOI), and main findings about challenges or databases.

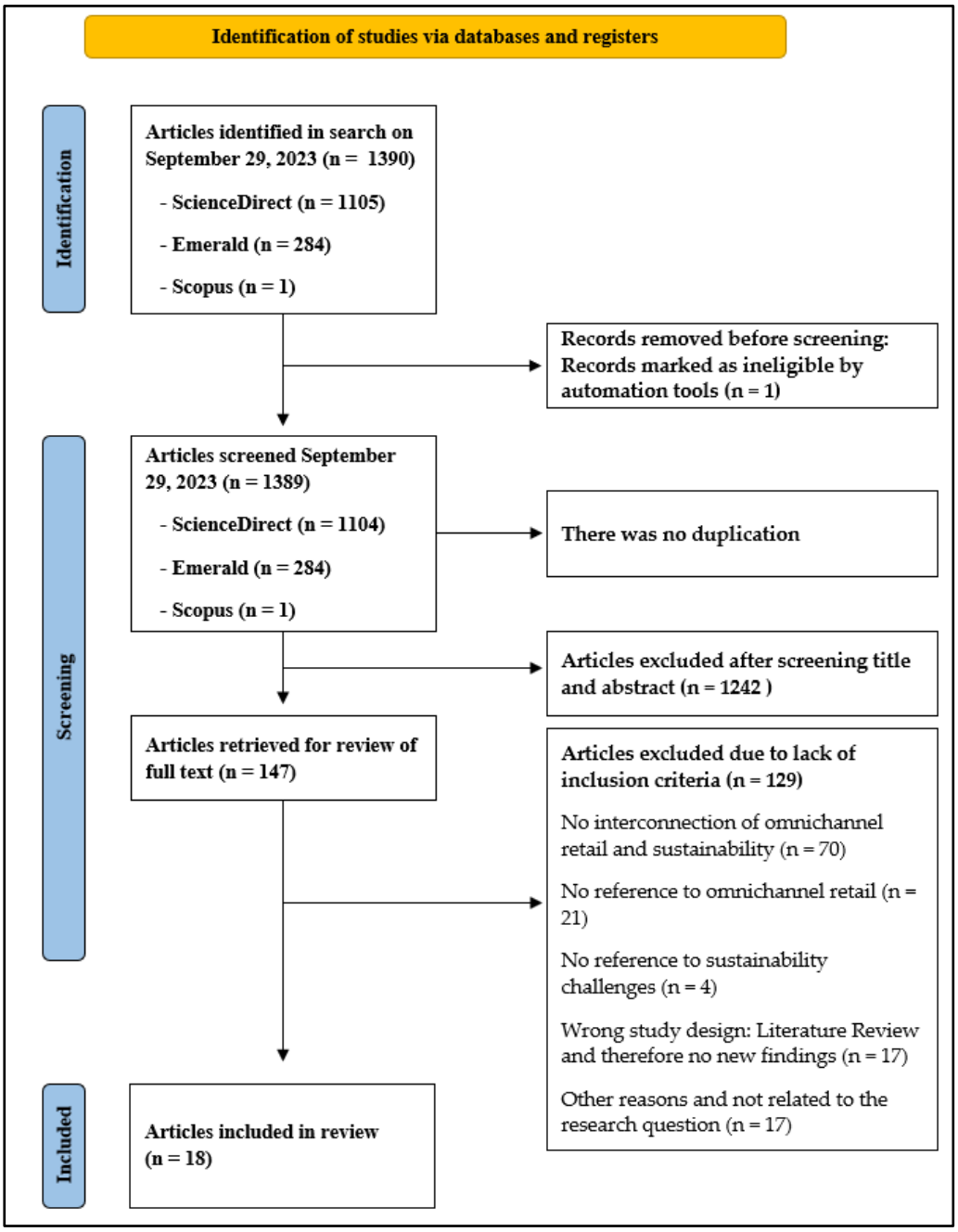


Figure 11. Flow chart of the study selection process
Source: Author's own elaboration based on Page et al. (2021)

Applying the search string, a total of 1390 records were identified in the databases (see Figure 11). The classification of the article type had already been considered in the initial search. In a further screening process, the selection was made with the help of the four-phase flow diagram. Despite articles being drawn from different data sources, there were no duplicates. Title and abstract of the articles were read thoroughly to determine their suitability. Because they were not related to the research question, 1242 and later 129 additional articles were excluded. For example, in some articles no relation between the terms "omnichannel retail" and

“sustainability” could be identified, but as keywords of the search string they were nevertheless in the text without any reference in the content. By the end of the screening, a total of 18 publications were included in this systematic literature review. Due to this low number of papers, further analysis methods could not be applied, e.g. meta analysis.

5.2 Methodology of the empirical study

This section presents the pilot and the main study side-by-side. Both studies adopt a hypothesis-driven quantitative design with an online survey to examine relationships between individual factors (environmental awareness, customer satisfaction) and organisational factors (sustainability measures, channel integration, brand identity) and their effects on purchase decisions in omnichannel consumer electronics retailing. The pilot served as an exploratory stage using PLS-SEM, while the main study provided confirmatory evidence using CB-SEM.

5.2.1 Sampling and data collection

The studies focused on German consumers who had purchased electronic consumer goods (such as smartphones, notebooks, cameras, or household appliances) from omnichannel retailers within the past 24 months. Participants were recruited through a professional online panel that provides access to pre-registered survey participants. The setup of the panel guaranteed that only respondents residing in Germany and being at least 18 years old were invited to the survey. Within the questionnaire, a screening question ensured that only consumers who had purchased an electronic consumer product from an omnichannel retailer during this period were able to continue and were not filtered out. The panel settings allowed all genders, all household income levels, and respondents from all German regions to participate, without quotas for age, gender, or regional distribution. Consequently, the eligible participants represented a wide demographic range. The survey was conducted online in February 2025 using SurveyMonkey. Participation was voluntary and anonymous, and respondents could withdraw at any time. Ethical approval for the study was obtained from the Interim Ethical Committee of the Doctoral School of Economic and Regional Sciences at the Hungarian University of Agriculture and Life Sciences. The sampling approach is best described as non-probabilistic, panel-based sampling. Participants were recruited from an existing pool of voluntary panel members rather than randomly selected from the entire population, meaning that not every consumer in Germany had an equal chance of being included in the study. Consequently, the results are only valid for the examined consumer group and cannot be generalised to all omnichannel electronics consumers.

5.2.1.1 Pilot study

In the pilot study, 125 fully completed questionnaires were included in the analysis. Although the sample is relatively small, it exceeds the minimum threshold of 100 cases for exploratory PLS-SEM studies and complies with the so-called “ten-times rule”, making it appropriate for this pilot study (Odunga et al., 2024). However, the limited sample size should be considered when interpreting the findings. The demographic data show that 49.6 percent of the respondents were male and 48.8 percent were female, while 1.6 percent did not provide any information regarding their gender. The largest group in the sample was the 30-44 age group (46.4%), followed by 45-59 year-olds (28.0%), over-60s (17.6%), 18-29 year-olds (6.4%), and under-18s (1.6%). Most respondents had vocational qualifications (58.4%), followed by university degrees (bachelor's degree: 16.0%; master's degree or higher: 11.2%). 12.8 percent had a school-leaving certificate, and 1.6 percent had reported no formal education.

5.2.1.2 Main study

In the main study, 417 participants took part in the survey. After excluding incomplete or invalid responses, the final sample comprised 358 participants (n = 358). The demographic characteristics differed from the pilot study due to the larger sample size. In the main study, 53.35 percent of the respondents were male, while 46.65 percent were female. The largest group was the 30-44 age group (32.68%), followed by 45-60 year-olds (28.77%), 18-29 year-olds (20.39%), and over-60s (18.16%). Education levels ranged from no formal education (0.84%) to postgraduate degrees (11.73%), with vocational training being the most common (55.31%). Additional information was collected on household income and device usage. Most participants reported an annual income between €25,000 and €50,000.

Table 7 provides a comparative overview of the demographic characteristics of the respondents in the pilot and main study.

Table 7. Demographic profile of respondents in the pilot and main study

Feature	**Values**	**Main Study %**	**Pilot Study %**
Gender	Male	53,35	49,6
	Female	46,65	48,8
	No answer		1,6
Age	<18		1,6
	18-29	20,39	6,4
	30-44	32,68	46,4
	45-59	28,77	28
	>60	18,16	17,6
Education	No formal education	0,84	1,6
	High school	14,25	12,8
	Vocational training	55,31	58,4
	Bachelors degree	17,88	16
	Postgraduate (Master or higher)	11,73	11,2
Income	<25,000 €	22,35	22,4
	25,000-50,000 €	39,94	45,6
	≥50,000 €	33,24	24,8
	No answer	4,47	7,2

5.2.1.3 Summary of similarities and differences

The survey design was identical in both studies regarding eligibility criteria, data collection method, timing, and ethical approval. The main difference lies in the sample size and the resulting demographic profiles (see Table 8). While the pilot study provided an initial exploratory overview, the main study allowed for a more differentiated demographic analysis due to the larger dataset.

Table 8. Similarities and differences between pilot and main study

Aspect	Pilot Study	Main Study	Comparison
Design	Quantitative, exploratory, PLS-SEM	Quantitative, confirmatory, CB-SEM	Same design, different SEM approach
Sample size	n = 125	n = 358 (after cleaning)	Main study larger, more robust
Data collection	Online survey, Feb 2025	Online survey, Feb 2025	Identical
Eligibility	German consumers, ≥18 years, omnichannel purchase in last 24 months	Same	Identical
Ethical approval	Granted (Hungarian University of Agriculture and Life Sciences)	Same	Identical
Demographics	Balanced gender, dominant 30-44 age group	Balanced gender, broader age distribution	Similar patterns

Building on this sample foundation, the following section details the measurement of the constructs applied in both studies

5.2.2 Measures

The core constructs of the model are operationalised using validated measurement instruments from the literature and adapted to the context of the study. For this purpose, all constructs were recorded on a 5-point Likert scale (1 = “strongly disagree” to 5 = “strongly agree”). The variables comprised environmental awareness (EA), sustainability measures (SM), customer satisfaction (CS), channel integration (CI), green brand identity (GBI), and green purchase intention (GPI).

The participants environmental awareness (EA) and how they perceive sustainable measures is determined on the basis of the work of Dunlap et al. (Dunlap et al., 2000), Sari et al. (Saari et al., 2021) and Shao et al. (Shao & Lassleben, 2021). In the pilot study, four items were included, while in the main study three items were retained to improve model fit and ensure convergent validity.

Sustainability measures (SM) captured consumers perceptions of sustainable practices in omnichannel retailing and includes aspects such as environmentally friendly shipping methods. The measurement scale with items for sustainability measures is based on Buldeo Rai et al. (Buldeo Rai et al., 2019b) and Lalchandani et al. (Lalchandani et al., 2024).

Customer Satisfaction (CS), understood as the overall evaluation of the purchasing process and customer satisfaction with the omnichannel retailer, was measured with four items, derieved from Lee et al. (V. Lee et al., 2022) and Rita et al. (Rita et al., 2019).

The determination of the quality of channel integration (CI) between different channels in terms of sustainability is based on the work of Yeğin et al. (Yeğin & Ikram, 2022), Cao et al. (L. Cao & Li, 2015), Ayachi et al. (Intissar Ayachi & Rim Trabelsi El Amri, 2024) and Zhang et al. (M. Zhang et al., 2018). While the pilot study used four items, the main study retained only two items to achieve acceptable global model fit indices (CFI, TLI, RMSEA).

Green brand identity (GBI), referring to consumers emotional attachment and identification with brands representing sustainable values, was measured with four items, derived from the work of So et al. (So et al., 2013).

Green purchase intention (GPI), which reflects consumers willingness to buy sustainability-oriented consumer electronics products in omnichannel settings, was operationalised with four items based on Konuk (Konuk, 2019).

While the pilot study applied the full set of items in an exploratory PLS-SEM context, the confirmatory CB-SEM approach of the main study required a more parsimonious specification. Despite the reduction, the theoretical breadth of the constructs was preserved, and the adapted scales achieved satisfactory reliability and validity measures. Table 9 provides a comparative overview of the constructs, number of items, and sources in the pilot and main study.

Table 9. Overview of the structural components of the model and their relationship

Factor	No. of Items	Description	Measurement Source(s)
Environmental Awareness (EA)	4/3	Assess the participants' environment attitudes and awareness	(Dunlap et al., 2000; Saari et al., 2021; Shao & Lassleben, 2021)
Sustainability Measures (SM)	3	Perception of sustainability measures in omnichannel retailing (e.g., green shipping, packaging)	(Buldeo Rai et al., 2019b; Lalchandani et al., 2024)
Customer Satisfaction (SC)	4	Evaluation of the overall shopping experience and satisfaction with the omnichannel retailer	(V. Lee et al., 2022; Rita et al., 2019)
Channel Integration (CI)	4/2	Assessment of the consistency and linkage of online and offline channels in a sustainable context	(L. Cao & Li, 2015; Intissar Ayachi & Rim Trabelsi El Amri, 2024; Yeğin & Ikram, 2022; M. Zhang et al., 2018)
Green Brand Identity (GBI)	4	Emotional connection and identification with sustainability-oriented brands	(So et al., 2013)
Green Purchase Intention (GPI)	4	Purchase intention	(Konuk, 2019)

After establishing the measurement instruments, the following section outlines the analytical methods applied to test the structural relationships.

5.2.3 Structural equation modelling methods

The empirical data from both studies in were analysed using structural equation modelling (SEM). Structural equation modeling is a statistical methodology for examining relationships between observed and latent variables and enables the modelling of complex causal structures and serves as a tool for empirically testing theoretically derived hypotheses (Kline, 2011).

In the pilot study, the partial least squares structural equation modeling (PLS-SEM) method was applied with the software SmartPLS 3. PLS-SEM is particularly well-suited for studies with smaller sample sizes, enables flexible modeling of complex relationships, and facilitates intuitive, exploratory examination of hypothesized structures through visual representation (Fauzi, 2022; Hair et al., 2017). These features make PLS-SEM especially appropriate in early research phases, where the goal is to empirically test hypothesised models and gain initial insights into the plausibility of theoretical relationships.

In the main study, a more detailed analysis was conducted based on a larger sample using covariance-based structural equation modeling (CB-SEM) in the statistical software R. The

analysis was carried out using the R packages lavaan and semTools *(Rosseel, 2012)*. CB-SEM enables a comprehensive assessment of causal models by calculating global fit indices such as CFI, TLI, and RMSEA. The larger sample of 358 respondents allowed for a differentiated confirmatory validation of the model, including the analysis of indirect effects and mediation paths. Given the increased sample size and the confirmatory research design, CB-SEM was considered the appropriate method for validating the findings of the pilot study (Dash & Paul, 2021).

Together, the applied techniques ensure a robust investigation of sustainability-related consumer behaviour and decision-making in the omnichannel retail context, with a specific focus on the consumer electronics sector.

6 RESULTS AND DISCUSSION

This chapter presents the empirical findings of the dissertation and discusses them in relation to the theoretical and conceptual foundations outlined in the previous chapters. In line with the methodological design, the results are presented in two steps. First, the findings of the systematic literature review, and second, the results of the empirical analyses, separated in a main and pilot study.

6.1 Results and discussion of the systematic literature review

The results of the systematic literature review provide an overview of the current state of research on sustainability challenges in omnichannel retailing. The main characteristics of the reviewed studies are summarised in Table 11.

Although the survey included publications from January 2013 to September 2023, the final records had only been published in the last six years with ten publications appearing within the last three years. Research in the retail or sustainability or computer science journals, as well as management and business journals, was mainly conducted in Europe (11 of 18), but data sets were also analysed in an international context (4 of 18), in South America (1 of 18) and India (1 of 18). The methodology of the reviewed studies was primarily qualitative in its approach, but these could be divided into three main groups.

The main group consisted of nine articles that employed qualitative methods. The qualitative approach appeared in articles that used (descriptive) case studies (Bilińska-Reformat & Dewalska-Opitek, 2021; Karlsson et al., 2023), including multi-case analyses (Kembro & Norrman, 2019; Mkansi & Nsakanda, 2021), for example in combination with an interview and the Delphi study (Kayikci, 2018) or further explorative interview approaches (Buldeo Rai et al., 2019a; Hagberg & Hulthén, 2022; Sallnäs & Björklund, 2020). Six papers in the second group are based on quantitative methods. The quantitative approaches are applied in the form of a multiple linear regression analysis (Bergmann et al., 2020), conjoint analysis (Buldeo Rai et al., 2019b) and a robust optimisation model (Xu et al., 2023). The mathematical model by Peng et al. was designed to optimise the store density in omnichannel retailing (Peng et al., 2022). Pan et al. conducted a two-stage data-driven experimental study (Pan et al., 2017) and Muñoz-Villamizar et al. employed a discrete-event simulation model (Muñoz-Villamizar et al., 2021).

In three articles, the researchers combined qualitative and quantitative methods to address the research question. Based on an interview on company characteristics, Risberg and Jafari developed a framework for a quantitative study (Risberg & Jafari, 2022). Buldeo Rai et al. (Buldeo Rai et al., 2021) conducted a two-step cluster analysis and He et al. (X. He et al., 2023) a numerical test model based on a review.

6.1.1 Sustainability dimensions studied

It is noteworthy from how many different perspectives and research directions the sustainability challenges can be viewed. Nevertheless, the examined studies have in common a strong company-related perspective. Such a weighting towards corporate-centric considerations of challenges in omnichannel research is also confirmed in other literature reviews in this field (Olsson et al., 2019; Özbük et al., 2020). The economic-corporate view in this study is also reflected in the coverage of the different sustainability dimensions (see Figure 12). Even if all three sustainability dimensions are addressed, the review of the articles indicates a slightly uneven weighting (see Tables 10 and 11) in favour of the economic dimension (31 of 66), followed by an environmental dimension (23 of 66), and lastly social dimension aspects (12 of 66).

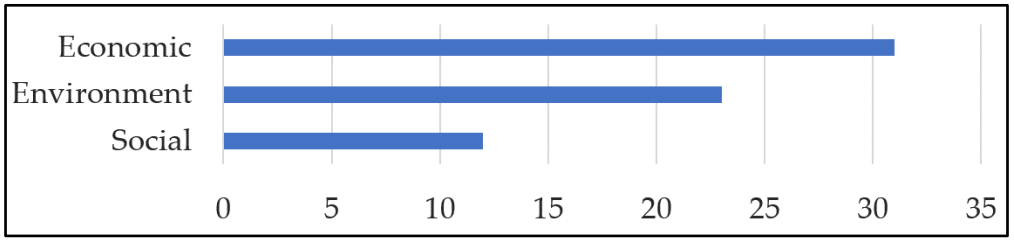


Figure 12. Weighting of the sustainability dimensions (number of mentions)
Source: Author's own elaboration

Table 10. Study characteristics and key findings

Study	Research field (of the journal)	Region	Challenges/Key findings			Subject	Method
			Environment	**Economic**	**Social**		
Bergmann et al. 2020	Retail, Distribution	India	Inefficient last mile routings affects the environment	Increased efficiency by combining pick-up and delivery processes on the last and first mile.	-	Increasing route efficiency to help omnichannel participants to reduce operational costs and emissions.	Regression analysis
Bilińska-Reformat & Dewalska-Opitek 2021	Computer Science	international	Environmental impact of the clothing industry	Reduction of the carbon footprint in fast fashion	Sustainability is only seen as a subordinate key factor for brand selection in fast fashion from the customer's point of view. But enhanced consumer awareness in relation to the social dimension (employment rights).	Challenges of the fast fashion industry during the Corona pandemic	Descriptive case study
Buldeo Rai et al. 2021	Transport	Belgium	Unfavourable environmental impact of the last mile;	Last mile of a delivery is cost-intensive	Limited interest of customers in more eco-friendly transport options	Crowdsourcing service solutions in omnichannel retailing to address the challenge to design the last mile more efficiently.	Cluster analysis
Buldeo Rai et al. 2019	Transport	Belgium	Increasing parcel volume; Parcel delivery with non-environmentally-friendly vehicles	Efficiency deficits in parcel delivery due to a lack of cooperation and information exchange between the parties involved.	-	Examining the organisation and distribution efficiency of urban parcel distribution in Brussels	Case study (Interview)

Buldeo Rai et al. 2019b	Retail, Distribution	Belgium	Unfavourable environmental impact of the last mile;	Last mile of a delivery is cost-intensive	Tendentially limited interest of customers in more eco-friendly transport options - unless they have cost advantages.	Investigation of the extent to which customers are willing to use more sustainable delivery options in omnichannel retail for the last mile.	Conjoint analysis
Hagberg & Hulthén 2022	Transport	Sweden	Consolidation potential through choice of more eco-friendly transport form; More delivery journeys if fast delivery is required	Increased returns rates weaken profitability and efficiency.	Consolidation potential on the consumer side by reducing the number of purchases or shopping trips.	Organisational forms of logistics on the last mile and their consolidation effects through resourcing	Case study (Interview)
Halldórsson & Wehner 2020	Transportation Business and Management	Sweden	High energy demand on the last mile of goods transport	Delivering goods collectively down in the supply chain as close as possible to the point of consumption	-	Challenge of high energy demand on the last mile of goods transport.	Explorative interview study
He et al.2023	Computer Science	International	Almost unlimited access to products worldwide is an environmental challenge.	Different national guidelines for market participants to reduce CO2 emissions; Coordination of the omnichannel supply chain towards greater energy efficiency is difficult due to the different requirements and interests of market participants.	Lack of (government) encouragement to reduce CO2 emissions; E-commerce increases user convenience.	Effects of subsidies and corporate social responsibility in an omnichannel environment in terms of product and price, but also of carbon emissions	Multi-study design
Karlsson et al. 2023	Management and Business	Sweden	Lenient returns policy leads to more returns and has a negative impact on the environment.	Lenient returns policy weakens profitability.	-	Analysing relevant challenges/components that cause returns in omnichannel retail to improve efficiency.	Case study (Interview)
Kayikci 2018	Sustainability	Turkey	Resource efficiency, waste, pollution, land use impact	Costs, delivery time, delay, inventory, reliability	Health (disease caused by transport side effect like	Digitalisation of logistics processes makes it easier for companies to overcome	Case study (Interview, document analysis)

					pollution or noise or accident rates)	sustainability challenges	
Kembro & Norrman 2019	Retail, Distribution	Sweden	Omnichannel retail executives still pay too little attention to sustainability aspects.	Decentralised omnichannel networks can help to improve sustainability when allocating the shipping location. Growing environmental awareness in management, nevertheless currently only of low relevance.	-	Challenges of logistics information systems from the perspective of Swedish omnichannel retailers.	Exploratory survey
Mkansi & Nsakanda 2021	Transport	United Kingdom	Food vans lead to more traffic congestion, noise pollution and increased space requirements	Due to several delivery and collection options, OCR (omnichannel retail) has a better environmental performance than pure online providers or centralised retailers.	Eco-friendly delivery methods increase brand visibility and customer loyalty	Examining advantages for UK's leading food retailers in operating an e-grocery channel using the existing retail network.	Qualitative multi-case study
Muñoz-Villamizar et al. 2021	Sustainability	Mexico	-	Fast delivery, like same day, significantly impacts costs massively (up to 15% and 68%)	-	Environmental impact of Mexico's largest (omnichannel) retailer caused by fast shipping.	Simulation model
Pan et al. 2017	Management and Data	Ireland	-	Failed home deliveries of food purchased online are a challenge due to the perishable nature of the goods (from env. and eco. perspective)	-	Using customer-related data to determine the probability of customer absence due to failed home deliveries	Experimental study
Peng et al. 2022	Sustainability	International	Packaging: Omnichannel leads to less packaging materials than the pure-online channel.	A optimal store density helps to increase profits.	Store pickups are tendentially inconvenient to costumers	Efficient store density in an omnichannel context to achieve a reduction in packaging while maximizing profits.	Multi-study design

Risberg & Jafari 2022	Retail, Distribution	Sweden	-	OCR still pays too little attention to sustainability aspects in deliveries	High environmental awareness of customers in Sweden	Analyses the last mile practices of omnichannel retailers.	Sequential, dual-phase approach
Sallnäs & Björklund 2020	Retail, Distribution	Belgium	Environmental challenges of transport, packaging, routing,	Efficiency and transparency constraints through information gaps among the market participants involved.	Little influence of consumers on the greening of distributions; Consumers tend to choose express deliveries that have poor environmental performance.	The influence of consumers on the greening of distributions in an omnichannel environment.	Explorative interview study
Xu et al. 2023	Computer Science	International	Increased energy and resource consumption in omnichannel retailing.	CO2 regulations and taxes are a financial burden for omnichannel retailer.	-	Development of a model to uncover efficiency and profit improvement potentials in consideration of CO2 emission regulations.	Robust optimization model

6.1.2 Challenges related to dimensions of sustainability

Challenges in transport and logistics were mostly mentioned in the reviewed studies, the so-called last mile was especially emphasised or at least considered as a major challenge. These last mile-related studies are examined in more detail in the following section. Afterwards, publications with a logistics reference are presented. Lastly, publications with a further focus on sustainability challenges in the supply chain (Pan et al., 2017; Peng et al., 2022), CO2 regulations (Xu et al., 2023) and the impact of subsidies and corporate social responsibility in an omnichannel environment (X. He et al., 2023) are revealed.

All studies on the last mile stated the high energy demand and the non-sustainable character on this final delivery leg in good transports (Buldeo Rai et al., 2019b, 2021; Hagberg & Hulthén, 2022; Halldórsson & Wehner, 2020; Mkansi & Nsakanda, 2021; Risberg & Jafari, 2022). Concerning supply chain management, Halldórsson & Wehner (Halldórsson & Wehner, 2020) viewed the delivery of goods collectively down in the supply chain as close as possible to the point of consumption as a solution to meet this last mile sustainability challenge. Risberg & Jafari (Risberg & Jafari, 2022) proposed price differentiations or advantages at the purchase (online) checkout for customers choosing a more sustainable-friendly delivery option. They also suggested cooperation with logistics service providers to achieve fossil-free deliveries (Risberg & Jafari, 2022). Even if e-commerce executives state an increasing relevance according to their survey, they contend that omnichannel retailers still pay too little attention to sustainability aspects in deliveries (Risberg & Jafari, 2022). The last mile is also considered from a social perspective, as it is directly related to customer satisfaction (speed vs. sustainability). Mkansi and Nsakanda (Mkansi & Nsakanda, 2021) uncovered a certain environmental challenge on the last mile for omnichannel retailers in the grocery industry. Deliveries with food vans potentially lead to more traffic congestion, noise pollution and increased space requirements, even if the environmental performance is better than deliveries by pure online providers or centralised retailers who do not benefit from shorter distances through a retail network (Mkansi & Nsakanda, 2021). Overcoming this challenge by adopting more eco-friendly delivery methods can also help companies to increase brand visibility and customer loyalty. Hagberg & Hulthén (Hagberg & Hulthén, 2022) examines organisational forms of logistics on the last mile and their consolidation effects through resourcing. They also identified more environmentally friendly vehicles and the choice of transport form as a measure to respond to the sustainability challenge. But also appoints consolidation potential by reducing the number of purchases or shopping trips on the customer side and improving transport

requirements (Hagberg & Hulthén, 2022). Two last mile-related studies by Buldeo Rai et al. were examined in this review. One publication analyses the extent to which customers are willing to use more sustainable delivery options for the last mile (Buldeo Rai et al., 2019b). And the other examines how omnichannel retailers can offer crowdsourcing services to increase efficiency and reduce the unfavourable environmental impact of a last mile delivery (Buldeo Rai et al., 2021).

In the second group with eight articles, transport and logistic challenges were considered from different perspectives. This group included another study by Buldeo rai et al. (Buldeo Rai et al., 2019a) examining the organisation and distribution efficiency of urban parcel distribution in Brussels. The authors mentioned sustainability and efficiency deficits in parcel delivery due to a lack of cooperation and information exchange between the parties involved and identified deliveries with non-environmentally-friendly vehicles as a further challenge (Buldeo Rai et al., 2019a). Karlsson et al. analysed challenges and components that cause returns in omnichannel retail to improve efficiency (Karlsson et al., 2023). A lenient returns policy for customers increases sales and leads to a higher return rate. This not only weakens the profitability of omnichannel retailers but also has a negative impact on the environment (Karlsson et al., 2023). Sallnäs & Björklund investigated the extent to which consumers can influence the greening of distributions in an omnichannel environment (Sallnäs & Björklund, 2020). The results suggest that consumers have only little influence due to information gaps among the actors involved (Sallnäs & Björklund, 2020).

Bilińska-Reformat & Dewalska-Opitek addressed the challenges of the fast fashion industry during the coronavirus pandemic (Bilińska-Reformat & Dewalska-Opitek, 2021). They noted an accelerated change in business models, especially towards more e-commerce and omnichannel solutions . Sustainability challenges were not the focus of the study. Nevertheless, the authors identified sustainability-related challenges in the literature review. They indicated that consumers have increasingly become aware of and raised concerns about the environmental impact and working conditions in the textile industry (Bilińska-Reformat & Dewalska-Opitek, 2021). Despite these developments from the customer’s point of view, sustainability is still only a subordinate key factor for brand selection in the fast fashion industry (Bilińska-Reformat & Dewalska-Opitek, 2021). A further study by Kayikci indicated that the digitalisation of logistics processes makes overcoming sustainability challenges easier for companies (Kayikci, 2018). In particular, the challenges of reducing waste, air pollution and greenhouse gas emissions are more likely to be met through the use of digital technologies. Companies that trade in so-called

Fast Moving Consumer Goods (FMCG) products were examined (Kayikci, 2018). It is therefore not possible to clearly verify how many of them are omnichannel retailers. Kembro & Norrman discussed the challenges of logistics information systems from the perspective of Swedish omnichannel retailers (Kembro & Norrman, 2019). Operational aspects such as increasing complexity, data accuracy or frequency of synchronisation were cited as main challenges (Kembro & Norrman, 2019). Sustainability aspects were also not the main concern of the study. Nevertheless, the authors argued that decentralised omnichannel networks, like warehouses or outlets, can help to improve sustainability when allocating the shipping location of a good. In this context, a management survey reveals the challenge of minimising environmental impact is becoming more relevant, evidenced by an increase on the Likert scale (0-7) from 2.85 (today) to 4.70 (five years). Pan et al. identified failed home deliveries of food purchased online as a challenge due to the perishable nature of the goods (Pan et al., 2017). They propose a two-stage methodological approach that uses customer-related data to determine the probability of customer absence. Computer simulations indicate that this could reduce the delivery distance (3%-20%) and improve the delivery rate (18%-26%) . The reduced environmental footprint would have a positive impact on sustainability (Pan et al., 2017). Muñoz-Villamizar et al. analyse the transport-related environmental impact of Mexico's largest (omnichannel) retailer caused by fast shipping. With the help of a simulation model, they demonstrate that a fast delivery, such as same-day delivery, significantly impact carbon emissions and influences costs massively (up to 15% and 68%) (Muñoz-Villamizar et al., 2021).

The studies of the last group have a more general approach to sustainability challenges in omnichannel retailing. Peng et al. met the challenge to achieve a reduction in packaging while maximising profits for ordered goods in an omnichannel context with a theoretical model for an efficient store density (Peng et al., 2022). He et al. analysed the effects and the associated challenges of subsidies and corporate social responsibility in an omnichannel environment in terms of product and price, as well as carbon emissions (X. He et al., 2023). With the help of a cost-sharing model, the coordination of reducing CO2 emissions should be made easier and more attractive for the market participants involved to meet environmental challenges (X. He et al., 2023). Xu et al. developed a model to uncover efficiency and profit improvement potentials in consideration of CO2 emission regulations. According to the authors, CO2 regulations and taxes are financial challenges in omnichannel retailing (Xu et al., 2023).

One of the most obvious outcomes of the current review concerns the wide range of different sustainability-related challenges and key findings in omnichannel retailing, covering all

sustainability dimensions (see Table 11). Nevertheless, the focus of many studies is primarily on increasing efficiency on the company side (economic), less on uncovering the ecological or social dimension. Challenges in transport and logistics are commonly highlighted in the literature, in particular the last mile. Concerning methodology, primarily qualitative approaches were used. Except two studies (Kayikci, 2018; Risberg & Jafari, 2022), the research question did not explicitly aim to uncover sustainability challenges in omnichannel retailing. Instead, the different sustainability challenges of omnichannel retailing have emerged in context and were revealed as a further result or finding of the analyses. The results indicate that there are still only a few studies that explicitly deal with sustainability challenges in omnichannel retail from consumers' point of view. The added value of this review therefore lies in summarising, classifying and structuring these challenges and thus offers a good starting point for further, even more detailed research on sustainability related challenges. All identified factors are visualised at the Figure 13 and Table 11 order by sustainability dimensions.

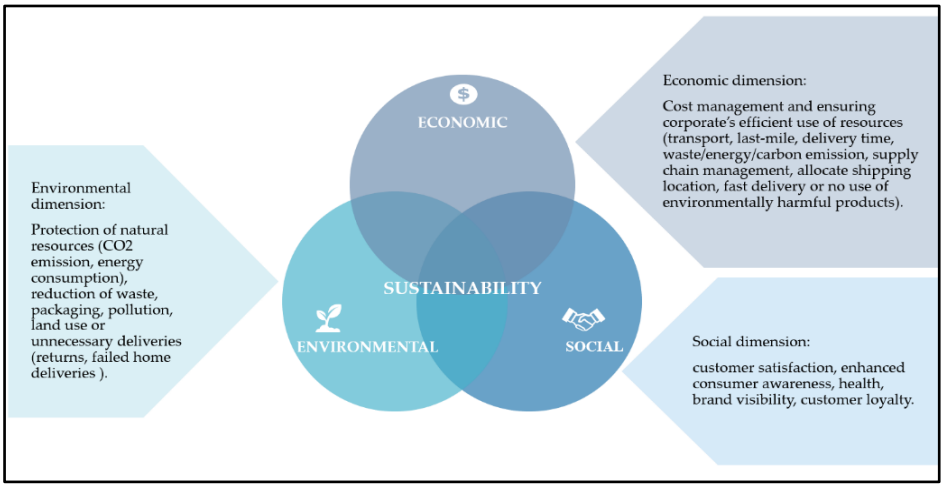


Figure 13. Interconnections of the three dimensions of sustainability challenges for omnichannel retailer
Source: Own presentation based on Sikdar (2003)

Table 11. Framework of challenges and key findings according to the three sustainability dimensions and (business) sectors

	Challenges/Key findings			Count
	Environment	**Economic**	**Social**	
Logistics	● Returns generate more waste and energy resources (Bijmolt et al., 2021; Sallnäs & Björklund, 2020). ● High environmental impact caused by fast shipping (Muñoz-Villamizar et al., 2021). ● Packaging waste (Adivar et al., 2019; Sallnäs & Björklund, 2020) ● Lenient returns policy leads to more returns and has a negative impact on the environment (Karlsson et al., 2023). ● Increased energy and resource consumption in omnichannel retailing with longer transport routes, more complex packaging, reduced basket sizes and higher return rates for online orders (Buldeo Rai, 2021; Xu et al., 2023)	● Decentralised omnichannel networks to improve sustainability when allocating the shipping location (Kembro & Norrman, 2019). ● Failed home deliveries of food purchased online due to the perishable nature of the goods (Pan et al., 2017). ● Lenient returns policy weakens profitability (Karlsson et al., 2023). ● Lack of planning to optimise the transport of goods to the final customer (scheduling, delivery window) (Sallnäs & Björklund, 2020) ● Poor exchange on packaging design between omnichannel retailer and logistic providers (Sallnäs & Björklund, 2020).	● Eco-friendly delivery methods increase brand visibility and customer loyalty (Kembro & Norrman, 2019). ● Health (disease caused by transport side effects like pollution or noise or accident rates) (Kayikci, 2018). ● Consumers tend to choose express deliveries with a poor environmental performance (Sallnäs & Björklund, 2020). ● Little influence of consumers on the greening of distributions (Sallnäs & Björklund, 2020).	
	6	5	4	**15**
Last mile	● Inefficient last mile routings affect the environment (Bergmann et al., 2020; Buldeo Rai et al., 2019b, 2021; Hagberg & Hulthén, 2022). ● Delivering goods collectively as close as possible to the point of consumption relieves the environment (Halldórsson & Wehner, 2020). ● Omnichannel retail executives still pay too little attention to sustainability aspects (Kembro & Norrman, 2019; Risberg & Jafari, 2022). ● Food vans of OCR in the UK lead to more traffic congestion, noise pollution	● High energy demand on the last mile (Bijmolt et al., 2021; Buldeo Rai, 2021; Buldeo Rai et al., 2019b; Hagberg & Hulthén, 2022; Halldórsson & Wehner, 2020; Kembro & Norrman, 2019; Risberg & Jafari, 2022). ● Last mile most expensive delivery leg (Bijmolt et al., 2021; Buldeo Rai et al., 2019b, 2021; Halldórsson & Wehner, 2020; Kembro & Norrman, 2019; Risberg & Jafari, 2022). ● Cooperations with logistics services providers to achieve fossil-free (Buldeo Rai, 2021) deliveries (Risberg & Jafari, 2022). ● Offering customers different/better prices for more sustainable-friendly delivery options (Risberg & Jafari, 2022). ● Increased efficiency by combining pick-up and delivery processes on the last and first mile. (Bergmann et al., 2020)	● Limited interest of customers in more eco-friendly transport options (Buldeo Rai et al., 2019b, 2021). But they also prefer the greatest possible delivery transparency (Buldeo Rai et al., 2021).	

	and increased space requirements (but better environmental performance than deliveries by pure online providers or centralised retailers) (Kembro & Norrman, 2019). ● Sustainability deficits due to a lack of cooperation and information exchange between logistics service providers and authorities (Buldeo Rai et al., 2019a) and deliveries with non-environmentally-friendly vehicles (Buldeo Rai et al., 2019a; Hagberg & Hulthén, 2022).	● Collection and delivery within a local network, e.g. collection points or hand over to the neighbour as a solution to increase efficiency (Buldeo Rai et al., 2021). ● Efficiency deficits due to a lack of cooperation and information exchange between logistics service providers and authorities (Buldeo Rai et al., 2019a) and deliveries with non-environmentally-friendly vehicles (Buldeo Rai et al., 2019a; Hagberg & Hulthén, 2022). ● Increased returns rates in OCR weaken profitability (Hagberg & Hulthén, 2022). ● Public transport requirements, e.g. for packaging, cooling, hazardous goods (Hagberg & Hulthén, 2022)		
	11	20	3	**34**
Business Operations & Information Technology	● High environmental impact of the clothing industry (Bilińska-Reformat & Dewalska-Opitek, 2021). ● Resource efficiency (waste, pollution, land use impact (Kayikci, 2018) ● Increasing parcel volume due to OCR (Buldeo Rai et al., 2019a) and almost unlimited access to products worldwide is an environmental challenge (X. He et al., 2023) ● Different national guidelines for market participants make it more challenging to reduce CO2 emission (X. He et al., 2023) ● Omnichannel leads to less packaging materials than the pure-online channel (Peng et al., 2022).	● Reduction of the carbon footprint in fast fashion (Bilińska-Reformat & Dewalska-Opitek, 2021). ● Reducing waste, air pollution and greenhouse gas emissions is more likely to be met through the use of digital technologies (delivery time, delay, inventory, reliability) (Kayikci, 2018). ● Improving delivery distances (3-20%) and delivery rates (18-26%) with computer simulations (Pan et al., 2017). ● Coordination of the omnichannel supply chain towards greater energy efficiency is difficult due to the different requirements and interests of market participants (X. He et al., 2023). ● An optimal store density helps to increase profits (Peng et al., 2022). ● CO2 regulations and taxes are a financial burden for omnichannel retailer (Xu et al., 2023).	● Almost unlimited availability to products in an online/OCR setting increases the demand to buy more (Buldeo Rai, 2021; X. He et al., 2023) and the number of purchases or shopping trips on the consumer side (Hagberg & Hulthén, 2022). ● Environmentally aware customers pay more attention to packaging-friendly pickup services but store pickups are tendentially inconvenient to customers (Peng et al., 2022)	
	6	6	3	**15**
			● Swedish customers are already more environmentally aware than retailers' executives (Risberg & Jafari, 2022).	

Costumer			• Enhanced consumer awareness of employment rights in the fast fashion industry (Bilińska-Reformat & Dewalska-Opitek, 2021).	
	0	0	2	**2**
Total	**23**	**31**	**12**	**66**

6.1.3 Limitations of the review

The current review has several limitations, such as the diversity of information sources and the selection of literature. Only review articles, dissertations and conference papers from three databases were included. Therefore, relevant information from other sources, including information from books or book chapters, may have been missed. However, it is noteworthy that IT and consulting companies also provide studies in omnichannel retailing and/or address sustainability-related challenges for companies (Lehmann & Teller, 2022; Pierre Mercier et al., 2014). Furthermore, this study focused only on literature written in the English language. The risk of bias due to limitations in the search process cannot be entirely negated, as the selected terms in the search string also have synonyms with similar meanings. For example, the term "sustainability" often appears in the context of words with similar meanings such as "environment", "ecology" or "green". An expansion of the search terms could be reconsidered in future reviews.

After the final screening in the method part, systematic literature reviews can be supplemented with additional systematic searches for further verification. For example, with an audit of primary sources, as recommended by Greenhalgh & Peacock using the "snowball" approach (Greenhalgh & Peacock, 2005). This method can identify additional sources that were not found via the systematic literature search in the databases. In addition to the search according to the PRISMA criteria, no further backward screening was performed in this study. Despite the stated limitations, the current systematic literature review offers a holistic, and structured view of the sustainability-related challenges in omnichannel retail and provides a starting point for further research, which is also necessary in this subject.

6.1.4 Concluding remarks on the review

This systematic literature review highlighted the established knowledge of sustainability challenges behind the academic literature on omnichannel retailing. The aim was the development of a comprehensive, structured overview to serve as a starting point for future research or to develop managerial implications in business practice. The review revealed that the number of publications on omnichannel has increased, especially in previous years. Our study proves that scientific sources have only been available for the last 10 years; in fact, only in the previous 6 years have researchers dealt with omnichannel retailing on a wider scale.

Even if the challenges in omnichannel retail are within the three sustainability dimensions, the review of the articles indicated a slightly uneven weighting in favour of the economic dimension with a strong corporate-centric view, followed by environmental and social aspects of

sustainability. One more critical revelation is that there were no separate reviews focusing on the different challenges of the sustainability dimension. This review recommends this gap, identifying factors in omnichannels retailing that are challenging at the last mile nowadays. However, there is a need to enhance consumers' sustainability expectations with the help of loyalty and brand awareness. While earlier studies have included a dual perspective on omnichannel retail and sustainability challenges (Adivar et al., 2019; Kayikci, 2018) the two components are not strongly linked in most articles.

Future studies should pay even more attention to integrating these two perspectives. This review's strength lies in combining these two aspects. Evidently, no systematic analysis has adequately focused on the current challenges in omnichannel retailing from a sustainability point of view.

6.1.5 Future directions

This systematic literature review contributes to omnichannel retail research by summarising the literature on sustainability challenges. Furthermore, it also identifies potential areas for future research. First, most recent studies are only focused on a specific topic. Broader-based investigations provide a coherent overview and can help marketers and researchers understand and explore how different sustainability challenges along the entire value chain are interrelated and connected. This review identifies a need for further reviews in this complex field of research. . Secondly, although this study provides a holistic overview, solutions to overcome sustainability-related challenges are only provided indirectly. The research landscape would therefore be enriched by more investigations, such as that by Pan et al., with concrete solutions and approaches to addressing certain environmental, economic or social obstacles in omnichannel retail (Pan et al., 2017). Thirdly, the review reveals that qualitative methods were most frequently applied in the studies. Therefore, increased use of quantitative research and data -driven methods could provide an even more robust empirical evidence in future research.

If the trend of increasing publications in omnichannel retail continues as rapidly as in the last three years, the research field will remain relevant and provide a fertile ground for further research on sustainability challenges in omnichannel retailing.

6.2 Results of the empirical study

The following chapter presents the empirical results of the dissertation, which are based on two quantitative analysis. Both studies aimed to empirically test the theoretically derived structural model and the corresponding hypotheses. However, they differ in terms of sample size, methodological approach, and statistical procedures.

To ensure transparency and methodological clarity, the results of the pilot study and the main study are presented separately. Each subsection first outlines the descriptive results and measurement model assessment before showing the findings of the structural model and the hypothesis tests. This separate presentation allows the specific characteristics of each study, particularly the use of PLS-SEM in the pilot study and CB-SEM in the main study, to be adequately described.

After the individual analyses have been presented, the findings are systematically compared and integrated in a dedicated subsection (see Chapter 6.4). This structure ensures that the methodological and statistical particularities of each approach are fully reflected, while at the same time enabling a direct comparison of the outcomes. The separation allows the pilot study to provide initial exploratory evidence, which was subsequently validated and extended by the main study.

6.2.1 Descriptive results of survey items

Before presenting the pilot and the main study separately, an overview of the descriptive statistics for all survey items is provided. The results illustrate how respondents evaluated each item on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Presenting these results at the beginning of Chapter 6 ensures transparency and offers an initial impression of distribution patterns and central tendencies before moving to the evaluation of the measurement and structural models.

As the sample size of the pilot study was relatively small and primarily used for exploratory purposes, no full descriptive distributions were reported. The following results are therefore based on the main study with 358 participants, which provides a more robust and representative dataset. Table 12 summarises the percentage distribution of responses across all items together with the mean values. The results indicate that respondents generally expressed agreement with sustainability-related statements, although the level of agreement varied between constructs. The findings here provide the empirical foundation for the subsequent assessment of measurement validity and the testing of hypotheses.

Table 12. Descriptive statistics of items (Likert scale 1–5)

Variables	Items	1	2	3	4	5	Mean
Environmental Awareness	I avoid products that significantly harm the environment.	5,3	6,5	35,3	35,5	17,4	3,5
	I am willing to accept longer delivery times if they are more environmentally friendly.	4,1	8,2	23,0	36,2	28,5	3,8
	It is important to me to contribute to environmental protection through my purchases.	3,6	6,2	32,4	36,9	20,9	3,7
	I actively seek information about the sustainability of products and companies.	7,5	15,4	35,7	29,9	11,6	3,2
Sustainability Measures	I prefer to buy from a retailer that offers more environmentally friendly packaging.	5,3	10,6	28,2	34,0	21,9	3,6
	I prefer to buy from a retailer that offers eco-friendly delivery options (e.g. CO2-neutral delivery).	5,5	10,8	28,4	33,9	21,4	3,6
	I inform myself about a retailer's sustainability measures before I buy a product.	9,2	15,4	38,1	26,0	11,3	3,2
Channel Integration	It is important to me that Information and Linking across online and offline channels of a retailer are consistent.	4,6	7,5	33,7	34,7	19,5	3,6
	I use different sales channels (e.g. online shop, retail store, app) and expect a seamless experience.	4,1	8,2	26,2	39,5	22,0	3,7
	I find it convenient to research products online and purchase them in a store.	5,8	10,4	28,7	31,1	24,1	3,6
	The ability to return a product purchased online to the store is important to me.	6,5	11,6	29,2	27,5	25,3	3,5
Customer Satuisfaction	I am satisfied with my shopping experience with the brand/omnichannel retailer when buying my electrical goods.	4,6	3,6	22,9	42,2	26,8	3,8
	The quality of the product I buy meets my expectations.	2,2	3,1	22,1	40,1	32,6	4,0
	I would recommend the brand/omnichannel retailer to others.	4,1	5,1	22,7	38,8	29,4	3,8
	The brand/omnichannel retailer offered me a pleasant shopping experience.	3,1	5,6	24,9	40,3	26,1	3,8
Green Brand identity	I identify with brands that promote sustainability.	8,6	13,9	30,2	32,6	14,6	3,3
	The values of a brand influence my purchasing decisions.	7,2	11,6	30,8	35,4	14,9	3,4
	I feel emotionally connected to brands that support environmentally friendly practices.	9,1	14,7	29,6	29,6	17,1	3,3
	Sustainable measures of a brand increase my loyalty to that brand.	7,2	11,8	27,5	34,7	18,8	3,5
Green Purchase Intention	It is important to me to contribute to environmental protection through my purchases.	6,7	7,2	29,1	35,6	21,4	3,6
	I avoid products that significantly harm the environment.	4,8	6,8	28,0	31,2	29,2	3,7
	My purchasing decision is strongly influenced by the sustainability of a product.	7,2	16,1	32,2	30,3	14,2	3,3
	I actively look for sustainable products when I shop.	8,5	15,0	30,5	30,5	15,5	3,3

6.2.2 Results of the pilot study

Data analysis using structural equation modelling (PLS-SEM) was performed with the software SmartPLS 3, following a structured multi-step approach (Al-Emran et al., 2019). The focus in the pilot study was on establishing the reliability and validity of the constructs under small-sample, exploratory conditions. Accordingly, discriminant validity was examined using Fornell-Larcker criterion, heterotrait-monotrait ratio (HTMT), and variance inflation factor (VIF) values, which are standard in variance-based SEM. Model fit was assessed with the PLS-specific indices standardised root mean square residual (SRMR), the normed fit index (NFI), and RMS Theta, since global covariance fit statistics such as CFI or RMSEA are not available in PLS-SEM. Finally, the structural model was tested using a bootstrapping procedure with 5000 subsamples to assess the significance of the hypothesised relationships.

6.2.2.1 Evaluation of the measurement model

The validity and reliability of the measurement model were assessed using established criteria. Factor loadings ranged from 0.685 to 0.919, indicating strong indicator reliability across all items. Cronbach's alpha values exceeded 0.70 for all constructs, and composite reliability (CR) values ranged from 0.815 to 0.925, demonstrating high internal consistency. Furthermore, the average variance extracted (AVE) was above the recommended threshold of 0.50 in all cases, confirming the convergent validity of the measurement scales (see Table 13).

In contrast to the main study, the Kaiser-Meyer-Olkin values were not reported, as these are not a standard criterion in variance-based PLS-SEM. Instead, the focus was placed on composite reliability and discriminant validity indices.

Table 13. Overview of the survey results and statistical key figures of the variables

Factor	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
Environmental Awareness	I avoid products that significantly harm the environment.	0.823	0.839	0.892	0.675
	I am willing to accept longer delivery times if they are more environmentally friendly.	0.827			
	It is important to me to contribute to environmental protection through my purchases.	0.822			
	I actively seek information about the sustainability of products and companies.	0.813			
Sustainability Measures	I prefer to buy from a retailer that offers more environmentally friendly packaging.	0.914	0.879	0.925	0.806
	I prefer to buy from a retailer that offers eco-friendly delivery options (e.g. CO2-neutral delivery).	0.919			
	I inform myself about a retailer's sustainability measures before I buy a product.	0.858			
Customer Satisfaction	I am satisfied with my shopping experience with the brand/omnichannel retailer when buying my electrical goods.	0.784	0.806	0.873	0.633
	The quality of the product I buy meets my expectations.	0.767			
	I would recommend the brand/omnichannel retailer to others.	0.786			
	The brand/omnichannel retailer offered me a pleasant shopping experience.	0.842			
Channel Integration	It is important to me that Information and Linking across online and offline channels of a retailer are consistent.	0.685	0.698	0.815	0.524
	I use different sales channels (e.g. online shop, retail store, app) and expect a seamless experience.	0.757			
	I find it convenient to research products online and purchase them in a store.	0.756			
	The ability to return a product purchased online to the store is important to me.	0.694			
Green Brand Identity	I identify with brands that promote sustainability.	0.876	0.876	0.915	0.73
	The values of a brand influence my purchasing decisions.	0.816			
	I feel emotionally connected to brands that support environmentally friendly practices.	0.833			
	Sustainable measures of a brand increase my loyalty to that brand.	0.89			
Green Purchase Intention	It is important to me to contribute to environmental protection through my purchases.	0.83	0.846	0.897	0.685
	I avoid products that significantly harm the environment.	0.831			
	My purchasing decision is strongly influenced by the sustainability of a product.	0.81			
	I actively look for sustainable products when I shop.	0.839			

To assess discriminant validity, the Fornell-Larcker criterion and the heterotrait-monotrait ratio (HTMT) were applied. The Fornell-Larcker criterion requires that the square root of each construct's average variance extracted (AVE) exceeds its correlations with all other constructs (Fornell & Larcker, 1981). This condition was consistently fulfilled, providing support for the model's discriminant validity (see Table 14).

Table 14. Discriminant validity based on the Fornell-Larcker criterion

Factor	**GBI**	**CI**	**SE**	**EA**	**SM**	**GPI**
Green Brand Identity	0.854					
Channel Integration	0.368	0.724				
Customer Satisfaction	0.328	0.562	0.795			
Environmental Awareness	0.676	0.344	0.266	0.821		
Sustainability Measures	0.694	0.387	0.303	0.765	0.898	
Green Purchase Intention	0.727	0.365	0.251	0.628	0.667	0.827

All HTMT values were also below the threshold of 0.90 (see Table 15), further supporting the distinctiveness of the constructs (Henseler et al., 2015). In line with these results, the cross-loadings indicated that each indicator loaded highest on its respective construct and substantially lower on all others, which provides additional support for discriminant validity.

Table 15. Discriminant validity based on the HTMT criterion

Factors	**GBI**	**CI**	**SE**	**EA**	**SM**	**GPI**
Green Purchase Intention						
Channel Integration	0.456					
Customer Satisfaction	0.377	0.745				
Environmental Awareness	0.785	0.435	0.323			
Sustainability Measures	0.788	0.491	0.356	0.886		
Green Purchase Intention	0.840	0.467	0.315	0.744	0.776	

Potential multicollinearity was assessed using variance inflation factors (VIFs). All values (see Table 16) were below the critical threshold of 5, indicating no multicollinearity issues, and the stability of the model estimates can be assumed (Hair, Risher, et al., 2019).

Table 16. Discriminant validity based on the VIF criterion

Key indicators	**GBI**	**CI**	**SE**	**EA**	**SM**	**GPI**
Green Brand identity			2.174			1.945
Channel Integration			1.205			1.571
Customer Satisfaction						1.500
Environmental Awareness			2.674		1.000	1.877
Sustainability Measures			2.858			
Green Purchase Intention						

6.2.2.2 Model fit

To evaluate the model fit, several key indicators were assessed (see Table 17). The Standardised Root Mean Square Residual (SRMR) was 0.099, which is just within the acceptable tolerance range (threshold < 0.10). The RMS Theta value of 0.183 is also considered acceptable for reflective measurement models, though it is not particularly strong. The Normed Fit Index (NFI) reached 0.697, which falls below the conventional cutoff of 0.90. However, this relatively low value can partly be attributed to the limited sample size (n = 125), as the NFI is known to be sensitive to small samples. In the context of an exploratory pilot study with moderate model complexity, this value is therefore still regarded as acceptable, but its fit is limited and results should be interpreted with caution.

Table 17. Model fit

SRMR	**RMS Theta**	**Normed Fit Index (NFI)**
0.099	0.183	0.697

In contrast to the main study, descriptive statistics such as means, standard deviations, and correlations were not reported in the pilot study. This decision reflects the exploratory aim of the

pilot, where the primary focus lay on assessing measurement quality and discriminant validity rather than on descriptive associations between constructs.

6.2.2.3 Hypothesis testing

The structural equation modelling (SEM) produced mixed results regarding the direct and indirect effects of the variables. The hypotheses (H1–H9) were tested using bootstrapping with 5,000 resamples. The path coefficients were examined for their statistical significance. While three hypotheses were confirmed, six did not reach statistical significance. Table 18 summarises the results of the hypothesis testing, including the standardised path coefficients, standard deviations, t-statistics, and p-values indicating the significance of the relationships between the latent constructs.

Table 18. Results of the hypothesis test

Hypothesis		**Original Sample**	**Sample Mean**	**SD**	**T Statistics**	**P Values**
H1	Environmental Awareness -> Sustainability Measures	0.765	0.765	0.047	16.186	**0.000**
H2	Environmental Awareness -> Customer Satisfaction	-0.023	-0.011	0.168	0.139	**0.889**
H3	Environmental Awareness -> Green Purchase Intention	0.236	0.239	0.128	1.847	**0.065**
H4	Customer Satisfaction -> Green Purchase Intention	-0.054	-0.058	0.084	0.646	**0.518**
H5	Sustainability Measures -> Customer Satisfaction	0.029	0.022	0.157	0.183	**0.855**
H6	Channel Integration -> Customer Satisfaction	0.509	0.508	0.085	6.012	**0.000**
H7	Channel Integration -> Green Purchase Intention	0.114	0.118	0.092	1.237	**0.216**
H8	Green Brand Identity -> Green Purchase Intention	0.543	0.541	0.093	5.827	**0.000**
H9	Green Brand Identity -> Customer Satisfaction	0.137	0.134	0.121	1.138	**0.255**

Significant direct influences were found for green brand identity on green purchase intention (H8: p = 0.000), environmental awareness on sustainability measures (H1: p = 0.000), and channel integration on shopping experience (H6: p = 0.000). No significant influence on green purchase intention was observed from environmental awareness (H3), channel integration (H7), or shopping experience (H4). Additionally, green brand identity on customer satisfaction (H9), environmental awareness on customer satisfaction (H2), and sustainability measures on customer satisfaction (H5) were also not significant. Indirect effects (for example, via customer satisfaction as a mediator) were not supported.

Overall, the pilot study provided initial empirical support for selected paths of the theoretical model, while also revealing limitations in model fit and measurement that informed refinements in the subsequent main study.

6.2.3 Results of the main study

Building on the exploratory insights of the pilot study, the main study provides a more comprehensive empirical test of the structural model by applying covariance-based structural equation modeling (CB-SEM) to a larger sample. The statistical tool R was used to analyse the data and test the hypotheses. The analysis was carried out in two steps. First, the measurement model was evaluated, followed by estimating the structural model using maximum likelihood methodology. Whereas in the pilot study all nine hypothesised paths were initially estimated in a variance-oriented framework, here a covariance-oriented approach was applied. A first model included all theoretically derived hypotheses, while in a reduced model, non-significant paths were removed to achieve a better fit.

Compared to the pilot study, which focused on basic reliability and discriminant validity (with Fornell-Larcker, HTMT, VIF), the main study additionally incorporated KMO statistics for each construct, thereby documenting sampling adequacy for factor analysis in a way not available in the exploratory design.

Table 19 provides an overview of the survey results and statistical key figures of the variables of the main study, serving as a basis for the subsequent presentation of results.

Table 19. Overview of the survey results and statistical key figures of the variables

Variables	Items	Factor Loading	KMO, Cronbach's α, AVE
Environmental Awareness	I avoid products that significantly harm the environment.	0,737	KMO = 0.71 Cronbach's α = 0.8131367 AVE = 0. 594
	I am willing to accept longer delivery times if they are more environmentally friendly.	0,764	
	It is important to me to contribute to environmental protection through my purchases.	0,811	
Sustainability Measures	I prefer to buy from a retailer that offers more environmentally friendly packaging.	0,881	KMO = 0.71 Cronbach's α = 0.868059 AVE = 0.698
	I prefer to buy from a retailer that offers eco-friendly delivery options (e.g. CO2-neutral delivery).	0,898	
	I inform myself about a retailer's sustainability measures before I buy a product.	0,715	
Channel Integration	It is important to me that Information and Linking across online and offline channels of a retailer are consistent.	0,711	KMO = 0.5 Cronbach's α = 0.6718957
	I use different sales channels (e.g. online shop, retail store, app) and expect a seamless experience.	0,711	AVE = 0.504
Customer Satisfaction	I am satisfied with my shopping experience with the brand/omnichannel retailer when buying my electrical goods.	0,788	KMO = 0.81 Cronbach's α = 0.8700384 AVE = 0.626
	The quality of the product I buy meets my expectations.	0,717	
	I would recommend the brand/omnichannel retailer to others.	0,818	
	The brand/omnichannel retailer offered me a pleasant shopping experience.	0,836	
Green Brand Identity	I identify with brands that promote sustainability.	0,835	KMO = 0.85 Cronbach's α = 0.8942445 AVE = 0.681
	The values of a brand influence my purchasing decisions.	0,783	
	I feel emotionally connected to brands that support environmentally friendly practices.	0,815	
	Sustainable measures of a brand increase my loyalty to that brand.	0,864	
Green Purchase Intention	It is important to me to contribute to environmental protection through my purchases.	0,698	KMO = 0.78 Cronbach's α = 0.8551644 AVE = 0.598
	I avoid products that significantly harm the environment.	0,739	
	My purchasing decision is strongly influenced by the sustainability of a product.	0,843	
	I actively look for sustainable products when I shop.	0,804	

6.2.3.1 Model fit

The measurement model was tested for validity and reliability using various criteria. The Kaiser-Meyer-Olkin (KMO) values and Cronbach's alpha were above the recommended threshold value of 0.5, which confirmed the suitability of the factor analysis. The factor loadings of the variables

were significant and varied between 0,698 and 0,898 indicating a high reliability of the scales. The average variance extracted (AVE) was above 0.50.

In contrast to the pilot study, where only PLS-specific indices such as SRMR, RMS Theta and NFI were available, the CB-SEM procedure enabled the evaluation of global fit through Chi-square test, Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA), supplemented by comparative indices (AIC, ECVI). High TLI and CFI values close to 1.00, along with an RMSEA value below 0.08, indicate a good model fit. The values of the model fit are shown in Table 20.

Table 20. Model fit

Model	Chi²	df	CFI	TLI	RMSEA	AIC	ECVI
Full Model	550.341	226.000	0.926	0.911	0.066	15.434.811	2.037
Red. Model	548.996	228.000	0.927	0.913	0.065	15.429.466	2.021

To analyse the variables of the measurement model, the mean values, standard deviations and correlations were calculated (see Table 21). The results show that some correlations correspond to theoretical expectations and are at a significance level of $p < 0.01$ (see Figure 14 and 15). The examination of the path coefficients in the model revealed that some of the theoretically assumed relationships were not significant. To improve the quality of the model, these paths were removed, after which the model was retested. In the final model, all remaining paths were found to be significant and the fit statistics showed a good fit (see Table 20): $\chi^2 = 548.996$, df = 228.000, CFI = 0.927, TLI = 0.913 and RMSEA = 0.065.

Table 21. Descriptive statistics and correlations

Variable	M	SD	EA	SM	CI	CS	GBI	GPI
EA	3.582.868	0.8351054	1.000	0.807	0.498	0.350	0.712	0.738
SM	3.470.121	0.9584260	0.807	1.000	0.520	0.313	0.728	0.767
CI	3.661.298	0.7846441	0.498	0.520	1.000	0.551	0.514	0.513
CS	3.959.032	0.7971300	0.350	0.313	0.551	1.000	0.371	0.351
GBI	3.429.004	0.9751738	0.712	0.728	0.514	0.371	1.000	0.778
GPI	3.529.097	0.9113925	0.738	0.767	0.513	0.351	0.778	1.000

A comparison of the original and the reduced model (see Table 20) on the Akaike Information Criterion (AIC) and the Expected Cross-Validation Index (ECVI) indicate a slight improvement in model fit (AIC =15.429.466 vs. 15.434.811, ECVI = 2.021 vs. 2.037). Based on these results, the reduced model was adopted as the final version.

6.2.3.2 Hypothesis testing

The following section reports the results of the hypothesis testing in the main study. Compared to the pilot analysis, one additional relationships reached significance, reflecting both the larger sample size and the confirmatory design of CB-SEM. Nevertheless, several hypothesised effects remained unsupported, indicating consistent patterns across both studies.

Of the nine formulated hypotheses, four hypotheses were confirmed, while five showed no statistically significant effect (see Figure 14 and 15).

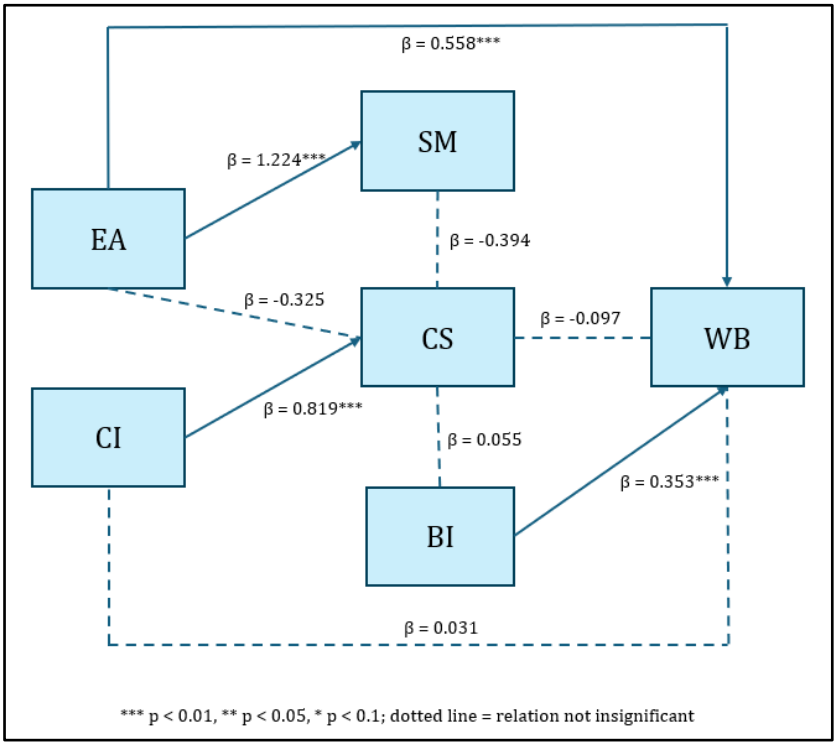


Figure 14. Results of the hypothesis test (full-model)
Source: Author's own elaboration

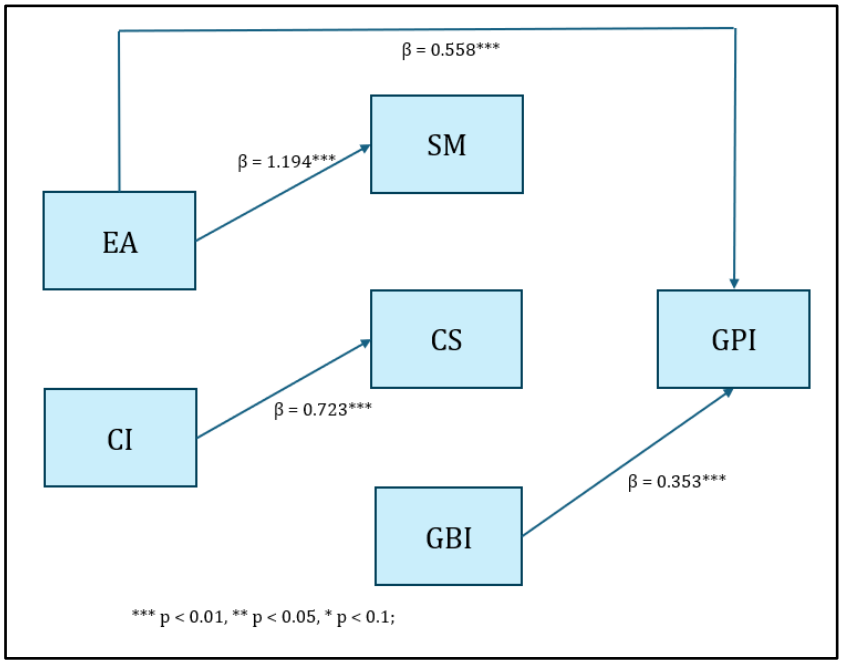


Figure 15. Results of the hypothesis test (reduced model)
Source: Author's own elaboration

The results of the hypothesis tests show that green purchase intention in the context of sustainability in omnichannel retailing in the consumer electronics industry is directly influenced by two factors in particular: Environmental awareness ($\beta = 0.558$, $p < 0.001$) and green brand identity ($\beta = 0.353$, $p < 0.001$). H3 (EA → GPI) confirms that environmentally aware customers are more likely to make sustainable purchasing decisions. H8 (GBI → GPI) demonstrates a significant influence of brand identity on green purchase intention and emphasises that consumers increasingly prefer brands that represent sustainability values. In addition to these direct effects on purchasing decisions, there is a strong relationship between environmental awareness and sustainability measures ($\beta = 1.194$, $p < 0.001$). H1 (EA → SM) indicates that environmentally aware consumers with a strong environmental awareness favour companies that are actively committed to sustainability and take measures that comply with ecological principles. Another significant relationship exists between channel integration and customer satisfaction ($\beta = 0.723$, $p < 0.001$). H6 (CI → CS) confirms that a consistent and seamless omnichannel experience significantly improves customer satisfaction.

Not above the threshold of significance is the relationship between channel integration and green purchase intention in H7 (CI → GPI). This result indicates that other factors probably have a greater impact on the purchase decision. H4 (CS → GPI) could not be confirmed either. This means that higher customer satisfaction does not necessarily lead to an increased green purchase intention. It appears that other factors such as green brand identity play a greater role. Brand

identity has no significant influence on customer satisfaction. H9 (GBI → CS) illustrates that a higher identification with a brand does not automatically lead to higher customer satisfaction. There was also no significant influence on customer satisfaction from the factors environmental awareness and sustainability measures. H2 (EA → CS,) and H5 (SM → CS) indicates that a consumer may perceive and value sustainable practices, but their satisfaction with the omnichannel retail experience is more dependent on other factors.

With regard to the indirect effects, the results show that none of them were significant. Neither does environmental awareness of sustainability measures and customer satisfaction influence green purchase intention (EA → SM → CS → GPI), nor does higher customer satisfaction through channel integration (CI → CS → GPI) or brand identity (GBI → CS → GPI) lead to an increased green purchase intention. To verify these effects, a bootstrapping analysis with 5,000 replicates was conducted, which did not confirm any statistically significant indirect paths. This suggests that environmental awareness and brand identity have a direct effect on purchasing decisions without being mediated (e.g. through customer satisfaction). Unlike in the pilot study, however, these results are based on a model that has undergone confirmatory fit assessment and thus provide stronger evidence that the effects of environmental awareness and green brand identity on green purchase intention are primarily direct rather than mediated

6.2.4 Comparative analysis of pilot and main study results

The results of the pilot (PLS-SEM) and the main study (CB-SEM) are presented separately due to differences in analytical approach and sample size. This section provides a side-by-side comparison of both studies, highlighting not only similarities in findings but also the distinct methodological logics that shaped measurement evaluation, model assessment, and hypothesis testing. The pilot study used a variance-based procedure suited to smaller samples and exploratory testing, whereas the main study applied a covariance-based procedure with a larger sample for confirmatory testing and global model fit evaluation.

6.2.4.1 Hypothesis testing

Table 22 summarises the results of the hypothesis testing from the pilot and main study. Both analyses confirm the significance of three central relationships: environmental awareness on sustainability measures (H1), channel integration on shopping experience (H6), and green brand identity on green purchase intention (H8). These robust effects highlight the importance of ecological awareness, seamless channel integration, and brand-related factors in shaping sustainable purchase intentions.

Differences emerge regarding H3 (EA → GPI), which was not significant in the pilot but confirmed in the main study, likely due to the larger sample and the confirmatory nature of CB-SEM. By contrast, hypotheses such as H4 (CS → GPI) or H5 (SM → CS) remained unsupported in both studies, which consistently points to their limited role in this context. Overall, the comparison shows a high degree of consistency across the two analysis, while also indicating how methodological and statistical differences influence the level of detail in the results. The more rigorous CB-SEM analysis confirmed effects (like H3) that remained inconclusive under the limited statistical power of the pilot study.

Table 22. Comparative results of hypothesis testing (pilot vs. main study)

Hypothesis	Path	Estimate (Pilot)	p-value (Pilot)	Significance (Pilot)	Estimate (Main)	p-value (Main)	Significance (Main)
H1	EA → SM	0,765	0	Yes	1,194	0	Yes
H2	EA → CS	-0,023	0,889	No	0,325	0,418	No
H3	EA → GPI	0,236	0,065	No	0,558	0	Yes
H4	CS → GPI	-0,054	0,518	No	-0,097	0,189	No
H5	SM → CS	0,029	0,855	No	-0,394	0,111	No
H6	CI → CS	0,509	0	Yes	0,723	0	Yes
H7	CI → GPI	0,114	0,216	No	0,031	0,773	No
H8	GBI → GPI	0,543	0	Yes	0,353	0	Yes
H9	GBI → CS	0,137	0,255	No	0,055	0,587	No

6.2.4.2 Methodological and statistical distinction

The pilot and main study fulfil different roles within the research design and therefore employed different statistical approaches. The pilot study applied PLS-SEM under exploratory conditions with a small sample, where the emphasis lay on indicator reliability, composite reliability, and discriminant validity. Model fit was assessed with PLS-specific fit indicators (SRMR, RMS Theta, NFI), which provide only approximate guidance in variance-based modelling and are known to be sensitive to small sample sizes.

In contrast, the main study employed CB-SEM using a considerably larger sample and a confirmatory design. Measurement quality was assessed by factor loadings, Cronbach's alpha, AVE, and KMO values, while model fit was evaluated through global fit indices (χ^2, CFI, TLI, RMSEA) as well as comparative measures (AIC, ECVI). The reduced model met established thresholds for acceptable model fit. (CFI = 0.927, RMSEA = 0.065), confirming the robustness of the refined measurement instruments.

These methodological choices reflect the complementary roles of the two studies. PLS-SEM served to test the stability of the constructs under limited statistical power, while CB-SEM provided a more rigorous evaluation of model fit and structural validity. The complementary application of both procedures strengthens the methodological foundation of the dissertation.

6.2.4.3 Measurement refinement and model fit

A closer comparison of the measurement models illustrates how the pilot study primarily served to validate and refine the measurement instruments. Based on the pilot results, several targeted adjustments were made in the main study to increase construct validity and improve the overall model specification. For example, the construct environmental Awareness in the pilot study comprised four items. The item "I actively seek information about the sustainability of products and companies" was not retained in the main study, as it conceptually overlapped with other indicators and did not contribute to higher AVE values. Also the variable channel integration was reduced from four to two items, with the indicators "I find it convenient to research products online and purchase them in a store" (factor loading = 0.756) and "The ability to return a product purchased online to the store is important to me" (factor loading = 0.694) being removed due to their relatively low loadings and the situation-specific wording, which reduced internal consistency. These refinements helped to stabilise the reliability of the constructs and clarify the measurement structure.

The pilot study achieved partly marginal fit values, with SRMR = 0.099 and NFI = 0.697, which can be explained by both the exploratory nature of the analysis and the small sample size. Such indices are known to be conservative under limited data conditions in variance-based SEM (Schuberth et al., 2023). Nevertheless, the results provided essential insights into how the model could be streamlined and enhanced. Building on these insights, the main study not only benefited from a substantially larger sample but also applied a more comprehensive range of global fit criteria. With values such as CFI = 0.927, TLI = 0.913, and RMSEA = 0.065, alongside supporting evidence from AIC and ECVI, the main study demonstrated that the final model specification met conventional methodological standards for confirmatory SEM.

Table 23 summarises the key results regarding measurement quality and model fit. It contrasts the exploratory validation approach of the pilot study with the confirmatory testing of the main study and shows how the applied refinements contributed to a clearer model structure and improved adequacy.

Table 23. Comparative Evaluation of Measurement and Model Fit (Pilot vs. Main Study)

Aspect	Pilot (PLS-SEM)	Main (CB-SEM)	Recommended thresholds
Loadings (range)	0.685–0.919	0.698–0.898	≥ 0.60 (Hair et al., 2010)
Cronbach's alpha	EA 0.839; SM 0.879; SE 0.806; CI 0.698; GBI 0.876; GPI 0.846	EA 0.813; SM 0.868; SE 0.870; CI 0.672; GBI 0.894; GPI 0.855	≥ 0.60 (better ≥ 0.70) (Nunnally & Bernstein, 1994)
Composite reliability	EA 0.892; SM 0.925; SE 0.873; CI 0.815; GBI 0.915; GPI 0.897	Not reported	≥ 0.70 (Hair et al., 2017)
AVE	EA 0.675; SM 0.806; SE 0.633; CI 0.524; GBI 0.730; GPI 0.685	EA 0.594; SM 0.698; SE 0.626; CI 0.504; GBI 0.681; GPI 0.598	≥ 0.50 (Fornell & Larcker, 1981)
KMO	Not reported	EA 0.71; SM 0.71; CI 0.50; SE 0.81; GBI 0.85; GPI 0.78	≥ 0.50 (better ≥ 0.60) (Kaiser, 1974)
Discriminant validity	Fornell–Larcker, HTMT and VIF reported and acceptable	Assessed via AVE, loads and global fit, FL/HTMT not reported	HTMT < 0.90 (Henseler et al., 2015)
Model fit	SRMR 0.099; RMS Theta 0.183; NFI 0.697	χ^2 548.996 (df 228); CFI 0.927; TLI 0.913; RMSEA 0.065; AIC 15,429.466; ECVI 2.021	CFI/TLI ≥ 0.90; RMSEA ≤ 0.08; RMR ≤ 0.08 (Hair, Black, et al., 2019)

6.2.5 Integrated discussion of empirical findings

The aim of this empirical analysis was to investigate the impact of sustainability on consumer behaviour and the purchasing decisions of customers who buy electronic consumer goods in an omnichannel retail environment. The findings provide a differentiated but coherent picture of how sustainability-related factors influence the purchase intention, revealing both robust effects and weaker or unsupported assumptions

6.2.5.1 Research results

The results show a multi-dimensional picture: the two variables with the greatest direct influence on green purchase intention are environmental awareness (individual factor) green brand identity (organisational factor). Consumers with a strong environmental awareness show a significantly higher willingness to buy products in an eco-friendly setting, even under the premise of longer delivery times or higher costs. Likewise, Identification with a brand that credibly communicates sustainable values also has a strong influence on purchasing decisions. These two factors form the key drivers of sustainable purchasing behaviour in the omnichannel consumer electronics sector.

In contrast, no direct effects on green purchase intention were found for the other organisational factors, such as channel integration and specific sustainability measures, or for customer satisfaction (individual factor). Indirect effects were also not confirmed in either study. This suggests that sustainable purchasing decisions are influenced less by the technical or functional retail experience and more by value orientation and strategic brand positioning.

It was also shown that channel integration contributes significantly to customer satisfaction without directly influencing the purchase decision. This underlines the importance of cross-channel consistency for a positive shopping experience, even if this does not necessarily result in sustainable consumer behaviour.

6.2.5.2 Contribution to the scientific literature

The key contribution of this dissertation lies in its focus on the consumer electronics sector within the context of omnichannel retailing. Although this sector, with its high online share and an unfavourable environmental profile, appears to be relevant, the consumer electronics sector is currently still underrepresented in existing sustainability and consumer research. The present work therefore provides a starting point for further research in this domain. Furthermore, by adapting and empirically analysing conceptual models from related industries, e.g. fashion (Shao & Lassleben, 2021) or sports and leisure (Nagy et al., 2024), and transferring them to the consumer electronics sector, it also contributes to the validity and transferability of theoretical concepts to new industry-specific contexts.

In addition, the empirical work combines individual and organisational perspectives on sustainability-related consumer behaviour. In the literature, individual factors (e.g. environmental awareness, customer satisfaction) or organisational factors (e.g. sustainability measures, channel integration) are usually considered separately. This study combines both dimensions in a standardised model. This enables a differentiated understanding of how individual preferences interact with corporate-driven activities and how they influence in combination green purchase intention in an omnichannel context in the consumer electronics sector. The results simultaneously provide empirical confirmation of the adapted Theory of Planned Behaviour (TPB). Environmental awareness functions as an attitudinal driver, brand identity can be interpreted as a proxy for subjective norms, and sustainability measures together with channel integration represent enabling conditions related to perceived behavioural control. The strong and direct influence of environmental awareness and brand identity on green purchase intention thus empirically supports the theoretical positioning of these constructs within the TPB framework.

Finally, the study offers methodological impulses by explicitly addressing both significant and non-significant correlations. In particular, the finding that customer satisfaction does not directly impact the purchase intention contradicts established assumptions from consumer behaviour research. This unexpected outcome raises new questions about alternative influencing factors such as ethical values or social norms.

6.2.5.3 Implications for further research

The results provide various starting points for future research. One approach could be to expand the existing model with additional individual (e.g. digital competence) and organisational (e.g. pricing strategy) influencing factors to reflect consumer behaviour in omnichannel retailing even more in depth. Also, an even more detailed investigation of one of the influencing factors could be the subject of a follow-up study. For example, the results show that green brand identity significantly influences green purchase intention. Future studies could investigate which specific aspects of brand communication, such as credibility, transparency or consistency, have a particular influence on strengthening brand identity and how they are perceived by customers across the various channels in an omnichannel environment.

Furthermore, cluster analyses could be applied based on the available data. Clustering consumers into market segments allows for the identification of behaviours and attitudes of different groups (e.g., price-sensitive, brand-loyal, or environmentally critical customer types) in order to develop even more targeted sustainability strategies in the retail sector. Or segmenting by age cohorts or generations could offer further insights, as generational differences often influence sustainability perceptions, digital affinity, and expectations regarding omnichannel retailing (Brand et al., 2022; Lavuri et al., 2021).

As the data was collected exclusively in Germany, expanding the survey to other regions and countries would broaden the findings to reveal cultural differences in sustainability in an omnichannel context. While environmental practices (e.g. environmentally friendly shipping options and return systems) are increasingly established in European markets, consumer attitudes and acceptance of such practices may differ in other regions. In addition to extending the data set to other regions, a different methodological approach, considering quantitative and qualitative methods, such as in-depth interviews, could be of interest. Explorative studies could more closely capture the psychological and social complexity of sustainable purchasing decisions in the omnichannel context. In contrast, standardised surveys can only cover this to a limited extent.

6.2.5.4 Implications for practice

Implications for practice can be derived from the results. A key finding is the significant influence of environmental awareness and brand identity on green purchase intention. This emphasises the importance of a credible and consistent brand positioning regarding sustainable values. Omnichannel retailers for consumer electronics should address environmentally aware customers in a reliable and differentiated way with concrete initiatives, such as a transparent supply chain, environmentally friendly shipping options or take-back systems for old appliances, which are consistently communicated across all channels.

Another outcome concerns the quality of channel integration. Even though channel integration had no direct influence on the purchase decision, a strong correlation with customer satisfaction was identified. Omnichannel retailers for consumer electronics should, therefore, ensure that all channels are consistently linked, especially when providing sustainable options, along the entire customer journey.

Finally, the findings indicate that sustainability measures alone do not drive purchase behaviour. The study thus illustrates that sustainability measures are only effective if they align with consumers' environmental attitudes. In practice, sustainable measures should, therefore, not only be offered without context. They should be strategically positioned and emotionally charged, for example, through transparent explanations in the checkout process or conscious decision-making options such as green shipping.

Overall, the results demonstrate that successful sustainability strategies in omnichannel retail require a holistic approach. Combining a credible brand identity, consistent channel integration, and targeted customer engagement can influence purchasing decisions in a sustainable and effective manner.

6.2.5.5 Conclusion and limitations

Both empirical studies jointly examined the influence of sustainability on consumer behaviour and green purchase intention in the omnichannel retailing of consumer electronics, The results show that environmental awareness and identification with sustainably positioned brands are the main factors influencing green purchase intention. On the other hand, organisational factors such as customer satisfaction or channel integration, have no direct impact on the purchase decision. This suggests that sustainable consumption is characterised less by functional aspects of the shopping process and more by personal convictions on the customer side.

Several limitations also restrict the analysis. A theoretical limitation arises from the adapted application of the Theory of Planned Behaviour. Environmental awareness (attitudes) and brand identity (as a proxy for subjective norms) could be meaningfully integrated, but perceived behavioural control was only indirectly operationalised through organisational factors such as sustainability measures and channel integration. Moreover, actual behaviour was not measured, only green purchase intention as behavioural intention. This partial operationalisation indicates that the TPB was not applied in its full scope and should be considered when interpreting the findings. The possible discrepancy between attitude and action (attitude-behaviour gap) must be also taken into account when interpreting the results (Boulstridge & Carrigan, 2000; Johnstone & Tan, 2015). The generalisability to other countries or sectors is limited, as the data were collected exclusively from German consumers in the omnichannel retailing of consumer electronics. Future research should therefore include cross-cultural comparisons and explore other industry sectors. The empirical analysis did also not include a generation-specific perspective but focused on overall consumer behaviour, which may have overlooked differences between age cohorts. In addition, organisational factors such as sustainability measures or brand identity were only evaluated from a customer perspective. A mixed-methods approach considering the omnichannel retailer's perspective could lead to even more differentiated findings.

Despite these limitations, the two empirical studies offers well-founded insights into the mechanisms of sustainability-related purchasing decisions in omnichannel retail for consumer electronics.

6.3 Final remarks on the results

The findings provide a twofold contribution. The systematic literature review demonstrates that prior research has largely adopted a company-focused perspective, with consumer-related aspects receiving comparatively limited attention. The empirical analyses of the pilot and main study extend this view by concentrating on consumer behaviour in the omnichannel retail consumer electronics sector. The results underline the central importance of environmental awareness and brand identity as primary drivers of sustainable purchasing decisions, whereas organisational and functional factors such as customer satisfaction, sustainability measures, and channel integration play only a secondary role. These results provide the basis for the broader theoretical and practical reflections.

7 CONCLUSIONS AND RECOMMENDATIONS

This chapter brings together the central insights of the dissertation and moves from detailed analysis to overarching conclusions. It provides a concise synthesis of the key findings and translates them into recommendations for practice and future research. In doing so, it highlights how the dissertation contributes to closing existing knowledge gaps at the intersection of sustainability, consumer behaviour, and omnichannel retailing in the consumer electronics sector.

7.1 Summary of the key findings

The aim of this integrated dissertation was to identify sustainability challenges and to analyse sustainability-related consumer behaviour in the context of omnichannel retailing, providing both a theoretical and empirical foundation. Building on a multi-method research design, the dissertation combines a systematic literature review with two empirical studies using structural equation modelling. The central focus was to investigate the factors that influence sustainable purchasing decisions in the consumer electronics sector and how these factors interact.

The systematic literature review, conducted according to the PRISMA guidelines, provides a structured overview of existing sustainability challenges in omnichannel retailing. The review shows that sustainability in this context has so far been primarily analysed from a company-centric perspective. Economic and ecological aspects, particularly logistics, transportation, and last-mile delivery, dominate the discourse. In contrast, social and consumer-related dimensions remain underrepresented. By systematically categorising the identified challenges along the three dimensions of sustainability, the review adresses a synthesis gap and establishes a theoretical foundation for subsequent empirical analysis. This structured systematisation contributes to an integrative view of ecological, economic, and social sustainability challenges across the entire value chain and provides a clearer basis for theory building and empirical work.

The empirical studies extend these insights by explicitly addressing the underexplored consumer dimension and testing an integrated structural model. The analysis focus on both individual factors (environmental awareness and customer satisfaction) and organisational factors (sustainability measures, channel integration, and green brand identity) in their influence on green purchase intention in the consumer electronics sector within the context of omnichannel retailing. The findings indicate that environmental awareness and especially green brand identity are the most influential direct predictors of green purchase intention. This highlights the crucial role of individual convictions in driving sustainable consumption. Another key finding concerns the role of organisational factors such as channel integration and sustainability measures. While channel

integration significantly enhances customer satisfaction, neither it nor sustainability measures or customer satisfaction itself exhibit a direct influence on green purchase intention. These results suggest that sustainable purchasing behaviour is driven less by functional or technical aspects of the shopping experience and more strongly by value-based factors, such as environmental awareness and green brand identity. This interpretation aligns with theoretical assumptions regarding the relevance of environmental attitudes in sustainability contexts (Shao & Lassleben, 2021). It is also consistent with the theoretical positioning of the dissertation, which embeds the determinants within the Triple Bottom Line as a contextual framework and within an adapted TPB perspective that accounts for attitudes, social identification, and perceived enablers.

Beyond the empirical results, this dissertation generates distinct theoretical contributions. Through the development and empirical validation of an integrated structural equation model that combines individual and organisational factors, it extends existing approaches to sustainable consumer behaviour. Furthermore, the findings illustrate that theoretical concepts established in related sectors, such as fashion, can be applied to the consumer electronics industry, thereby strengthening the cross-sectoral relevance and transferability of sustainability-oriented behavioural models.

Overall, the integrative analysis underscores that sustainability strategies in omnichannel consumer electronics retail should prioritise value-oriented components, namely environmental awareness and green brand identity, while complementing them with functional measures, such as high levels of channel integration (Pereira et al., 2023), to support customer satisfaction. Methodologically, the dissertation further demonstrates the complementary value of exploratory (PLS-SEM) and confirmatory (CB-SEM) modelling, which supports the validation of complex relationships and contributes to theory development.

7.2 Recommendations for practice

Although the systematic literature review provides a structured overview and highlights critical issues such as the ecological and economic impact of transport and last mile logistic, it plays a subordinate role in deriving practical implications, as it offers no original empirical findings. Consequently, the results from the empirical consumer analysis form the core basis for practice-oriented implications in this dissertation.

Firstly, the empirical studies show that environmental awareness has a significant direct impact on green purchase intention and the perception of sustainability measures. This finding is consistent with results from other sectors, such as food, where pro-environmental attitudes have also been linked to sustainable purchase intentions (Alamsyah et al., 2020; Jianming Wang et al., 2020),

underscoring their cross-sector relevance. This highlights the need for retailers to actively address environmentally conscious consumers through credible sustainability initiatives, such as carbon-neutral delivery, device recycling programs, and transparent product impact information. These measures should be designed in alignment with consumer values and communicated clearly to ensure effectiveness.

Secondly, a strong direct effect of green brand identity on green purchase intention emphasises the importance of consistent and value-driven brand positioning. This finding aligns with previous research beyond the consumer electronics context (Y.-S. Chen et al., 2020; Sarinya L. Suttharatanagul et al., 2025; Siyal et al., 2021). For practice, this means that sustainability commitments must be transparently communicated across all channels and supported by visible and verifiable actions in order to foster long-term trust and loyalty among environmentally conscious consumers.

Thirdly, the findings indicate that channel integration significantly enhances customer satisfaction, but does not exert a direct influence on green purchase intention. From a practical perspective, this suggests that technical and functional elements such as seamless omnichannel processes, consistent information provision, or flexible return options, may not directly promote sustainable purchasing decisions but are nonetheless essential for creating a consistent and satisfactory shopping experience. These results align with previous studies, which confirm the positive effect of channel integration on customer satisfaction (Buckley et al., 2024; T. Y. Chen et al., 2023; Xin et al., 2022), but have not identified a significant direct relationship with purchase intention in an omnichannel environment for consumer electronics.

Finally, neither customer satisfaction nor sustainability measures alone directly predict green purchase intention, indicating that technical or functional offerings alone are insufficient to drive sustainable purchase intentions. Their effectiveness largely depends on the extent to which they align with consumers individual values and convictions. From a practical perspective, this implies that in the consumer electronics sector, sustainable measures should not merely be offered as technical features but should be meaningfully integrated into the omnichannel customer journey, for example by highlighting CO2 savings when offering environmentally friendly shipping options at checkout. Results from previous consumer research suggesting that customer satisfaction is a key determinant of purchase intention (Kim et al., 2009; V. Lee et al., 2022) could not be confirmed in the context of omnichannel retailing for consumer electronics.

7.3 Recommendations for future research

Despite the substantial theoretical and empirical contributions of this dissertation, several research-related limitations need to be considered. The systematic literature review was based exclusively on three academic databases and includes only English-language publications, which may result in a potential bias in terms of regional research perspectives. The focus on the keyword "sustainability" further narrowed the scope, while related concepts such as "environment" or "green" were not systematically captured. Future reviews should therefore expand both the choice of databases and the conceptual scope to provide a broader and more inclusive picture of sustainability challenges in omnichannel retailing.

The empirical studies included in this dissertation likewise face methodological limitations. Both studies were conducted exclusively in Germany, which restricts generalisability across countries. Furthermore, the use of standardised online surveys increases the possibility of self-selection and socially desirable responses, which may affect the validity of the findings (Podsakoff et al., 2003). The smaller sample in the exploratory stage constrained the robustness of statistical testing and reflects the preliminary nature of the initial model. Moreover, the analysis focused primarily on the consumer perspective, while the retailer perspective, for example with regard to internal sustainability strategies, operational trade-offs or economic constraints, was not considered, which limits the comprehensiveness of the multi stakeholder view.

Building on the identified limitations, future research could address several directions. Comparative cross-country analyses are required to test the stability of the observed determinants across different cultural and institutional settings. Sector-specific investigations could provide further insights into whether the relative weight of individual factors, such as environmental awareness, versus organisational factors, like channel integration, varies across industries. Methodological diversification would also be valuable. Future research could benefit from mixed-method approaches that integrate structural modelling with qualitative interviews or experimental designs. Such methodological diversity would enable a deeper understanding of the psychological and normative foundations of sustainable consumption and offer a more comprehensive explanation of the persistent attitude-behaviour gap, which purely quantitative surveys can only capture to a limited extent. Future research could further extend the structural model by incorporating additional determinants such as price sensitivity, perceived convenience, or social norms. The inclusion of digital literacy and technological readiness would also be valuable, as these factors may influence consumers evaluation of omnichannel processes. Post-purchase

behaviours, like repair, reuse, and recycling, could also examine closer in order to capture sustainability-related dynamics across the entire consumption cycle.

In summary, future research should extend its scope across national contexts, adopt a more diverse set of methodological approaches, and further develop the structural model by integrating additional factors and perspectives. Such advancements would not only strengthen the validity of the present findings but also contribute to a more robust theoretical foundation for understanding sustainable consumer behaviour in omnichannel retailing. From a theoretical perspective, future work could apply the Theory of Planned Behaviour in its full scope, including direct measures of subjective norms and perceived behavioural control, in order to enable a systematic comparison with the adapted framework employed in this dissertation.

8 NEW SCIENTIFIC RESULTS

The new scientific results are derived from the research objectives and the identified research gaps. This dissertation offers both empirical and methodological contributions to the study of sustainability-related consumer behaviour in omnichannel retailing, with a particular focus on the consumer electronics sector. Table 24 presents the consolidated set of new scientific results.

Table 24. Overview of the new scientific results derived from the publications

No.	Result	Novelty	Reference
1	Structured systematisation of sustainability challenges in omnichannel retailing	First systematic literature review in this field across ecological, economic, and social dimensions, applying the PRISMA method, and highlighting underrepresented social and consumer-related aspects.	Systematic Literature Review
2	Development of a structured model to explain sustainable purchase decisions in the consumer electronics sector.	First integrative structural model combining individual and organisational factors in the context of omnichannel consumer electronics retailing.	Empirical Study
3	Channel integration increases customer satisfaction without directly influencing sustainable purchase intention	Provides a new perspective on the interplay of technical and emotional factors by differentiating between functional and value-based impact pathways in consumer behaviour.	Empirical Study

8.1 Empirical contributions

This research provides the first differentiated empirical insights into the effects of individual and organisational factors on consumer behaviour and sustainable purchase decisions in the consumer electronics sector in the context of omnichannel retailing. A key finding is the sector-specific confirmation of the strong influence of environmental awareness and green brand identity on green purchase intention. Although this relationship has been extensively confirmed in other industries, its empirical validation in the electronics sector within an omnichannel setting extends the applicability of existing behavioural models and underscores the particular relevance of value-based drivers in this context and highlights the importance of value-based drivers in this specific industry.

The results also show that functional aspects, such as channel integration, increase customer satisfaction but do not have a direct effect on green purchase intention. This differentiation between functional and value-based impact pathways offers new perspectives on the interplay between technical and emotional factors in consumer behaviour. The analysis also indicated that customer satisfaction does not directly predict sustainable purchase intention, but this finding is

interpreted here not as a stand-alone new result, but rather as a clarification of the boundary conditions under which customer satisfaction contributes to sustainable consumption.

In addition, the systematic literature review provides the first comprehensive and structured mapping of sustainability challenges across ecological, economic, and social dimensions in omnichannel retailing. By identifying the last mile as a central sustainability challenge and revealing the underrepresentation of social and consumer-related aspects, this dissertation provides a theoretical foundation for future research and strategic considerations in omnichannel retailing.

8.2 Methodological contributions

In addition to the empirical findings, this dissertation makes valuable methodological contributions. These include the development of a structured model to explain sustainable purchase decisions, which for the first time integrates both individual and organisational factors in the context of omnichannel consumer electronics retailing. Furthermore, a methodological comparison of exploratory (PLS-SEM) and confirmatory (CB-SEM) approaches illustrates their complementary value for sustainability and retail research. While the novelty of this contribution is limited by the use of different samples, the findings nevertheless demonstrate how PLS-SEM can serve for hypothesis development in smaller, exploratory studies, and CB-SEM for more robust validation in larger samples. This dual application strengthens methodological practice and provides a useful reference point for future research. Finally, the application of the PRISMA method delivers the first systematic and comprehensive literature review in this field and enables the structured systematisation of ecological, economic, and social sustainability challenges.

Overall, this dissertation presents three consolidated new scientific results that advance theoretical and empirical understanding of sustainability-related consumer behaviour in omnichannel retailing. In addition, it contributes methodologically through the systematic application of the PRISMA framework and the complementary use of PLS-SEM and CB-SEM. While not classified as independent results, these elements enhance the robustness of the research design and provide orientation for future studies. Together, these contributions establish a coherent foundation for advancing academic research and practical strategy development in sustainable omnichannel consumer electronics retailing.

9 SUMMARY

The overall objective of this dissertation was to advance the understanding of sustainability-related consumer behaviour in the context of omnichannel retailing, with a particular focus on the consumer electronics sector. The thesis aimed to identify key sustainability challenges and to analyse the individual and organisational factors that influence sustainable purchase decisions in this context.

The first step was to provide a structured overview of sustainability challenges in omnichannel retailing. The systematic literature review, conducted in accordance with PRISMA guidelines, provides the first structured systematisation of challenges across ecological, economic, and social dimensions and reveals that prior research has primarily focused on ecological and economic aspects, particularly with regard to logistics and the last mile. In contrast, social and consumer-related dimensions have so far been significantly underrepresented. This synthesis establishes a theoretical foundation for subsequent empirical analysis.

In the further course of the research, a structural model was developed to examine consumer behaviour and sustainable purchase decisions. This model was specifically adapted to the consumer electronics sector and integrates both individual factors (environmental awareness and customer satisfaction) and organisational factors (green brand identity, channel integration, and sustainability measures) within the omnichannel context. The model was subsequently tested in two empirical studies using structural equation modelling. The pilot study applied PLS-SEM for exploratory model testing, while the main study employed CB-SEM to confirm key findings on a larger sample. The results demonstrate that environmental awareness and green brand identity, in particular, have a significant direct influence on green purchase intention. In contrast, functional aspects such as channel integration enhance customer satisfaction but do not directly influence sustainable purchasing decisions. These findings highlight the dominance of value-based factors over purely functional determinants and indicate that sustainability strategies must combine credible brand positioning with reliable omnichannel processes.

The results of the two empirical studies show that successful sustainability strategies in omnichannel retailing for consumer electronics require a holistic approach in which technical and functional elements must be aligned with value-based drivers rather than standing alone.

Finally, this work makes important methodological contributions by demonstrating the added value of combining exploratory and confirmatory SEM approaches for the validation of complex models in the context of sustainability in omnichannel retail for consumer electronics. In addition,

the application of the PRISMA framework delivers the first comprehensive mapping of sustainability challenges in this field.

Overall, this dissertation offers substantial contributions to both theory and practice. It advances the scientific understanding of sustainability-oriented consumer behaviour in omnichannel retailing and provides concrete points of reference for the development of integrated sustainability strategies in consumer electronics retail. Moreover, it demonstrates how sector-specific analysis can refine general behavioural models and extend their cross-sector transferability. The identified limitations, such as the geographical focus on Germany and the use of standardised online surveys, create potential for replication studies in broader contexts. Future research could extend the model by incorporating additional individual and organisational factors, exploring generational differences in sustainability perceptions and omnichannel expectations, or applying it to other sectors and regions in order to further validate and refine the results.

APPENDIX

Appendix A1. Bibliography

Adivar, B., Hüseyinoğlu, I. Ö. Y., & Christopher, M. (2019). A quantitative performance management framework for assessing omnichannel retail supply chains. *Journal of Retailing and Consumer Services*, *48*, 257–269. https://doi.org/10.1016/j.jretconser.2019.02.024

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Alamsyah, D. P., Othman, N. A., & Mohammed, H. A. A. (2020). The awareness of environmentally friendly products: The impact of green advertising and green brand image. *Management Science Letters*, 1961–1968. https://doi.org/10.5267/j.msl.2020.2.017

Al-Emran, M., Mezhuyev, V., & Kamaludin, A. (2019). Pls-SEM in Information Systems Research: A Comprehensive Methodological Reference. In (pp. 644–653). Springer, Cham. https://doi.org/10.1007/978-3-319-99010-1_59

Althaf, S., Babbitt, C. W., & Chen, R. (2021). The evolution of consumer electronic waste in the United States. *Journal of Industrial Ecology*, *25*(3), 693–706. https://doi.org/10.1111/jiec.13074

Arora, S. (2019). Devising e-commerce and green e-commerce sustainability. *IJEDR*, *2019*(Volume 7, Issue 2), 206–210. https://www.ijedr.org/papers/IJEDR1902042.pdf

Asmare, A., & Zewdie, S. (2022). Omnichannel retailing strategy: a systematic review. *The International Review of Retail, Distribution and Consumer Research*, *32*(1), 59–79. https://doi.org/10.1080/09593969.2021.2024447

Augusto, F. J., & Rodrigues, R. (2015). Organizational factors and customers' motivation effect on insurance companies' performance. *Journal of Business Research*, *68*(7), 1622–1629. https://doi.org/10.1016/j.jbusres.2015.02.006

Bagozzi, R. P., & Yi, Y. (2012). Specification, evaluation, and interpretation of structural equation models. *Journal of the Academy of Marketing Science*, *40*(1), 8–34. https://doi.org/10.1007/s11747-011-0278-x

Bălan, C. (2021). How Does Retail Engage Consumers in Sustainable Consumption? A Systematic Literature Review. *Sustainability*, *13*(1), 96. https://doi.org/10.3390/su13010096

Barbier, E. B. (1987). The Concept of Sustainable Economic Development. *Environmental Conservation*, *14*(2), 101–110. https://doi.org/10.1017/S0376892900011449

Bartels, J., & Hoogendam, K. (2011). The role of social identity and attitudes toward sustainability brands in buying behaviors for organic products. *Journal of Brand Management*, *18*(9), 697–708. https://doi.org/10.1057/bm.2011.3

Bauer, A. (2021). Consumer Electronics in Europe: More than half of buyers are prepared to spend more for a sustainable product, *2021*. https://www.quantilope.com/hubfs/Q%20-%20Marketing%20internal/Website/download-files/210525_PR-Study-Consumer-Electronics-EU-EN.pdf

Bauer, D. J., & Curran, P. J. Structural equation modeling: R demonstration notes, *2019*, Article Version 2019.3. https://centerstat.org/wp-content/uploads/2019/04/SEM-R-notes-2019-3.pdf

Bergmann, F. M., Wagner, S. M., & Winkenbach, M. (2020). Integrating first-mile pickup and last-mile delivery on shared vehicle routes for efficient urban e-commerce

distribution. *Transportation Research Part B: Methodological*, *131*, 26–62. https://doi.org/10.1016/j.trb.2019.09.013

Bertram, R. F., & Chi, T. (2018). A study of companies' business responses to fashion e-commerce's environmental impact. *International Journal of Fashion Design, Technology and Education*, *11*(2), 254–264. https://doi.org/10.1080/17543266.2017.1406541

Bhutto, M., Khan, Mussadiq, A., Sun, C., Hashim, S., & Khan, H. (2023). Factors affecting repurchase intention of organic food among generation Z (Evidence from developing economy). *PLOS ONE*, *18*(3), e0281527. https://doi.org/10.1371/journal.pone.0281527

Bijmolt, T. H., Broekhuis, M., Leeuw, S. de, Hirche, C., Rooderkerk, R. P., Sousa, R., & Zhu, S. X. (2021). Challenges at the marketing–operations interface in omni-channel retail environments. *Journal of Business Research*, *122*, 864–874. https://doi.org/10.1016/j.jbusres.2019.11.034

Bilińska-Reformat, K., & Dewalska-Opitek, A. (2021). E-commerce as the predominant business model of fast fashion retailers in the era of global COVID 19 pandemics. *Procedia Computer Science*, *192*, 2479–2490. https://doi.org/10.1016/j.procs.2021.09.017

Blum, S. (2025). *Home Electronics Markt 2024 mit Licht und Schatten - PoS-Mail*. https://pos-mail.de/home-electronics-markt-2024-mit-licht-und-schatten/

Bosona, T. (2020). Urban Freight Last Mile Logistics—Challenges and Opportunities to Improve Sustainability: A Literature Review. *Sustainability*, *12*(21), 8769. https://doi.org/10.3390/su12218769

Boulstridge, E., & Carrigan, M. (2000). Do consumers really care about corporate responsibility? Highlighting the attitude—Behaviour gap. *Journal of Communication Management*, *4*(4), 355–368. https://doi.org/10.1108/eb023532

Brand, B. M., Rausch, T. M., & Brandel, J. (2022). The Importance of Sustainability Aspects When Purchasing Online: Comparing Generation X and Generation Z. *Sustainability*, *14*(9), 5689. https://doi.org/10.3390/su14095689

Briel, F. von (2018). The future of omnichannel retail: A four-stage Delphi study. *Technological Forecasting and Social Change*, *132*, 217–229. https://doi.org/10.1016/j.techfore.2018.02.004

Buckley, B., Antonio, J., Feldman, M., & Samuel, P. (2024). Effects of channel integration on the omnichannel customer experience. *Cogent Business & Management*, *11*(1), Article 2364841, 2364841. https://doi.org/10.1080/23311975.2024.2364841

Buldeo Rai, H. (2019). Environmental sustainability of the last mile in omnichannel retail. https://researchportal.vub.be/en/publications/environmental-sustainability-of-the-last-mile-in-omnichannel-reta

Buldeo Rai, H. (2021). The net environmental impact of online shopping, beyond the substitution bias. *Journal of Transport Geography*, *93*, 103058. https://doi.org/10.1016/j.jtrangeo.2021.103058

Buldeo Rai, H., Verlinde, S., & Macharis, C. (2019a). City logistics in an omnichannel environment. The case of Brussels. *Case Studies on Transport Policy*, *7*(2), 310–317. https://doi.org/10.1016/j.cstp.2019.02.002

Buldeo Rai, H., Verlinde, S., & Macharis, C. (2019b). The “next day, free delivery” myth unravelled. *International Journal of Retail & Distribution Management*, *47*(1), 39–54. https://doi.org/10.1108/IJRDM-06-2018-0104

Buldeo Rai, H., Verlinde, S., & Macharis, C. (2021). Who is interested in a crowdsourced last mile? A segmentation of attitudinal profiles. *Travel Behaviour and Society*, *22*, 22–31. https://doi.org/10.1016/j.tbs.2020.08.004

Cai, Y.-J., & Choi, T.-M. (2021). Extended Producer Responsibility: A Systematic Review and Innovative Proposals for Improving Sustainability. *IEEE Transactions on Engineering Management*, *68*(1), 272–288. https://doi.org/10.1109/TEM.2019.2914341

Cai, Y.-J., & Lo, C. K. (2020). Omni-channel management in the new retailing era: A systematic review and future research agenda. *International Journal of Production Economics*, *229*, 107729. https://doi.org/10.1016/j.ijpe.2020.107729

Cao, H., & Shao, P. (2021). Impact of environmental attitude and materialism on apparel disposal intention. *Journal of Physics: Conference Series*, *1790*(1), 12095. https://doi.org/10.1088/1742-6596/1790/1/012095

Cao, L., & Li, L. (2015). The Impact of Cross-Channel Integration on Retailers' Sales Growth. *Journal of Retailing*, *91*(2), 198–216. https://doi.org/10.1016/j.jretai.2014.12.005

Carrigan, M., & Attalla, A. (2001). The myth of the ethical consumer – do ethics matter in purchase behaviour? *Journal of Consumer Marketing*, *18*(7), 560–578. https://doi.org/10.1108/07363760110410263

Chen, J., & Liu, L. (2020). Customer participation, and green product innovation in SMEs: The mediating role of opportunity recognition and exploitation. *Journal of Business Research*, *119*, 151–162. https://doi.org/10.1016/j.jbusres.2019.05.033

Chen, T. Y., Yeh, T. L., Wu, H. L., & Deng, S. (2023). Effect of channel integration quality on consumer responses within omni-channel retailing. *Asia Pacific Journal of*

Marketing and Logistics, *35*(1), 149–173. https://doi.org/10.1108/APJML-04-2021-0270

Chen, Y., Cheung, C. M., & Tan, C.-W. (2018). Omnichannel business research: Opportunities and challenges. *Decision Support Systems*, *109*, 1–4. https://doi.org/10.1016/j.dss.2018.03.007

Chen, Y.-S., Chang, T.-W., Li, H.-X., & Chen, Y.-R. (2020). The Influence of Green Brand Affect on Green Purchase Intentions: The Mediation Effects of Green Brand Associations and Green Brand Attitude. *International Journal of Environmental Research and Public Health*, *17*(11), 4089. https://doi.org/10.3390/ijerph17114089

Cocco, H., & De-Juan-Vigaray, M. D. (2022). A typology of omnichannel retailer activities during the COVID-19 pandemic. *International Journal of Retail & Distribution Management*, *50*(8/9), 1062–1094. https://doi.org/10.1108/IJRDM-10-2021-0506

Cummins, S., Peltier, J. W., & Dixon, A. (2016). Omni-channel research framework in the context of personal selling and sales management. *Journal of Research in Interactive Marketing*, *10*(1), 2–16. https://doi.org/10.1108/JRIM-12-2015-0094

da Silveira, C., Lages, C., & Simões, C. (2013). Reconceptualizing brand identity in a dynamic environment. *Journal of Business Research*, *66*(1), 28–36. https://doi.org/10.1016/j.jbusres.2011.07.020

Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, *173*, 121092. https://doi.org/10.1016/j.techfore.2021.121092

Dirsehan, T. (Ed.). (2021). *Managing customer experiences in an omnichannel world: Melody of online and offline environments in the customer journey* (First edition). Emerald Publishing Limited.

Dong, X., Liu, S., Li, H., Yang, Z., Liang, S., & Deng, N. (2020). Love of nature as a mediator between connectedness to nature and sustainable consumption behavior. *Journal of Cleaner Production*, *242*, 118451. https://doi.org/10.1016/j.jclepro.2019.118451

Dunlap, R. E., van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). New Trends in Measuring Environmental Attitudes: Measuring Endorsement of the New Ecological Paradigm: A Revised NEP Scale. *Journal of Social Issues*, *56*(3), 425–442. https://doi.org/10.1111/0022-4537.00176

Ebner, T., Sauer, J., & Spitzer, S. (2022). *Green Nudging im E-Commerce*. Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-39367-0

Ejelöv, E., & Nilsson, A. (2020). Individual Factors Influencing Acceptability for Environmental Policies: A Review and Research Agenda. *Sustainability*, *12*(6), 2404. https://doi.org/10.3390/su12062404

Elia, S., Giuffrida, M., Mariani, M. M., & Bresciani, S. (2021). Resources and digital export: An RBV perspective on the role of digital technologies and capabilities in cross-border e-commerce. *Journal of Business Research*, *132*, 158–169. https://doi.org/10.1016/j.jbusres.2021.04.010

Elkington, J. (1994). Enter the Triple Bottom Line, *1994*. https://johnelkington.com/archive/TBL-elkington-chapter.pdf

Escursell, S., Llorach-Massana, P., & Roncero, M. B. (2021). Sustainability in e-commerce packaging: A review. *Journal of Cleaner Production*, *280*, 124314. https://doi.org/10.1016/j.jclepro.2020.124314

Fahim, M., Saleh, M., Grida, M., & Gamila, M. A. (2025). Greening the route: Enhancing sustainability and efficiency in omnichannel retailing. *Journal of Cleaner Production*, *500*, 145264. https://doi.org/10.1016/j.jclepro.2025.145264

Fauzi, M. A. (2022). Partial least square structural equation modelling (PLS-SEM) in knowledge management studies: Knowledge sharing in virtual communities. *Knowledge Management & E-Learning: An International Journal*, 103–124. https://doi.org/10.34105/j.kmel.2022.14.007

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Gadenne, D. L., Kennedy, J., & McKeiver, C. (2009). An Empirical Study of Environmental Awareness and Practices in SMEs. *Journal of Business Ethics*, *84*(1), 45–63. https://doi.org/10.1007/s10551-008-9672-9

Galli, M., Sebastiani, R., & Anzivino, A. (2022). Sustainability and Omnichannel Strategies in the Italian Wine Industry. *Corporate Responsibility, Sustainability and Markets*, 31–51. https://doi.org/10.1007/978-3-030-79660-0_3

Gerling, M., Roik, O., Petras, A., Sievers, M., & Fetsch, S. (2025). *Trends im Einzelhandel*. https://einzelhandel.de/themeninhalte/konjunkturundmarktdaten/940-publikationen/714-broschueren/3902-studie-trends-im-handel-2025

Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, *140*(1), 149–159. https://doi.org/10.1016/j.ijpe.2012.01.035

Giuffrida, M., Mangiaracina, R., Miragliotta, G., Perotti, S., & Tumino, A. (2019). Modelling the environmental impact of omni-channel purchasing in the apparel industry: the role of logistics. *International Journal of Logistics Systems and Management*, *34*(4), Article 103514, 431. https://doi.org/10.1504/IJLSM.2019.103514

Greenhalgh, T., & Peacock, R. (2005). Effectiveness and efficiency of search methods in systematic reviews of complex evidence: Audit of primary sources. *BMJ (Clinical Research Ed.)*, *331*(7524), 1064–1065. https://doi.org/10.1136/bmj.38636.593461.68

Ha, H.-Y., & Perks, H. (2005). Effects of consumer perceptions of brand experience on the web: brand familiarity, satisfaction and brand trust. *Journal of Consumer Behaviour*, *4*(6), 438–452. https://doi.org/10.1002/cb.29

Hagberg, J., & Hulthén, K. (2022). Consolidation through resourcing in last-mile logistics. *Research in Transportation Business & Management*, *45*, 100834. https://doi.org/10.1016/j.rtbm.2022.100834

Hair, J. F., Black, W., & Babin, B. J. (2010). *Multivariate data analysis: A global perspective* (7. ed., global ed.). Pearson.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (Eighth edition). Cengage.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (Second edition). Sage. https://eli.johogo.com/Class/CCU/SEM/_A%20Primer%20on%20Partial%20Least%20Squares%20Structural%20Equation%20Modeling_Hair.pdf

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Halldórsson, Á., & Wehner, J. (2020). Last-mile logistics fulfilment: A framework for energy efficiency. *Research in Transportation Business & Management*, *37*, 100481. https://doi.org/10.1016/j.rtbm.2020.100481

Hänninen, M., Kwan, S. K., & Mitronen, L. (2021). From the store to omnichannel retail: looking back over three decades of research. *The International Review of Retail,*

Distribution and Consumer Research, *31*(1), 1–35. https://doi.org/10.1080/09593969.2020.1833961

Hansmann, R., Mieg, H. A., & Frischknecht, P. (2012). Principal sustainability components: empirical analysis of synergies between the three pillars of sustainability. *International Journal of Sustainable Development & World Ecology*, *19*(5), 451–459. https://doi.org/10.1080/13504509.2012.696220

Harris, F., Roby, H., & Dibb, S. (2016). Sustainable clothing: Challenges, barriers and interventions for encouraging more sustainable consumer behaviour. *International Journal of Consumer Studies*, *40*(3), 309–318. https://doi.org/10.1111/ijcs.12257

He, X., Jiang, J., & Hu, W. (2023). Cross effects of government subsidies and corporate social responsibility on carbon emissions reductions in an omnichannel supply chain system. *Computers & Industrial Engineering*, *175*, 108872. https://doi.org/10.1016/j.cie.2022.108872

He, Y., Xu, Q., & Wu, P. (2020). Omnichannel retail operations with refurbished consumer returns. *International Journal of Production Research*, *58*(1), 271–290. https://doi.org/10.1080/00207543.2019.1629672

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hübner, A. H., Kuhn, H., & Wollenburg, J. (2016). Last mile fulfilment and distribution in omni-channel grocery retailing: A strategic planning framework. *International Journal of Retail & Distribution Management*, *44*(3). https://doi.org/10.1108/IJRDM-11-2014-0154

Iglesias-Pradas, S., & Acquila-Natale, E. (2023). The Future of E-Commerce: Overview and Prospects of Multichannel and Omnichannel Retail. *Journal of Theoretical and*

Applied Electronic Commerce Research, *18*(1), 656–667. https://doi.org/10.3390/jtaer18010033

Intissar Ayachi, & Rim Trabelsi El Amri. (2024). *Cross-Channel Integration and Consumer Loyalty: Mediating Effect of Consumer Empowerment and Satisfaction* (VII). https://www.researchgate.net/publication/378158374_Cross-Channel_Integration_and_Consumer_Loyalty_Mediating_Effect_of_Consumer_Empowerment_and_Satisfaction

Jena, S. K., & Meena, P. (2022). Competitive sustainable processes and pricing decisions in omnichannel closed-up supply chains under different channel power structures. *Journal of Retailing and Consumer Services*, *69*, 103114. https://doi.org/10.1016/j.jretconser.2022.103114

Johnstone, M.-L., & Tan, L. P. (2015). Exploring the Gap Between Consumers' Green Rhetoric and Purchasing Behaviour. *Journal of Business Ethics*, *132*(2), 311–328. https://doi.org/10.1007/s10551-014-2316-3

Kaiser, H. F. (1974). An Index of Factorial Simplicity. *Psychometrika*, *39*(1), 31–36. https://doi.org/10.1007/BF02291575

Kaklauskas, A., & Kaklauskiene, L. (2022). Analysis of the impact of success on three dimensions of sustainability in 173 countries. *Scientific Reports*, *12*(1), 14719. https://doi.org/10.1038/s41598-022-19131-6

Karlsson, S., Oghazi, P., Hellstrom, D., Patel, P. C., Papadopoulou, C., & Hjort, K. (2023). Retail returns management strategy: An alignment perspective. *Journal of Innovation & Knowledge*, *8*(4), 100420. https://doi.org/10.1016/j.jik.2023.100420

Kayikci, Y. (2018). Sustainability impact of digitization in logistics. *Procedia Manufacturing*, *21*, 782–789. https://doi.org/10.1016/j.promfg.2018.02.184

Kembro, J., & Norrman, A. (2019). Exploring trends, implications and challenges for logistics information systems in omni-channels. *International Journal of Retail & Distribution Management*, *47*(4), 384–411. https://doi.org/10.1108/IJRDM-07-2017-0141

Kim, D. J., Ferrin, D. L., & Rao, H. R. (2009). Trust and Satisfaction, Two Stepping Stones for Successful E-Commerce Relationships: A Longitudinal Exploration. *Information Systems Research*, *20*(2), 237–257. https://doi.org/10.1287/isre.1080.0188

Klein, P., & Popp, B. (2023). A comparison of the environmental sustainability of brick-and-mortar retailing and online retailing: Contrasting academic research and consumer perceptions. *Business and Society Review*, *128*(4), 635–660. https://doi.org/10.1111/basr.12332

Kleindorfer, P. R., Singhal, K., & Wassenhove, L. N. (2005). Sustainable Operations Management. *Production and Operations Management*, *14*(4), 482–492. https://doi.org/10.1111/j.1937-5956.2005.tb00235.x

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3. ed.). *Methodology in the social sciences*. Guilford Press.

Koleva, S., & Chankov, S. (2022). The Impact of the COVID-19 Pandemic on E-commerce Consumers' Pro-environmental Behavior. In M. Freitag, A. Kinra, H. Kotzab, & N. Megow (Eds.), *Lecture Notes in Logistics. Dynamics in logistics: Proceedings of the 8th international conference LDIC 2022, Bremen, Germany* (pp. 474–485). Springer. https://doi.org/10.1007/978-3-031-05359-7_38

Konuk, F. A. (2019). Consumers' willingness to buy and willingness to pay for fair trade food: The influence of consciousness for fair consumption, environmental concern, trust and innovativeness. *Food Research International (Ottawa, Ont.)*, *120*, 141–147. https://doi.org/10.1016/j.foodres.2019.02.018

Lalchandani, R., Chitnis, A., & Priyadarshi, R. (2024). Mix Method Assessment of Sustainable Consumption Preferences Towards Omni-Channel Operations. *2nd International Conference on Emerging Technologies and Sustainable Business Practices-2024 (ICETSBP 2024)*, *296*, 486–499. https://doi.org/10.2991/978-94-6463-544-7_32

Lavuri, R., Jusuf, E., & Gunardi, A. (2021). Green sustainability: Factors fostering and behavioural difference between Millennial and Gen Z: Mediating role of green purchase intention. *Ekonomia I Środowisko*, *nr 1*. https://doi.org/10.34659/2021/1/1

Lazaris, C., Sarantopoulos, P., Vrechopoulos, A., & Doukidis, G. (2021). Effects of Increased Omnichannel Integration on Customer Satisfaction and Loyalty Intentions. *International Journal of Electronic Commerce*, *25*(4), 440–468. https://doi.org/10.1080/10864415.2021.1967005

Lee, V., Park, S., & Lee, D. (2022). The Effect of E-commerce Service Quality Factors on Customer Satisfaction, Purchase Intention, and Actual Purchase in Uzbekistan. *Global Business & Finance Review (GBFR)*, *27*(3), 56–74. https://doi.org/10.17549/gbfr.2022.27.3.56

Lee, Z. W., Chan, T. K., Chong, A. Y.-L., & Thadani, D. R. (2019). Customer engagement through omnichannel retailing: The effects of channel integration quality. *Industrial Marketing Management*, *77*, 90–101. https://doi.org/10.1016/j.indmarman.2018.12.004

Lehmann, K., & Teller, A. (2022). Wie Händler im zweiten Pandemiejahr die Gunst der Konsument:innen gewinnen. *EY*. https://www.ey.com/de_de/strategy/wie-haendler-unterschiedliche-kundensegmente-ueberzeugen

Lemon, K. N., & Verhoef, P. C. (2016). Understanding Customer Experience Throughout the Customer Journey. *Journal of Marketing*, *80*(6), 69–96. https://doi.org/10.1509/jm.15.0420

Li, J., Zeng, X., & Stevels, A. (2015). Ecodesign in Consumer Electronics: Past, Present, and Future. *Critical Reviews in Environmental Science and Technology*, *45*(8), 840–860. https://doi.org/10.1080/10643389.2014.900245

Li, Y., Mohammadi, A., Sun, H., & Jantan, H. J. (2024). Factors Influencing Green Food Purchase Intentions: The Intervening Role of Customer Satisfaction and Advertising. *Journal of International Business and Management.* Advance online publication. https://doi.org/10.37227/JIBM-2024-06-6512

Lim, S. F. W., & Srai, J. S. (2018). Examining the anatomy of last-mile distribution in e-commerce omnichannel retailing. *International Journal of Operations & Production Management*, *38*(9), 1735–1764. https://doi.org/10.1108/IJOPM-12-2016-0733

Mahmoud, M. A., Tsetse, E. K. K., Tulasi, E. E., & Muddey, D. K. (2022). Green Packaging, Environmental Awareness, Willingness to Pay and Consumers' Purchase Decisions. *Sustainability*, *14*(23), 16091. https://doi.org/10.3390/su142316091

Malhotra, G., & Srivastava, H. (2024). Green purchase intention in omnichannel retailing: role of environmental knowledge and price sensitivity. *Journal of Strategic Marketing*, *32*(4), 467–490. https://doi.org/10.1080/0965254X.2023.2241464

Marchet, G., Melacini, M., Perotti, S., Rasini, M., & Tappia, E. (2017, September 18 - 2017, September 20). Logistics in omni-channel retailing: Modelling and analysis of three distribution configurations. In *2017 IEEE International Conference on Service Operations and Logistics, and Informatics (SOLI)* (pp. 21–26). IEEE. https://doi.org/10.1109/SOLI.2017.8120963

Massanneck, S. (2025). Home Electronic Market Index Quartal 1-4 / 2021. https://gfu.de/wp-content/uploads/2025/03/HEMIX-Q1-4-2024.pdf

Melacini, M., & Tappia, E. (2018). A Critical Comparison of Alternative Distribution Configurations in Omni-Channel Retailing in Terms of Cost and Greenhouse Gas Emissions. *Sustainability*, *10*(2), 307. https://doi.org/10.3390/su10020307

Meyer, D. E., & Katz, J. P. (2016). Analyzing the environmental impacts of laptop enclosures using screening-level life cycle assessment to support sustainable consumer electronics. *Journal of Cleaner Production*, *112*, 369–383. https://doi.org/10.1016/j.jclepro.2015.05.143

Michel, G. M., Feori, M., Damhorst, M. L., Lee, Y.-A., & Niehm, L. S. (2019). Stories We Wear: Promoting Sustainability Practices with the Case of Patagonia. *Family and Consumer Sciences Research Journal*, *48*(2), 165–180. https://doi.org/10.1111/fcsr.12340

Miquel-Romero, M.-J., Frasquet, M., & Mollá-Descals, A. (2025). Environmental awareness and showrooming: price and moral moderating effects. *International Journal of Retail & Distribution Management*, *53*(7), 671–684. https://doi.org/10.1108/IJRDM-06-2024-0295

Mirsch, T., Lehrer, C., & Jung, R. (2016). Channel Integration Towards Omnichannel Management: A Literature Review. *PACIS 2016 Proceedings*, 288. https://research.cbs.dk/en/publications/channel-integration-towards-omnichannel-management-a-literature-r

Mirzabeiki, V., & Saghiri, S. S. (2020). From ambition to action: How to achieve integration in omni-channel? *Journal of Business Research*, *110*, 1–11. https://doi.org/10.1016/j.jbusres.2019.12.028

Mkansi, M., & Nsakanda, A. L. (2021). Leveraging the physical network of stores in e-grocery order fulfilment for sustainable competitive advantage. *Research in Transportation Economics*, *87*, 100786. https://doi.org/10.1016/j.retrec.2019.100786

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, *6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Moraes, C., Carrigan, M., & Szmigin, I. (2012). The coherence of inconsistencies: Attitude–behaviour gaps and new consumption communities. *Journal of Marketing Management*, *28*(1-2), 103–128. https://doi.org/10.1080/0267257X.2011.615482

Muñoz-Villamizar, A., Velázquez-Martínez, J. C., Haro, P., Ferrer, A., & Mariño, R. (2021). The environmental impact of fast shipping ecommerce in inbound logistics operations: A case study in Mexico. *Journal of Cleaner Production*, *283*, 125400. https://doi.org/10.1016/j.jclepro.2020.125400

Nagy, A., Kemeny, I., & Szucs, K. (2024). Channel preferences: Unveiling omnichannel behavior in sports and leisure product purchases. *Management & Marketing*, *19*(4), 667–691. https://doi.org/10.2478/mmcks-2024-0030

Nayak, R., Houshyar, S., Patnaik, A., Nguyen, L. T., Shanks, R. A., Padhye, R., & Fegusson, M. (2020). Sustainable reuse of fashion waste as flame-retardant mattress filing with ecofriendly chemicals. *Journal of Cleaner Production*, *251*, 119620. https://doi.org/10.1016/j.jclepro.2019.119620

Ng, S., Adriana Mohd Rizal, Haliyana Khalid, T. C. Ho, & M. Sahimi (2021). Increasing Customer Satisfaction through Omnichannel Retailing. *International Journal of Academic Research in Business and Social Sciences*. https://www.semanticscholar.org/paper/Increasing-Customer-Satisfaction-through-Retailing-Hee-Rizal/19ca033af4970cb4009e685647e9476ee8324a51

Nguyen, N., & Johnson, L. W. (2020). Consumer behaviour and environmental sustainability. *Journal of Consumer Behaviour*, *19*(6), 539–541. https://doi.org/10.1002/cb.1892

Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric Theory. *Psychometrika*, *60*, 0–752. https://doi.org/10.1007/BF02301419

Odunga, S., Szente, V., & Szabó, K. (2024). Community Support and Socioeconomic Impacts of Cultural Tourism Development in Western Kenya. *Tourism and Hospitality*, *5*(4), 1510–1524. https://doi.org/10.3390/tourhosp5040084

Olaf Roik (2023). HDE Online Monitor 2023. https://einzelhandel.de/images/attachments/article/2876/HDE_Online_Monitor_2023.pdf

Olaf Roik (2024). Online_Monitor_2024_1305_WEB. *HDE Handelsverbadn Deutschland: Online-Monitor*, *2024*.

Olsson, J., Hellström, D., & Pålsson, H. (2019). Framework of last mile logistics research: A systematic review of the literature. *Sustainability*, *11*(24). https://doi.org/10.3390/su11247131

Özbük, R. M. Y., Ünal, D. A., & Oktay, B. (Eds.). (2020). *Managing Customer Experiences in an Omnichannel World: Melody of Online and Offline Environments in the Customer Journey: Consumer Behavior in Omnichannel Retailing*. Emerald Publishing Limited.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S [Steve], . . . Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Pan, S., Giannikas, V., Han, Y., Grover-Silva, E., & Qiao, B. (2017). Using customer-related data to enhance e-grocery home delivery. *Industrial Management & Data Systems*, *117*(9), 1917–1933. https://doi.org/10.1108/IMDS-10-2016-0432

Peattie, K., & Collins, A. (2009). Guest editorial: Perspectives on sustainable consumption. *International Journal of Consumer Studies*, *33*(2), 107–112. https://doi.org/10.1111/j.1470-6431.2009.00758.x

Peng, Y., Liu, Y [Yuxuan], & Ablanedo-Rosas, J. H. (2022). Store density in omnichannel implementation while considering the environmental impact of packaging materials. *Journal of Cleaner Production*, *371*, 133668. https://doi.org/10.1016/j.jclepro.2022.133668

Pereira, M. L., La Martinière Petroll, M. de, Soares, J. C., Matos, C. A. de, & Hernani-Merino, M. (2023). Impulse buying behaviour in omnichannel retail: an approach through the stimulus-organism-response theory. *International Journal of Retail & Distribution Management*, *51*(1), 39–58. https://doi.org/10.1108/IJRDM-09-2021-0394

Pierre Mercier, David Welch, & and Guillaume Crétenot (2014). In Omnichannel Retail, It's Still About Detail. https://web-assets.bcg.com/img-src/In_Omnichannel_Retail_Its_Still_About_Detail_Aug_2014_tcm9-82575.pdf

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *The Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Potter, K., Olaoye, F., & Doris, L. (2024). Assessing the Sustainability of Omnichannel Retailing and Its Influence on the Future of Consumer Shopping Behavior. *Marketing*. https://www.researchgate.net/publication/384637766_Assessing_the_Sustainability_of

_Omnichannel_Retailing_and_Its_Influence_on_the_Future_of_Consumer_Shopping_Behavior

Pourmohammadreza, N., Jokar, M. R. A., & van Woensel, T. (2025). Last-mile logistics with alternative delivery locations: A systematic literature review. *Results in Engineering*, *25*, 104085. https://doi.org/10.1016/j.rineng.2025.104085

Prayoga, I. M. S., Adiyadnya, M. S. P., & Putra, B. N. K. (2020). Green Awareness Effect on Consumers' Purchasing Decision. *APMBA (Asia Pacific Management and Business Application)*, *008*(03), 199–208. https://doi.org/10.21776/ub.apmba.2020.008.03.4

Purcărea, T., Ioan-Franc, V., Ionescu, Ș.-A., Purcărea, I. M., Purcărea, V. L., Purcărea, I., Mateescu-Soare, M. C., Platon, O.-E., & Orzan, A.-O. (2022). Major Shifts in Sustainable Consumer Behavior in Romania and Retailers' Priorities in Agilely Adapting to It. *Sustainability*, *14*(3), 1627. https://doi.org/10.3390/su14031627

Purvis, B., Mao, Y., & Robinson, D. (2019). Three pillars of sustainability: in search of conceptual origins. *Sustainability Science*, *14*(3), 681–695. https://doi.org/10.1007/s11625-018-0627-5

Ramprasad, C., Gwenzi, W., Chaukura, N., Izyan Wan Azelee, N., Upamali Rajapaksha, A., Naushad, M., & Rangabhashiyam, S. (2022). Strategies and options for the sustainable recovery of rare earth elements from electrical and electronic waste. *Chemical Engineering Journal*, *442*, 135992. https://doi.org/10.1016/j.cej.2022.135992

Risberg, A., & Jafari, H. (2022). Last mile practices in e-commerce: framework development and empirical analysis of Swedish firms. *International Journal of Retail & Distribution Management*, *50*(8/9), 942–961. https://doi.org/10.1108/IJRDM-10-2021-0513

Rita, P., Oliveira, T., & Farisa, A. (2019). The impact of e-service quality and customer satisfaction on customer behavior in online shopping. *Heliyon*, *5*(10), e02690. https://doi.org/10.1016/j.heliyon.2019.e02690

Rosseel, Y. (2012). Lavaan : An R Package for Structural Equation Modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Rouzbahani, T. R., Rezai, M., Goudarzi, A., & Naghibi, S. M. The Effect of Individual Factors on Consumers' Purchasing Decisions. *J. Basic. Appl. Sci. Res*, *2013*(3(1)1149-1156, 2013), 1149–1156. https://d1wqtxts1xzle7.cloudfront.net/32275677/invidual_factors-libre.pdf?1391086729=&response-content-disposition=inline%3B+filename%3DCorresponding_Author_The_Effect_of_Indiv.pdf&Expires=1756042347&Signature=YeEkXvJsYKPQ2D286kf8PIZ4u9g9JE~balpqNU1xrvddVNTb35tR0ROU3akAObmhXEFB~4NPt3LHbbrtaJ-3k24fbm2WDyFGwymiQimXutn7Hk3LVflDMh0Gp9TfNv8KcEIcNFEStQ1IarPMWkkZP-Dnnzs9gHdiK5hmgNdR7f-zEdHRJAX5DLC0OFoi0IekeNyDfHy2n8M7nfMqeOyrsdc053cV7roBokk-pQ1H7hsWAvhCj0F~CFujN3SmMLO5L-437fUnZzhfJSkRWPfWWUJC3-YLTB7XyHGXOgke37HxfJhH5dbZu2atoYGg5E-mRfOLIBvaix4X8R3rriC96w__&Key-Pair-Id=APKAJLOHF5GGSLRBV4ZA

Saari, U. A., Damberg, S., Frömbling, L., & Ringle, C. M. (2021). Sustainable consumption behavior of Europeans: The influence of environmental knowledge and risk perception on environmental concern and behavioral intention. *Ecological Economics*, *189*, 107155. https://doi.org/10.1016/j.ecolecon.2021.107155

Šajn, & Nikolina (2020). Sustainable consumption. *EPRS | European Parliamentary Research Service*, *2020*(PE 659.295).

https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/659295/EPRS_BRI(2020)659295_EN.pdf

Sallnäs, U., & Björklund, M. (2020). Consumers' influence on the greening of distribution – exploring the communication between logistics service providers, e-tailers and consumers. *International Journal of Retail & Distribution Management*, *48*(11), 1177–1193. https://doi.org/10.1108/IJRDM-07-2019-0213

Salnikova, E., Strizhakova, Y., & Coulter, R. A. (2022). Engaging Consumers with Environmental Sustainability Initiatives: Consumer Global–Local Identity and Global Brand Messaging. *Journal of Marketing Research*, *59*(5), 983–1001. https://doi.org/10.1177/00222437221078522

Sarinya L. Suttharatanagul, Norawat CHUTIVONGSE, Benjamard JONGMAHASANCHAI, & Ruedee LIMPAIROJ (2025). The MODERATING ROLE OF SOCIAL INFLUENCE ON BRAND IMAGE AND PURCHASE INTENTION FOR SUSTAINABLE PRODUCTS. *Procedia of Multidisciplinary Research*, *3*(1), 10. https://so09.tci-thaijo.org/index.php/PMR/article/view/5739

Schuberth, F., Rademaker, M. E., & Henseler, J. (2023). Assessing the overall fit of composite models estimated by partial least squares path modeling. *European Journal of Marketing*, *57*(6), 1678–1702. https://doi.org/10.1108/EJM-08-2020-0586

Sfakianaki, E., Vrechopoulos, A., & Lazaris, C. (2022). Conceptualizing Green Strategies' Effects on Customer Experience in the Context of Omnichannel Retailing. *International Journal of Innovation and Technology Management*, *19*(05), Article 2241004. https://doi.org/10.1142/S0219877022410048

Shao, P., & Lassleben, H. (2021). Determinants of Consumers' Willingness to Participate in Fast Fashion Brands' Used Clothes Recycling Plans in an Omnichannel Retail

Environment. *Journal of Theoretical and Applied Electronic Commerce Research*, *16*(7), 3340–3355. https://doi.org/10.3390/jtaer16070181

Simone, A., & Sabbadin, E. (2017). The New Paradigm of the Omnichannel Retailing: Key Drivers, New Challenges and Potential Outcomes Resulting from the Adoption of an Omnichannel Approach. *International Journal of Business and Management*, *13*(1), 85. https://doi.org/10.5539/ijbm.v13n1p85

Siyal, S., Ahmed, M. J., Ahmad, R., Khan, B. S., & Xin, C. (2021). Factors Influencing Green Purchase Intention: Moderating Role of Green Brand Knowledge. *International Journal of Environmental Research and Public Health*, *18*(20), 10762. https://doi.org/10.3390/ijerph182010762

Skowron, L., & Sak-Skowron, M. (2021). Environmental Sensitivity and Awareness as Differentiating Factors in the Purchase Decision-Making Process in the Smartphone Industry—Case of Polish Consumers. *Sustainability*, *13*(1), 348. https://doi.org/10.3390/su13010348

So, K. K. F., King, C., Sparks, B. A., & Wang, Y. (2013). The influence of customer brand identification on hotel brand evaluation and loyalty development. *International Journal of Hospitality Management*, *34*, 31–41. https://doi.org/10.1016/j.ijhm.2013.02.002

Solomon, M., Russell-Bennett, R., & Previte, J. (2012). *Consumer Behaviour*. Pearson Higher Education AU. https://books.google.de/books?id=ajDiBAAAQBAJ

Sousa, P. R. de, Barbosa, M. W., Oliveira, L. K. de, Resende, P. T. V. de, Rodrigues, R. R., Moura, M. T., & Matoso, D. (2021). Challenges, Opportunities, and Lessons Learned: Sustainability in Brazilian Omnichannel Retail. *Sustainability*, *13*(2), 666. https://doi.org/10.3390/su13020666

Statista. (2024a). *Consumer Electronics: market data & analysis*. https://de.statista.com/statistik/studie/id/55506/dokument/consumer-electronics-marktdaten-und-analyse/

Statista. (2024b). *Unterhaltungselektronik Deutschland*. https://de.statista.com/statistik/studie/id/7065/dokument/unterhaltungselektronik-statista-dossier/

Statista. (2025). *Umsatz mit dem Verkauf von Unterhaltungselektronik auf dem Konsumentenmarkt in Deutschland von 2004 bis 2024*. https://de.statista.com/statistik/daten/studie/717465/umfrage/online-umsatz-nach-branchen-in-deutschland/

Švecová, L., Ostapenko, G., & Veber, J. (2020). Impact of Global Trends and the Coronavirus Challenge on Consumer Behavior. *2020 6th International Conference on Social Science and Higher Education (ICSSHE 2020)*, 1005–1009. https://doi.org/10.2991/assehr.k.201214.193

Tajfel, H., & Turner, J. C. (1986). The Social Identity Theory of Intergroup Behavior. *Psychology of Intergroup Relation*, 7–24. https://christosaioannou.com/Tajfel%20and%20Turner%201986.pdf

Tanriverdi, İ., & Aydın, H. (2024). A bibliometric review of the omnichannel logistics literature. *The International Review of Retail, Distribution and Consumer Research*, *34*(3), 310–330. https://doi.org/10.1080/09593969.2023.2259645

Taylor, D., Brockhaus, S., Knemeyer, A. M., & Murphy, P. (2019). Omnichannel fulfillment strategies: Defining the concept and building an agenda for future inquiry. *The International Journal of Logistics Management*, *ahead-of-print*(ahead-of-print), 863–891. https://doi.org/10.1108/IJLM-09-2018-0223

Teixeira, S [Sara], Oliveira, Z., & Teixeira, S [Sandrina] (2023). Understanding the Impact of Online Communication Strategies on Consumer Purchase Intention for Green Cosmetics. *Sustainability*, *15*(20), 14784. https://doi.org/10.3390/su152014784

Timotuis, E. (2021). Global Changing of Consumer Behavior to Retail Distribution due to Pandemic of COVID-19: A Systematic Review. *Journal of Distribution Science.* Advance online publication. https://doi.org/10.15722/JDS.19.11.202111.69

Tyrväinen, O., & Karjaluoto, H. (2019). Omnichannel experience: Towards successful channel integration in retail. *Journal of Customer Behaviour*, *18*(1), 17–34. https://doi.org/10.1362/147539219X15633616548498

Verhoef, P. C. (2021). Omni-channel retailing: some reflections. *Journal of Strategic Marketing*, *29*(7), 608–616. https://doi.org/10.1080/0965254X.2021.1892163

Verhoef, P. C., Kannan, P. K., & Inman, J. J. (2015). From Multi-Channel Retailing to Omni-Channel Retailing. *Journal of Retailing*, *91*(2), 174–181. https://doi.org/10.1016/j.jretai.2015.02.005

Verhoef, P. C., van Ittersum, K., Kannan, P. K., & Inman, J. (2022). Omnichannel retailing: A consumer perspective. In L. R. Kahle, T. M. Lowrey, & J. Huber (Eds.), *APA handbook of consumer psychology* (pp. 649–672). American Psychological Association. https://doi.org/10.1037/0000262-029

Vhatkar, M. S., Raut, R. D., Gokhale, R., Cheikhrouhou, N., & Akarte, M. (2024). A glimpse of the future sustainable digital omnichannel retailing emerges - A systematic literature review. *Journal of Cleaner Production*, *442*, 141111. https://doi.org/10.1016/j.jclepro.2024.141111

Wang, J [J.], Xu, S., Zhang, S., Sun, C., & Wu, L. (2023). Research on the Impact of Consumer Experience Satisfaction on Green Food Repurchase Intention. *Foods*, *12*(24), 4510. https://doi.org/10.3390/foods12244510

Wang, J [Jianming], Pham, T. L., & van Dang, T. (2020). Environmental Consciousness and Organic Food Purchase Intention: A Moderated Mediation Model of Perceived Food Quality and Price Sensitivity. *International Journal of Environmental Research and Public Health*, *17*(3), 850. https://doi.org/10.3390/ijerph17030850

Werners, S. E., Pfenninger, S., van Slobbe, E., Haasnoot, M., Kwakkel, J. H., & Swart, R. J. (2013). Thresholds, tipping and turning points for sustainability under climate change. *Current Opinion in Environmental Sustainability*, *5*(3-4), 334–340. https://doi.org/10.1016/j.cosust.2013.06.005

Wiese, A., Zielke, S., & Toporowski, W. (2015). Sustainability in retailing – research streams and emerging trends. *International Journal of Retail & Distribution Management*, *43*(4/5). https://doi.org/10.1108/IJRDM-02-2015-0024

Wiwik Handayani, Reiga Ritomiea Ariescy, Felia Ananda Cahya, Salsabila Islami Yusnindi, & Desy Ari Sulistyo (2021). Literature Review: Environmental Awareness and Pro-Environmental Behavior. *Nusantara Science and Technology Proceedings*, 170–173. https://doi.org/10.11594/nstp.2021.0925

Wu, S.-M., Chan, F. T. S., & Sio-Chong U, T. (2024). Enhancing sustainability in mass customisation of consumer electronics with salvage value through supply chain financing. *International Journal of Logistics Research and Applications*, 1–21. https://doi.org/10.1080/13675567.2024.2322515

Xin, X., Wu, J., Huang, L., Shang, S., & Chen, P. (2022). Effect of Multi-Channel Integration on Customer Purchase Intention. *Journal of Computer Information Systems*, *62*(5), 1036–1047. https://doi.org/10.1080/08874417.2021.1965052

Xu, J., Lyu, G., Bai, Q., & Luo, Q. (2023). Robust pricing and inventory strategies for an omnichannel retailer under carbon tax and cap-and-offset regulations. *Computers & Industrial Engineering*, *185*, 109615. https://doi.org/10.1016/j.cie.2023.109615

Yao, X., Liu, Y [Yanfeng], & Qi, G. (2024). Enhancing Environmental Awareness for Sustainable Retail: Analysis of the Buy-Online-and-Return-in-Store Policy Adoption Using Theory of Planned Behavior. *Journal of Theoretical and Applied Electronic Commerce Research*, *19*(4), 2694–2713. https://doi.org/10.3390/jtaer19040129

Ye, Y., Lau, K. H., & Teo, L. K. Y. (2018). Drivers and barriers of omni-channel retailing in China. *International Journal of Retail & Distribution Management*, *46*(7), 657–689. https://doi.org/10.1108/IJRDM-04-2017-0062

Yeğin, T., & Ikram, M. (2022). Developing a Sustainable Omnichannel Strategic Framework toward Circular Revolution: An Integrated Approach. *Sustainability*, *14*(18), 11578. https://doi.org/10.3390/su141811578

Young, W., Hwang, K., McDonald, S [Seonaidh], & Oates, C. J. (2009). Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development*, *18*(1), n/a-n/a. https://doi.org/10.1002/sd.394

Zahid, M. M., Ali, B., Ahmad, M. S., Thurasamy, R., & Amin, N. (2018). Factors Affecting Purchase Intention and Social Media Publicity of Green Products: The Mediating Role of Concern for Consequences. *Corporate Social Responsibility and Environmental Management*, *25*(3), 225–236. https://doi.org/10.1002/csr.1450

Zhang, J. J. Y., Følstad, A., & Bjørkli, C. A. (2023). Organizational Factors Affecting Successful Implementation of Chatbots for Customer Service. *Journal of Internet Commerce*, *22*(1), 122–156. https://doi.org/10.1080/15332861.2021.1966723

Zhang, L., & Hänninen, M. (2022). Chapter 14 - Digital retail—key trends and developments. In B. L. MacCarthy & D. Ivanov (Eds.), *The digital supply chain* (pp. 237–254). Elsevier. https://doi.org/10.1016/B978-0-323-91614-1.00014-9

Zhang, M., Ren, C., Wang, G. A., & He, Z. (2018). The impact of channel integration on consumer responses in omni-channel retailing: The mediating effect of consumer

empowerment. *Electronic Commerce Research and Applications*, *28*, 181–193. https://doi.org/10.1016/j.elerap.2018.02.002

Zhuo, Z., Ren, Z., & Zhu, Z. (2023). *Attitude-Behavior Gap in Green Consumption Behavior: A Review.*

Appendix A2. Publications

Accepted / In press

Raether, J., Végvári, B., & Szente, V. (in press). Sustainable consumer behavior in omnichannel electronics retailing: Evidence from a pilot study. Tér – Gazdaság – Ember: Journal of Region, Society and Economy.

Raether, J., Osiako, P. O., & Szente, V. (in press). Sustainability challenges in omni-channel retailing: A systematic review. Regional and Business Studies.

Published

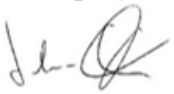
Osiako, P. O., Raether, J., & Szente, V. (2022). The influence of marketing communication channels on the motivations, consumption behaviour, and satisfaction of domestic tourists in Kenya. Regional and Business Studies, 14(1), 17–31. https://doi.org/10.33568/rbs.3598

Appendix A3. Declaration

Declaration

I hereby declare that this dissertation is my own original work. All sources and references used have been properly acknowledged and cited. It has neither been submitted to any other university nor previously rejected.

Place and Date: Stuttgart, 30.08.2025

Signature: 

Name: Julius Raether

This dissertation has been submitted to the Doctoral School of Management and Organizational Sciences for review with my approval as the University supervisor.

Place and Date

Signature

Name Professor Dr. Viktória Szente

Hungarian University of Agriculture and Life Sciences

Appendix A4. Questionnaire of the empirical study

Consumer Electronics

Willkommen zu dieser Umfrage!
Ziel dieser Umfrage ist es, zu untersuchen, wie Nachhaltigkeitsmaßnahmen das Verbraucherverhalten und die Kaufentscheidungen im Omnichannel-Einzelhandel mit Elektronikprodukten beeinflussen. Die Umfrage wird etwa 5 Minuten dauern. Ihre Antworten bleiben anonym und werden nur für wissenschaftliche Zwecke verwendet.

* 1. Haben Sie in den letzten 24 Monaten Unterhaltungselektronik oder Heimelektronik (z. B. Smartphone, Computer, Kamera, Kopfhörer, Haushaltsgerät) online oder offline bei einem Omnichannel-Händler gekauft?

Omnichannel-Handel bedeutet, dass der Anbieter verschiedene Online- und Offline-Kommunikations- und/oder Verkaufskanäle kombiniert und stationäre, mobile und Online-Kanäle miteinander verbindet (z. B. Media Markt, Expert, Euronics oder ein Fachhändler mit kanalübergreifendem Vertrieb).

- ◯ Ja
- ◯ Nein

2. **Umweltbewusstsein /Umwelteinstellung**
Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Ich vermeide Produkte, die die Umwelt erheblich belasten.	◯	◯	◯	◯	◯
Ich bin bereit, längere Lieferzeiten zu akzeptieren, wenn sie umweltfreundlicher sind.	◯	◯	◯	◯	◯
Es ist mir wichtig, mit meinen Einkäufen einen Beitrag zum Umweltschutz zu leisten.	◯	◯	◯	◯	◯
Ich informiere mich aktiv über die Nachhaltigkeit von Produkten und Unternehmen.	◯	◯	◯	◯	◯

3. **Nachhaltigkeitsmaßnahmen**

Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Ich kaufe lieber bei einem Händler, der umweltfreundlichere Verpackungen anbietet.	○	○	○	○	○
Ich kaufe lieber bei einem Händler, der umweltfreundliche Lieferoptionen anbietet (z. B. CO_2-neutrale Lieferung).	○	○	○	○	○
Ich informiere mich über Nachhaltigkeitsmaßnahmen eines Händlers, bevor ich ein Produkt kaufe.	○	○	○	○	○

4. **Kanalintegration**

Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Es ist mir wichtig, dass Informationen und Verlinkungen über Online- und Offline-Kanäle eines Händlers konsistent sind.	○	○	○	○	○
Ich nutze verschiedene Vertriebskanäle (z.B. Online-Shop, Ladengeschäft, App) und erwarte ein nahtloses Erlebnis.	○	○	○	○	○
Ich finde es bequem, Produkte online zu recherchieren und in einem Ladengeschäft zu kaufen.	○	○	○	○	○
Die Möglichkeit, ein online gekauftes Produkt im Geschäft zurückzugeben, ist mir wichtig.	○	○	○	○	○

5. **Kundenzufriedenheit**

Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Ich bin mit meinem Einkaufserlebnis bei der Marke/dem Omnichannel-Händler für Elektronikprodukte zufrieden.	○	○	○	○	○
Die Qualität des gekauften Produkts entspricht meinen Erwartungen.	○	○	○	○	○
Ich würde die Marke/den Omnichannel-Einzelhändler weiter empfehlen.	○	○	○	○	○
Die Marke/der Omnichannel-Händler hat mir ein angenehmes Einkaufserlebnis geboten.	○	○	○	○	○

6. **Markenidentität**

Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Ich identifiziere mich mit Marken, die Nachhaltigkeit fördern.	○	○	○	○	○
Die Werte einer Marke beeinflussen meine Kaufentscheidungen.	○	○	○	○	○
Ich fühle mich emotional mit Marken verbunden, die umweltfreundliche Praktiken unterstützen.	○	○	○	○	○
Nachhaltige Maßnahmen einer Marke erhöhen meine Loyalität gegenüber dieser Marke.	○	○	○	○	○

7. **Kaufbereitschaft**

Wie stark stimmen Sie den folgenden Aussagen zu?

	trifft nicht zu	trifft eher nicht zu	teils-teils	trifft eher zu	trifft zu
Es ist mir wichtig, mit meinen Einkäufen einen Beitrag zum Umweltschutz zu leisten.	○	○	○	○	○
Ich vermeide Produkte, die die Umwelt erheblich belasten.	○	○	○	○	○
Meine Kaufentscheidung wird stark von der Nachhaltigkeit eines Produkts beeinflusst.	○	○	○	○	○
Ich suche aktiv nach nachhaltigen Produkten, wenn ich einkaufe.	○	○	○	○	○

* 8. Geschlecht

- ○ Weiblich
- ○ Männlich
- ○ Divers
- ○ Keine Angabe

* 9. Alter in Jahren

- ○ 0-18
- ○ 18-14
- ○ 25-40
- ○ 41-60
- ○ Über 60

* 10. Bildung

- ○ Keine formale Bildung
- ○ Schulabschluss
- ○ Berufsausbildung
- ○ Bachelor
- ○ Postgraduiertenabschluss/Master/Höhere Abschlüsse

* 11. Ihr jährliches Gesamteinkommen?

- ◯ <25.000 €
- ◯ 25.000 € – 50.000 €
- ◯ > 50.001 €
- ◯ Keine Angabe

Fertig!
Vielen Dank für Ihre Teilnahme an dieser Umfrage! Ihre Antworten helfen uns, das Verbraucherverhalten besser zu verstehen und nachhaltige Strategien zu entwickeln.

Appendix A5. Acknowledgement

My deepest gratitude goes to my supervisor, Prof. Dr. Viktória Szente, PhD, for her tireless and excellent support, her professional guidance, and her great patience with me. She has supported me in an exceptional way, for which I am profoundly thankful. I am also grateful to the members of the dissertation committee for their constructive guidance with special thanks to Dr. Krisztina Taralik, C.Sc., Associate Professor, and Dr. habil. Szilárd Podruzsik for their evaluation. From the university environment, I would also like to thank Dr. Kinga Szabó and Zsófia Móga for their excellent support throughout my doctoral studies, as well as my fellow researchers Peter Onyonje Osiako, Bence Végvári, and Prof. Dr. Ilka Heinze for their great support and enriching academic exchange.

My deepest gratitude goes to Inaam, hose love, patience, and understanding have been an indispensable anchor throughout this long journey. In addition, her scientific expertise has provided valuable support. Without her, this path would hardly have been possible. I am also really grateful to my parents, Lore and Andreas, for their unwavering support and belief in me, and to my colleagues, especially Christof, Alex, and Juliane, for giving me the freedom and encouragement that made this dissertation possible. I also wish to thank Pflugi, Christina and Fanny.