

**The importance of sustainability:  
Three essays on ESG considerations in supply chains**

CHRISTOPH JOACHIM KÖSTER

Vollständiger Abdruck der von der TUM School of Management der Technischen Universität München zur Erlangung eines Doktors der Wirtschafts- und Sozialwissenschaften (Dr. rer. pol.) genehmigten Dissertation.

Vorsitz: Prof. Dr Jürgen Ernstberger

Prüfende der Dissertation:

1. Prof. Dr. Gunther Friedl
2. Assoc. Prof. Dr. Andreas Ostermaier

Die Dissertation wurde am 16.02.2024 bei der Technischen Universität München eingereicht und durch die TUM School of Management am 25.06.2024 angenommen.

## Acknowledgements

First of all, I am sincerely grateful to my supervisor, Prof. Dr. Gunther Friedl, for providing me with the opportunity to embark on my doctoral studies at the Chair of Management Accounting. Throughout the past two years, I have not only continuously benefited from your valuable feedback but also always felt supported in all my research endeavors. Thank you!

I extend my thanks to Prof. Matthew Beck and Prof. John Rose from The University of Sydney, the co-authors of my third essay. You provided me with the chance to gain international research experience, engaged in numerous valuable discussion sessions, and made my stay in Sydney just exceptional. Thank you!

My gratitude also goes to the entire team at the Chair of Management Accounting for their warm welcome from the very beginning. I couldn't have asked for a better team to accompany me on my dissertation journey, fostering such a positive and supportive environment with meaningful discussions that went beyond research alone. Special thanks to Alexander, Alexandra, Johanna, Julius, Marcus, and Sophia for making this journey truly unforgettable. I really hope we will stay in touch. Thank you all!

A special acknowledgment is reserved for my longtime friend Johannes. Our conversations and discussions regarding the decision to pursue a doctorate, which unfolded over several years, played a fundamental role in my decision to take this significant step. I don't know if I would have taken this step without your influence. Thank you!

I want to express my gratitude to my entire family for their continuous support. Especially, I want to thank my late grandfather. You always protected and supported our family and always made everything possible so that we could engage in any educational achievements. I know that due to the war, you never had the chance to pursue a doctorate yourself. But, I know that you would have been very happy to see me doing this. I dedicate

---

this doctoral thesis to you. Thank you all!

Last but certainly not least, my heartfelt thanks go to Simone. Our paths crossed early in my doctorate, making the journey worthwhile for this reason alone. Thank you for always being by my side, making me laugh every day, offering unlimited support, and making our time together so wonderful. I'm truly looking forward to our hopefully very long journey together. Thank you!

## Abstract

Sustainability is a global contemporary challenge, leading to the growing importance of environmental, social, and governance (ESG) criteria in the supply chain. Yet, true sustainability improvement requires a holistic understanding of stakeholder perspectives and interests. In light of this, the dissertation aims to explore the overarching topic regarding the importance of sustainability within supply chains. The first essay explores the role of governance criteria in supplier selection, using a multiple-case study approach to empirically assess their evolving importance in German DAX and MDAX companies. This research extends the literature on supplier selection by revealing the increasing relevance of governance criteria, identifying their drivers, and providing practical insights to help practitioners enhance their ESG performance. The second essay examines the role of sustainability in supplier selection. Using the fuzzy analytical hierarchy process (FAHP), it empirically quantifies the relative importance of economic and ESG key criteria across 17 German industries. The findings reveal average weights of 51% for economic, 22% for environmental, 16% for social, and 11% for governance criteria. The findings extend the supplier selection literature and provide practitioners with an objective and data-driven framework for the selection of sustainable suppliers. The third essay assesses the relevance of sustainability for apparel consumers. Through choice experiments, it investigates consumer preferences for ESG criteria and evaluates four label designs. The results indicate an increased willingness-to-pay (WTP) of up to 200% for improved ESG performance when presented with the most effective label, characterized by both visual and textual information. The findings add to the literature on sustainable fashion purchasing decisions and provide valuable guidance for practitioners seeking to improve their ESG performance.

## Summary in German

Nachhaltigkeit ist eine globale Herausforderung, die die Relevanz von Umwelt, Sozial und Unternehmensführung bzw. Governance (ESG) Kriterien in der Lieferkette steigert. Eine umfassende Verbesserung der Nachhaltigkeit erfordert jedoch ein ganzheitliches Verständnis der Stakeholder Perspektiven und Interessen. Diese Dissertation untersucht daher die Bedeutung von Nachhaltigkeit in der Lieferkette. Der erste Aufsatz erforscht die Rolle von Governance Kriterien bei der Lieferantenauswahl in deutschen DAX- und MDAX-Unternehmen mithilfe eines Multiplen-Fallstudien Ansatzes. Dabei wird die wachsende Bedeutung dieser Kriterien empirisch belegt und ihre Treiber identifiziert. Die Ergebnisse tragen zur Literatur über die Lieferantenauswahl bei und bieten praktische Einblicke zur Verbesserung der ESG-Performance. Im zweiten Aufsatz wird die Bedeutung von Nachhaltigkeit bei der Lieferantenauswahl in 17 deutschen Branchen mithilfe des "fuzzy analytical hierarchy process" untersucht. Die Ergebnisse zeigen, dass wirtschaftliche Kriterien durchschnittlich mit 51%, ökologische mit 22%, soziale mit 16% und Governance Kriterien mit 11% gewichtet sind. Die Ergebnisse erweitern die Literatur zur Lieferantenauswahl und bieten Praktikern einen objektiven und datenbasierten Ansatz für die Auswahl von Lieferanten. Im dritten Aufsatz wird die Bedeutung von Nachhaltigkeit für Bekleidungskonsumenten mittels Entscheidungsexperimenten untersucht. Dabei werden Verbraucherpräferenzen für ESG-Kriterien und vier Etiketten-Designs bewertet. Die Ergebnisse zeigen, dass die Zahlungsbereitschaft für eine verbesserte ESG-Performance um bis zu 200% steigt, wenn das effektivste Etikett verwendet wird, das sowohl visuelle als auch textliche Informationen enthält. Diese Ergebnisse erweitern die Literatur zu Kaufentscheidungen bei nachhaltiger Mode und bieten wertvolle Einblicke für Manager, die ihre ESG-Leistung verbessern möchten.

# Contents

- 1 Introduction 1**
  - 1.1 Introduction to sustainability in supply chains . . . . . 1
  - 1.2 Research background and gap identification . . . . . 6
    - 1.2.1 Theoretical and legal context . . . . . 6
    - 1.2.2 Essay I - Changing impact of governance criteria in the supplier selection process . . . . . 10
    - 1.2.3 Essay II - The relevance of ESG in sustainable supplier selection . . 12
    - 1.2.4 Essay III - Sustainable purchase preferences and ESG labeling in the apparel industry . . . . . 13
  - 1.3 Methodology . . . . . 14
    - 1.3.1 Essay I - Qualitative, empirical research . . . . . 15
    - 1.3.2 Essay II - Quantitative, empirical research . . . . . 16
    - 1.3.3 Essay III - Experimental, empirical research . . . . . 17
  - 1.4 Results and contribution . . . . . 18
  - 1.5 Dissertation structure . . . . . 22
  
- 2 Essay I - The changing impact of governance criteria in the supplier selection process 24**
  - 2.1 Introduction . . . . . 25
  - 2.2 Theoretical background . . . . . 29
    - 2.2.1 Supplier selection . . . . . 29
    - 2.2.2 Governance . . . . . 31
    - 2.2.3 German Supply Chain Act . . . . . 32

---

2.2.4	Theories . . . . .	33
2.3	Research method . . . . .	35
2.3.1	Research design and sampling . . . . .	35
2.3.2	Data collection . . . . .	37
2.3.3	Data analysis . . . . .	39
2.4	Results . . . . .	39
2.4.1	Process . . . . .	40
2.4.2	Motivation . . . . .	42
2.4.3	Criteria . . . . .	44
2.4.4	Variation of criteria . . . . .	48
2.4.5	Challenges . . . . .	49
2.5	Discussion and conclusion . . . . .	50
2.6	Limitations and future research . . . . .	53
<b>3</b>	<b>Essay II - Does sustainability matter? The relevance of ESG in sustainable supplier selection</b>	<b>55</b>
3.1	Introduction . . . . .	56
3.2	Theoretical background . . . . .	59
3.2.1	Criteria formulation . . . . .	59
3.2.2	Supplier selection method . . . . .	61
3.2.3	Resource-based view . . . . .	61
3.2.4	German Supply Chain Act . . . . .	62
3.3	Research method . . . . .	63
3.3.1	Criteria identification . . . . .	63
3.3.2	Multi-criteria decision making method . . . . .	64
3.3.3	Data collection . . . . .	70
3.3.4	Data sampling and sample . . . . .	70
3.3.5	Data analysis . . . . .	73
3.4	Results . . . . .	73
3.4.1	Criteria . . . . .	73

---

3.4.2	Overall results . . . . .	75
3.4.3	Results by industry . . . . .	78
3.4.4	Results by type of purchasing . . . . .	81
3.4.5	Results by demographic factors . . . . .	81
3.4.6	Results by expert experience . . . . .	82
3.5	Discussion and conclusion . . . . .	83
3.6	Limitations and future research . . . . .	85
<b>4</b>	<b>Essay III - Sustainable purchase preferences and ESG labeling: Experimental evidence from German consumers in the apparel industry</b>	<b>87</b>
4.1	Introduction . . . . .	88
4.2	Theoretical background . . . . .	91
4.2.1	Willingness-to-pay for sustainable fashion . . . . .	91
4.2.2	Attitude-behavior gap . . . . .	93
4.2.3	Effect of labels on willingness-to-pay . . . . .	94
4.2.4	Labels and label design . . . . .	95
4.2.5	Theory and development of hypotheses . . . . .	97
4.3	Methodology . . . . .	99
4.3.1	Development of the choice experiment . . . . .	99
4.3.2	Design . . . . .	104
4.3.3	Model . . . . .	105
4.3.4	Data collection and analysis . . . . .	107
4.4	Descriptive results . . . . .	109
4.4.1	Sample characteristics . . . . .	110
4.4.2	Shopping behavior . . . . .	110
4.4.3	Attitude and behavior . . . . .	112
4.4.4	Label usefulness . . . . .	113
4.5	Choice results . . . . .	114
4.5.1	Experiment 1 - Fashion without sustainable characteristics . . . . .	114
4.5.2	Experiment 2 - Fashion with sustainable characteristics . . . . .	118



---

4.6	Discussion and conclusion . . . . .	124
4.7	Limitations and future research . . . . .	129
<b>5</b>	<b>Conclusion</b>	<b>131</b>
5.1	Summary of the research findings . . . . .	131
5.2	Avenues for further research . . . . .	134
5.3	Concluding remarks . . . . .	136
<b>6</b>	<b>Appendix</b>	<b>138</b>
6.1	Appendix to Essay II . . . . .	138
6.1.1	Identification and summary of relevant criteria . . . . .	138
6.1.2	Detailed analysis per industry . . . . .	140
6.1.3	Detailed analysis per type of purchasing . . . . .	145
6.1.4	Detailed analysis by demographic factors . . . . .	146
6.1.5	Detailed analysis by expert experience . . . . .	149
6.2	Appendix to Essay III . . . . .	153
6.2.1	Sustainable attributes . . . . .	153
6.2.2	Descriptive results . . . . .	154
6.2.3	Complementary analysis for choice experiments without sustainable information . . . . .	158
6.2.4	Complementary analysis for choice experiments with sustainable information . . . . .	160

## List of Figures

1.1	Annual and cumulative number of publications related to ESG and sustainability between 1990 and 2022 . . . . .	7
2.1	Evolution of supplier selection . . . . .	31
2.2	Sampling process . . . . .	36
2.3	Supplier selection process . . . . .	40
3.1	Evolution of supplier selection . . . . .	59
3.2	Sampling process . . . . .	71
3.3	Sample selection . . . . .	71
3.4	Age and gender distribution of participants . . . . .	71
3.5	Tenure and experience of participants . . . . .	72
3.6	Participants per industry and type of purchasing . . . . .	72
3.7	Sub-criteria clusters by global weight . . . . .	78
3.8	Criteria weights by industries . . . . .	80
4.1	Label designs . . . . .	103
4.2	Exemplary choice task without ESG information . . . . .	108
4.3	Exemplary choice task with ESG information . . . . .	109
4.4	Stated average prices per clothing article and gender . . . . .	111
4.5	Questions and results in the context of the theory of planned behavior . . .	113

## List of Tables

1.1	Overview of the three essays . . . . .	23
2.1	Interview panel . . . . .	37
2.2	Criteria registration process . . . . .	45
2.3	Criteria selection process . . . . .	47
3.1	Conversion of linguistic variables to triangular fuzzy numbers . . . . .	67
3.2	Consistency index . . . . .	68
3.3	Criteria and sub-criteria . . . . .	74
3.4	Overall criteria weights and ranks . . . . .	75
3.5	Overall sub-criteria weights and ranks . . . . .	76
3.6	Criteria weights and ranks by industry . . . . .	79
3.7	Criteria weights and ranks by type of purchasing . . . . .	81
3.8	Criteria weights and ranks by demographic factors . . . . .	82
3.9	Criteria weights and ranks by expert experience . . . . .	82
4.1	General attributes and levels for the choice experiment . . . . .	101
4.2	Sustainable attributes and levels for the choice experiment . . . . .	102
4.3	Sample characteristics . . . . .	110
4.4	Results factor analysis . . . . .	114
4.5	Experiment results - Clothing articles without sustainable characteristics . . . . .	116
4.6	Experiment results - Clothing articles with sustainable characteristics . . . . .	120
4.7	Presentation of various product prices based on their characteristics . . . . .	128
6.1	Criteria identification . . . . .	138

---

6.2	Sub-criteria weights and ranks by industry . . . . .	140
6.13	Sub-criteria weights and ranks by type of purchasing . . . . .	145
6.14	Sub-criteria weights and ranks by gender . . . . .	146
6.15	Sub-criteria weights and ranks by age . . . . .	147
6.16	Sub-criteria weights and ranks by years of purchasing experience . . . . .	149
6.17	Sub-criteria weights and ranks by years of company tenure . . . . .	151
6.19	Sustainable attributes and levels for the choice experiment . . . . .	153
6.20	Influence of gender on timing of last purchase . . . . .	154
6.21	Influence of age on timing of last purchase . . . . .	155
6.22	Influence of income on timing of last purchase . . . . .	155
6.23	Correlation between age and income to shopping frequency . . . . .	156
6.24	Correlation between age and stated average prices per clothing article . . .	156
6.25	Influence of gender on stated average prices per clothing article . . . . .	156
6.26	Influence of gender on person shopping . . . . .	156
6.27	Correlation between age and factors of TPB . . . . .	156
6.28	Influence of age on label usefulness . . . . .	157
6.29	Influence of factors of TPB on label usefulness . . . . .	157
6.30	Correlation between selected sample factors and significant parameters of socks choice experiment without sustainable information . . . . .	158
6.31	Correlation between selected sample factors and significant parameters of t-shirt choice experiment without sustainable information . . . . .	158
6.32	Correlation between selected sample factors and significant parameters of pants choice experiment without sustainable information . . . . .	159
6.33	Correlation between selected sample factors and significant parameters of suits choice experiment without sustainable information . . . . .	159
6.34	Correlation between selected sample factors and significant parameters of socks choice experiment with sustainable information . . . . .	160
6.35	Correlation between selected sample factors and significant parameters of t-shirt choice experiment with sustainable information . . . . .	160

6.36 Correlation between selected sample factors and significant parameters of pants choice experiment with sustainable information . . . . .	161
6.37 Correlation between selected sample factors and significant parameters of suits choice experiment with sustainable information . . . . .	161

## Abbreviations

AHP	Analytical hierarchy process
ASC	Alternative specific constant
CI	Consistency index
CoC	Code of conduct
CoM	Country of manufacturing
CR	Consistency ratio
CSR	Corporate social responsibility
ESG	Environmental, social, and governance
EU	European Union
FAHP	Fuzzy analytical hierarchy process
GR	Global rank
GW	Global weight
KSF	Key success factor
LR	Local rank
LW	Local weight
MCDM	Multi-criteria decision making
MMNL	Mixed multinomial logit
PBC	Perceived behavioral control
RBV	Resource-based view
SDG	Sustainable development goal
TFN	Triangular fuzzy number
TMT	Technology, media, and telecommunications
TPB	Theory of planned behavior
VRIN	Valuable, rare, imperfectly imitable, and non-substitutable
WTP	Willingness-to-pay

# 1 | Introduction

## 1.1 Introduction to sustainability in supply chains

Sustainability poses one of the greatest challenges of our time, demanding a profound shift in the way people behave to meet present needs without compromising future generations. These worldwide concerns have resulted in an increased emphasis on sustainability factors across all industries for some time past (Haws et al., 2014). To tackle the current issues, the United Nations proposed 17 sustainable development goals (SDGs) in 2015, which seek to "balance the three dimensions of sustainable development: the economic, social and environmental" (United Nations, 2015, p.1), also referred to as the triple bottom line (Elkington, 1998). The agenda is a roadmap for the future that aims to enable people around the world to live in dignity while at the same time preserving the natural foundations of life in the long term. One of these goals proposes to "ensure sustainable production and consumption patterns" (United Nations, 2015, p.22). Besides only asking for an improvement of the sustainability performance of a company itself, it also addresses the entire supply chain. On the one end of the supply chain, the promotion of sustainable procurement processes is suggested for buying firms. On the other end, the end-consumer is also targeted by requesting that all information for sustainable behavior should be provided at any time so that consumers have the chance to behave responsibly. The consumers' capacity to shape both the composition of products and the methods employed in their production is fundamentally rooted in their routine purchase choices. Succinctly stated and in accordance with the fundamental principles of supply and demand, companies will respond by augmenting their supply of sustainable products when consumers exhibit heightened interest, and conversely, if demand wanes, production diminishes.

When talking about sustainable development, it is imperative to include discussions about ESG criteria. ESG was formerly proposed in a United Nations Global Compact Report in 2004 and was promoted to an even broader integration within the investment process through the launch of the United Nations Principles for Responsible Investing in 2006 (United Nations, 2004, 2006). ESG is partly used interchangeably with corporate social responsibility (CSR), has emerged as the primary framework for evaluating the sustainability performance of companies, and sees the three pillars as the most important considerations for sustainable corporate performance (Li et al., 2021). Although the ESG concept has been extensively studied due to its increasing popularity in both practice and academia, it lacks a unified definition or a standardized set of criteria (European Commission, 2022a). Instead, many criteria are proposed, contingent on the context, definition, perspective, and rating agency employed (Drempetic et al., 2020). For instance, environmental criteria may encompass only CO<sub>2</sub> emissions but also factors such as waste generation, water consumption, recycling, or energy consumption.

In addition to the aforementioned SDGs, both the European Union and the national regulators have catalyzed a bolstering of ESG initiatives within corporate entities. To illustrate this, within the European context, whereas a mere 11,000 companies were previously mandated to disclose ESG information, this figure is projected to escalate to 50,000 within the forthcoming years (European Commission, 2021). These initiatives are designed to facilitate increased transparency to the general public regarding their sustainable endeavors by demanding regular disclosure of ESG performance and exerting pressure for continuous enhancements in this domain (European Commission, 2021). One of these regulations is the Act on Corporate Due Diligence Obligations for the Prevention of Human Rights Violations in Supply Chains (German: Lieferantkettensorgfaltspflichtengesetz), abbreviated the German Supply Chain Act, which will be discussed later in detail.

However, regulators are not the only ones who require companies to increase their sustainable performance. Also, investors are increasingly assigning greater significance to incorporate ESG policies and practices within a company's strategic framework and daily



operational procedures, recognizing their pivotal role in attaining sustained long-term value (Ching, 2020). This can be significantly substantiated through the percentage of investments allocated to ESG criteria: almost 90% of investors worldwide consider some form of ESG issues in their investment approach meanwhile (Capital Group, 2022). One famous pioneer is Blackrock. In 2020, its CEO, Larry Fink, opened up to its customers that they (i.e., Blackrock) "believe that sustainability should be our new standard for investing" (Fink, 2020). While the pursuit of this course has become less stringent, particularly in response to criticism from US Republican quarters contending that it adversely affects states heavily reliant on fossil fuels, the significance of investment linked to the transition to a lower-carbon economy persists (Brush, 2023; Masters and Temple-West, 2023). But the ESG performance holds significant importance even for conventional corporations. For instance, shareholders are progressively emphasizing the significance of ESG criteria and actively advocating for companies to align their actions with these criteria (Krueger et al., 2020).

It seems like Milton Friedman's famous statement, "The Social Responsibility of Business Is to Increase Its Profits" (Friedman, 1970, p. 1), is currently being reevaluated in the context of discussions surrounding corporate ESG initiatives. This reevaluation stems from the recognition that corporate social responsibility, especially concerning environmental and social concerns, can be in harmony with the long-term interests of both corporations and society. On the other hand, the focus on sustainability is not necessarily an end in itself but is pursued by companies to increase profits ultimately. So, one could also argue that companies can increase their profits by improving their sustainable performance.

In one manner or another, ESG has emerged as an integral component of a firm's business strategy, serving as an enduring reservoir of competitive advantage (Khan et al., 2016; Welch and Yoon, 2022). In the literature, the manifold advantages and economic value additions that accrue to companies when they incorporate sustainability initiatives as integral components of their strategic behaviors have already been documented, including the integration of ESG initiatives (e.g., Smith, 2003; Menguc and Ozanne, 2005;

Gupta and Gupta, 2020; Hermundsdottir and Aspelund, 2022). One example is the study of Friede et al. (2015), who analyzed over 2000 research studies and assessed the influence of ESG propositions on equity returns. Approximately 90% of these studies identify a non-negative relationship between ESG and corporate financial performance, with 53% reporting explicitly positive results. In contrast, only 8% of the findings reveal a negative association. Vividly illustrated, this could, for example, be a decline in ESG performance that may result in the degradation of credit conditions, a prohibition on bond issuance, or diminished prospects for involvement in government-funded initiatives (Everling, 2020; Chodnicka-Jaworska, 2021). More direct consequences are also discernible, including alterations in costs associated with the increase or reduction of CO<sub>2</sub> emissions. In addition, there are also indirect financial effects, for instance, through a loss of reputation. It is a truism that a good corporate reputation is a company's essential and dominant intangible asset. While building and developing a "good reputation" often takes years or decades, reputation can be damaged or even completely destroyed in no time at all (Weißensteiner, 2014).

In addition to the influence exerted by capital market stakeholders, society is becoming increasingly aware of their daily actions and has grown a moral impetus, exemplified by movements such as *Fridays for Future*, or slogans like *Think globally, act locally*, which aim to motivate people to act sustainable and companies to align with ESG criteria. This shift is also discernible in the context of market development, as for example evidenced by the fact that the US market for sustainable-marketed consumer packaged goods experienced a growth rate that was twice as high as that of conventionally branded products between 2017 and 2022 (Kronthal-Sacco and Whelan, 2023).

Despite the observable trend toward sustainability, a significant deficit remains in progressing towards the attainment of the SDGs and sustainable development. Therefore, it is necessary to understand the origin behind the current non-sustainable behavior and develop an understanding of how to improve it in the future. Especially supply chains are particularly interesting due to their substantial impact on social and environmental dimensions (Grant et al., 2017).

This dissertation aims to contribute to the discourse on sustainable development and the dynamic academic dialog surrounding ESG criteria within three essays. Specifically, the central question across all essays pertains to the examination of sustainability and ESG criteria within the context of supply chains. Three distinct research questions are derived that are analyzed using a triad of methods and a duet of perspectives. While the first two essays focus on the company perspective when selecting suppliers using qualitative and quantitative methods, the last essay adopts a perspective centered on end-consumers and their decision-making processes during purchases by applying an experimental method.

Essay I investigates the contemporary evolution in sustainable supplier selection procedures, placing particular emphasis on governance criteria. Supplier selection can be considered a key part of supply chain management with a substantial effect on business performance (Govindan et al., 2013; Thornton et al., 2013). Prior research has predominantly centered on economic, environmental, and social criteria, while the consideration of governance criteria has been comparatively scant. Nevertheless, the field is undergoing a transformation driven by the growing prominence of ESG criteria and the implementation of new regulatory measures, notably the German Supply Chain Act (German Bundestag, 2021; Mittwoch and Bremenkamp, 2021). Therefore, the first essay applies an exploratory interview-based approach to answer the following research question: *"How is the impact of governance criteria in the supplier selection process changing?"*

Essay II also delves into examining supplier selection, adopting a more comprehensive perspective. Precisely, it extends existing research by concurrently taking into account economic and ESG criteria. Pertinent criteria are identified, and their weights are quantified across 17 distinct German industries, employing a quantitative methodology, specifically the fuzzy analytical hierarchy process (FAHP), with the aim to answer the following research question: *"How important are the key selection criteria for sustainable supplier selection?"*

In contrast to Essay I and II, the perspective in Essay III changes to an end-consumer perspective. Customers frequently exert influence on companies to transit toward more sustainable supply chains, so it is imperative to recognize that the customer perspective

constitutes a vital domain for research exploration (Rogers et al., 2019). In order to identify the specific facets that hold particular significance for end-customers in the context of sustainability, an analysis is conducted within the fashion industry, which is chosen due to its notably poor sustainability performance. Specifically, choice experiments are employed to explore the extent of willingness-to-pay (WTP) associated with general and sustainable purchase criteria and the most effective labels for communicating this information, formulated through the following research question: *"How does ESG information presented via different label designs affect consumer choices in the apparel industry?"*

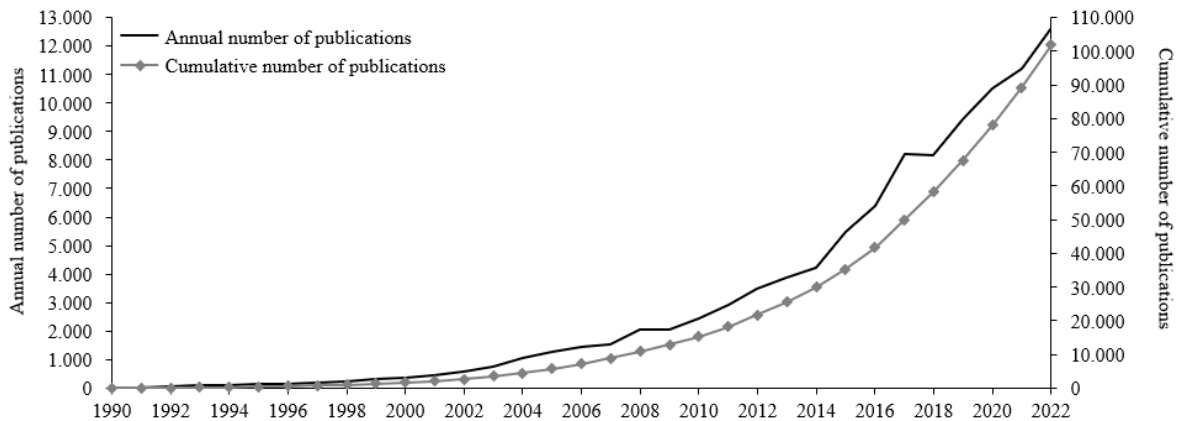
All three essays focus their investigations on the German context. Germany is chosen in this research context due to its dual significance as the largest economy, but also the leading emitter of CO<sub>2</sub> within the European Union (EU) (European Commission, 2022a; German Environmental Agency, 2023). While Germany has a history of pioneering efforts in sustainability, it must also contend with emissions reduction targets mandated by the EU, which are contingent upon economic power (Lafortune et al., 2021). For instance, Germany is tasked with achieving a 50% reduction in emissions by 2030, a requirement up to five times more demanding as compared to smaller nations (European Council, 2023). Furthermore, the enactment of the German Supply Chain Act poses distinctive challenges for companies operating within Germany, carrying extensive ramifications for supply chain operations (German Bundestag, 2021; Mittwoch and Bremenkamp, 2021).

## **1.2 Research background and gap identification**

### **1.2.1 Theoretical and legal context**

The three essays explore diverse aspects within the realm of supply chain, all of which are interconnected with the concepts of the ESG principles and sustainability. Prior to delving into these essays' theoretical underpinnings, the previously cited statement by Friedman (1970) is revisited. This statement revolves around Friedman's theory of shareholder value, positing that a company's primary obligation is to increase its profits and maximize returns to its shareholders (Friedman, 1970). Adhering strictly to this

theory would suggest that considerations of sustainability and ESG are irrelevant and may not warrant research attention. Nevertheless, as emphasized in the previous section, this perspective does not align with reality, and research focusing on sustainability and ESG is growing, a fact that can be substantiated through empirical evidence, as shown in Figure 1.1.



Note: The analysis is based on Scopus search of published articles with title, abstract, or keywords containing *Sustainable*, *Sustainability*, or *ESG* in the area of *Business, Management, and Accounting*

**Figure 1.1:** Annual and cumulative number of publications related to ESG and sustainability between 1990 and 2022

One plausible explanation for this misalignment is that the shareholder value theory inadequately encapsulates the actual objectives pursued by businesses, resulting in the stakeholder theory emerging as a counterpoint. The theory posits that a company's stakeholders encompass "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 46). These stakeholder groups encompass a wide array of entities, including but not limited to "employees, customers, suppliers, stockholders, banks, environmentalists, government, and other groups who can help or hurt the corporation" (Freeman, 2010, p. vi). The actions and externalities generated by firms have ramifications both internally and externally. As a result of these externalities, stakeholders exert influence on companies, urging them to enhance positive outcomes while extenuating negative consequences (Sarkis et al., 2010). For instance, internal stakeholders, such as employees and managers, and external stakeholders, such as customers and suppliers, might put pressure on firms to adopt responsible supply chain practices that can mitigate social challenges throughout the supply chain (Yawar

and Seuring, 2017).

The stakeholder theory elucidates the general relevance of sustainability considerations within supply chains and guides the research endeavors expounded in this dissertation as the overarching theoretical framework. Further supplementary theoretical constructs come into play in a more detailed examination of the individual essays. The principal-agent theory and the resource-based view underpin the first two essays, whereas the third essay uses the theory of planned behavior as its fundamental theoretical framework (Jensen and Meckling, 1976; Ajzen, 1991; Barney, 1991). In addition to theoretical considerations, the Germany Supply Chain Act will also be introduced, as it exerts a pivotal influence on the supplier selection process within the German context (German Bundestag, 2021).

*Principal-agent theory.* Essays I delves into the sustainable supplier selection process's evolution, focusing on the rising importance of governance factors that aid principals in better controlling their agents. The principal-agent theory is pivotal in this context, emphasizing how a principal delegates tasks to an agent who should act in the principal's best interests. When a buying firm outsources tasks to a supplier, this relationship can be defined as a principal-agent dynamic (Whipple and Roh, 2010). It involves granting decision-making power to the supplier, leading to a separation of ownership and control (Jensen and Meckling, 1976). Under the assumption that both parties aim to maximize their gains, conflicts of interest can arise (Jensen and Meckling, 1976). To address this, suppliers must be incentivized to align with the buying firm's interests, often through effective corporate governance mechanisms or goal harmonization (Jensen and Meckling, 1976; Eisenhardt, 1989a; Chang et al., 2015; McColgan, 2001; Ampenberger, 2010). Thus, this theory provides a solid logical base for the increasing relevance of governance criteria in supplier selection observed from a theoretical point of view.

*Resource-based view.* Besides the principal-agent theory, the resource-based view (RBV) provides a pertinent theoretical foundation for elucidating the significance of selecting sustainable suppliers and the ongoing development of this process within corporate operations (Bai et al., 2019). According to Barney (1991), the RBV states that companies

can attain a competitive advantage by possessing or effectively leveraging resources that are characterized as "valuable, rare, inimitable, and non-substitutable" (Barney et al., 2001, p. 625). These resources, known as "VRIN" resources, include both tangible and intangible assets. The latter also encompasses a robust sustainable performance, which can be fostered by selecting sustainable suppliers as one of the integral components (Heider, 2017; Bai et al., 2019). It is important to note that sustainable performance, to qualify as a rare resource, must possess the potential to differentiate itself from competitors. Hence, there is a compelling need to continually refine the supplier selection process, particularly when new regulations such as the German Supply Chain Act are introduced.

*German Supply Chain Act.* In 2021, the German Supply Chain Act was passed by the German parliament in response to the National Action Plan's unsuccessful attempt to prompt German companies to ensure the protection of human rights, environment, and social standards throughout their global supply and value chains. The act came into force at the beginning of 2023 for companies with over 3,000 employees and 2024 for companies with over 1,000 employees, impacting approximately 3,000 companies in total (German Bundestag, 2021; Mittwoch and Bremenkamp, 2021). It represents a significant external catalyst for sustainability within the supply chain, with a primary focus on safeguarding human rights, including the prevention of child labor and slavery, as well as environmental preservation at all stages of the supply chain (German Federal Ministry for Economic Corporation and Development, 2021, 2022; Mittwoch and Bremenkamp, 2021). The act particularly aims to enhance transparency regarding the origin of products or services and the production conditions and places responsibility on a focal company for any breaches of sustainability within their supply chain (Koos, 2022). Consequently, the act necessitates developing and implementing appropriate procurement strategies and practices. Given that these companies are accountable throughout the entire supply chain, i.e., starting with the extraction of raw materials, the supplier selection process must be reconfigured accordingly, and sustainability criteria must be fostered in supplier selection.

*Theory of planned behavior.* Essay III focuses on the end-consumer perspective in the apparel industry and makes use of Ajzen's (1991) theory of planned behavior as an un-

derlying theoretical concept to understand the reasons behind consumer actions that lead to a certain behavior. It is the most frequently applied theory when analyzing behavioral intentions and consumer behavior and has effectively confirmed its predictive capability in various studies (e.g., Maloney et al., 2014; Moser, 2015; Chekima et al., 2016; Aitken et al., 2020). The theory designates consumers' intentions as the principal element in anticipating their behavior, which, in turn, is primarily determined by attitude, subjective norms, and perceived behavioral control (Ajzen, 1991; Fishbein and Ajzen, 2010). Attitude pertains to the individuals' assessment of whether a specific behavior holds a positive or negative value. Subjective norm encompasses the individuals' perception of social influences, norms, or pressures relevant to the engagement or avoidance of the behavior. Perceived behavioral control denotes the individuals' perception of the ease or difficulty associated with executing the behavior (Ajzen, 1991; Fishbein and Ajzen, 2010). As Essay III conducts experiments to assess which product attributes positively influence attitudes and which labels enhance the perceived ease of identifying sustainable clothing to increase intention, the theory of planned behavior is well suited as an underlying framework.

### **1.2.2 Essay I - Changing impact of governance criteria in the supplier selection process**

Supplier selection is an important part of supply chain management and simultaneously influences a company's economic success, competitiveness, and customer satisfaction (Ahmad and Mondal, 2016). It is, therefore, not surprising that this topic has been the subject of research since the 1960s (c.f. Dickson, 1966). As corporations were progressively acknowledging the significance of integrating social and environmental considerations into their operational practices and supply chain management beyond solely focusing on conventional economic metrics, also supplier selection has evolved from a strictly economic perspective to the goal of selecting a supplier that excels in all dimensions of Elkington's triple bottom line concept: economic, environmental, and social aspects (Elkington, 1998; Andersen and Skjoett-Larsen, 2009; Ageron et al., 2012; Meixell and Luoma, 2015; Zimmer et al., 2016).



The persistent trends of globalization and trade liberalization have led to an expansion in the pool of potential suppliers and the elongation and increased intricacy of supply chains, thereby heightening companies' reliance on their supplier networks. In the context of global competition, it is imperative for firms to optimize their entire supply chain strategically, underscoring the growing significance of supplier selection in this regard (Simić et al., 2017). Nowadays, suppliers are frequently selected from countries that may not adhere to minimum environmental and social standards (Köksal et al., 2018). This is precisely where the German Supply Chain Act intervenes, mandating that companies in Germany must not only prudently choose their suppliers for economic considerations but are also legally required to adhere to specified environmental and social standards for their entire supply chain (German Federal Ministry for Economic Corporation and Development, 2021, 2022).

The law has been effective since the outset of 2023 and has already elicited initial grievances. An illustrative case arises from China, where, as reported by the Financial Times, the three prominent German automotive manufacturers - BMW, Volkswagen, and Mercedes-Benz - are facing allegations concerning the utilization of forced labor by direct and indirect suppliers within their Chinese supply networks (Yang and Nilsson, 2023). Specifically, each of the three complaints asserted that raw materials extraction was associated with a notably elevated risk of being connected to forced labor.

This underscores the notion that companies must now extend their scrutiny beyond their primary suppliers to encompass their secondary suppliers as well. Nonetheless, given that companies may not always exert direct control over these secondary suppliers, the importance of effective governance in the context of supplier selection by these secondary suppliers is growing. However, research pertaining to governance mechanisms in the process of supplier selection remains restricted, with a dearth of investigations addressing the essential governance criteria relevant to the selection of sustainable suppliers. Consequently, the following research question emerges: *"How is the impact of governance criteria in the supplier selection process changing?"*

### 1.2.3 Essay II - The relevance of ESG in sustainable supplier selection

Sustainability is one of the foremost contemporary challenges. And its significance has been proven to increase, as outlined before. In this context, research in the field of supplier selection has not remained static either. Following the incorporation of environmental criteria in supplier selection research during the 1990s and the subsequent introduction of social criteria in the 2010s, the term "sustainable supplier selection" has become commonplace.

Since 2020 alone, over 1,000 papers have been published in this field<sup>1</sup>. A significant part of this research is dedicated to identifying pertinent criteria. The most frequently employed criteria in the literature typically encompass economic criteria such as quality, flexibility, and price; environmental criteria such as environmental management system, resource consumption, and eco-design; and social criteria such as health and safety, working conditions, and staff training (Zimmer et al., 2016).

In conjunction with the process of identifying criteria, the criteria weights were determined through the utilization of multi-criteria decision making techniques and tailored to specific industry sectors and market segments. In this context, the Analytical Hierarchy Process, in combination with fuzzy logic, has emerged as both the most commonly employed and most effective method, as substantiated by prior research (Chai et al., 2013; Genovese et al., 2013; Govindan et al., 2015; Alkahtani et al., 2019).

Despite the extensive research, there is a lack of quantified weights, especially for governance criteria. Moreover, a singular determination of selection criteria and assigning their respective weights is not sufficient. Instead, a continuous process of adaptation and improvement proves to be imperative, as corporations can only uphold or enhance their competitive advantage when they commission suppliers that can be considered as a scarce resource contributing significantly to the sustainability performance of the buying firm, as delineated in the resource-based view elucidated in section 1.2.1. These propositions

---

<sup>1</sup>based on Scopus search of published articles with the title containing *Supplier Selection*

become more evident when contemplating the introduction of the German Supply Chain Act. Thus far, the influence of this legislation on supplier selection has not undergone a comprehensive investigation. Moreover, irrespective of this consideration, there is a dearth of scholarly inquiries in the current body of literature concerning Germany, which is the foremost economic powerhouse within the European Union, as well as addressing diverse industries. Thus, the subsequent research question arises: *How important are the key selection criteria for sustainable supplier selection?*

#### **1.2.4 Essay III - Sustainable purchase preferences and ESG labeling in the apparel industry**

Promoting sustainability within the fashion industry can be characterized as among the most important and potentially impactful responsibilities within the sphere of influence of an end-consumer. This stems from the fact that the clothing sector has developed into one of the most significant contributors to global environmental pollution, e.g., accounting for nearly 10% of worldwide greenhouse gas emissions, and an industry characterized by notably deficient social standards (Niinimäki et al., 2020; Dhir et al., 2021; Koszewska, 2021; Fallon, 2022; Ribeiro, 2022).

Despite the growing awareness among customers, the increasing relevance of sustainability considerations of sustainable supply chain management, and the integration of sustainability aspects into corporate policies by companies, a substantial disparity persists between actual practices and desired outcomes (Gillespie and Rogers, 2016; White et al., 2019; Muresan et al., 2021; Wiederhold and Martinez, 2018; Aitken et al., 2020). Previous research has proven that consumers are theoretically willing to select and even pay premiums for sustainable materials, such as organic cotton, locally produced clothes, and sustainable practices. However, there is a considerable difference between what consumers say and what they actually do, the so-called attitude-behavior gap (Dickson, 2001; Nakano, 2019; White et al., 2019; Sandra and Alessandro, 2021; Brand et al., 2022; Boufous et al., 2023).

The factors contributing to this incongruity are manifold, encompassing elements such

as pricing, transparency, consumer awareness, and inadequate labeling (Wiederhold and Martinez, 2018). The latter, on the other hand, can also positively influence customers, potentially steering them towards sustainable choices and fostering a greater willingness to pay (Thøgersen, 2005; Proto et al., 2007; Žurga and Tavčer, 2014). In order to do so, the design of these labels plays a pivotal role in their effectiveness. Specifically, labels must possess characteristics such as clarity and simplicity while at the same time a requisite level of informational depth in order to serve as valuable tools for consumers (Ma et al., 2017; Williams and Hodges, 2022).

Despite the considerable volume of research conducted in the realm of willingness-to-pay concerning sustainability and label formats, the majority of studies have tended to narrow their focus on the influence of specific environmental or social information, predominantly concentrating on environmental attributes. This limited approach to analyzing selected sustainability elements overlooks the intricacy that consumers encounter when making comprehensive decisions. Although some studies have explored the interplay between certain dimensions of sustainability, there appears to be a dearth of research that comprehensively investigates the interaction of all ESG dimensions concurrently. Furthermore, the assessment of various label designs has primarily centered on the food sector despite the distinct characteristics characterizing the apparel industry. Therefore, Essay III proposes the following research question: *"How does ESG information presented via different label designs affect consumer choices in the apparel industry?"*

### 1.3 Methodology

This dissertation employs a diverse array of methods to address the specific research questions effectively. While Essay I adopts a qualitative multiple-case study methodology, Essay II employs the quantitative approach of the fuzzy analytical hierarchy process. Essay III utilizes choice experiments as an experimental method. Comprehensive descriptions of these methods can be found in the respective essays, with only a concise summary provided in this section.

### 1.3.1 Essay I - Qualitative, empirical research

Essay I analyzes the changing impact of governance factors by deploying a multiple-case study approach (Eisenhardt, 1989b; Yin, 2018). This chosen approach is particularly appropriate in light of the limited existing theoretical and empirical evidence, the research question's focus on understanding the "how" aspect, and the method's capacity to yield robust, accurate, generalizable, and reliable results (Eisenhardt, 1991; Eisenhardt and Graebner, 2007; Yin, 2018). An additional benefit conferred by the multiple-case study methodology pertains to its capacity for direct interaction with involved subjects (Miles et al., 2014). Specifically, within the scope of this investigation, this entails involvement with purchasing and sustainability experts who possess specialized insights into the intricacies of the supplier selection process.

The paper adheres to the theoretical, multi-stage sampling approach outlined by Glaser and Strauss (1967) in order to ascertain the selection of exclusively pertinent companies that the German Supply Chain Act impacts. The selection process assures a heightened degree of professionalization, formalized structures, and regulatory adherence within the purchasing and sustainability departments. The final sample comprises 13 companies listed on the German DAX and MDAX stock indices, characterized by an average revenue of approximately €12 billion and an employee count of around 40,000, representing a diverse array of eight distinct industries.

The interviews were designed as semi-structured, in-depth interviews, a design choice that enables systematic data collection while also accommodating the discovery of novel and unanticipated insights (Yin, 2018). To enhance the robustness of the findings, a triangulation approach was employed, incorporating supplementary data sources. Specifically, archival data (i.e., supplier code of conducts) was integrated both during the interview process and in the subsequent evaluation and analysis of the interviews.

The data analysis followed a multi-stage procedure, following the process proposed by Gioia et al. (2013). Initially, a within-case analysis was conducted using transcribed interviews and archival data, yielding first-order concepts. These outcomes were subsequently employed in a cross-case analysis to identify variations and commonalities between the

cases, facilitating the derivation of overarching patterns aimed at synthesizing the first-order themes into second-order themes. Through an iterative process involving continual refinement between literature review and data analysis, these outcomes were then used to develop a theoretical construct.

### **1.3.2 Essay II - Quantitative, empirical research**

Essay II analyzes the importance of the key selection criteria for the sustainable supplier selection process utilizing the fuzzy analytical hierarchy process, combining the analytical hierarchy process (AHP) and fuzzy sets (Saaty, 1988). The utilization of the FAHP seems appropriate, as it accommodates both quantitative and qualitative data within the same problem, simultaneously offering an increased likelihood of finding an optimal solution (Kahraman et al., 2003; Matemane et al., 2022). By employing triangular fuzzy numbers, FAHP effectively addresses the limitations of the AHP in handling uncertainty (Zadeh, 1965; Kahraman et al., 2003; Kwong and Bai, 2003). Moreover, this approach exhibits superior performance compared to alternative methods and has been identified as the most prevalent technique employed in scholarly literature for the supplier selection procedure (Chai et al., 2013; Genovese et al., 2013; Govindan et al., 2015; Zimmer et al., 2016; Alkahtani et al., 2019).

In the first step, relevant economic and ESG selection criteria were derived from a comprehensive review of the sustainable supplier selection literature. These criteria were subsequently grouped by similarity and condensed into a concise set of up to seven criteria per category, which aligns with the maximum limit typically employed when utilizing the FAHP (Saaty, 1980). The final criteria set encompassed seven economic criteria, along with six criteria each for environmental and social aspects, in addition to five governance-related criteria.

Subsequently, a two-step theoretical sampling approach, as delineated by Glaser and Strauss (1967), was employed to select experts who can provide valuable insights. As a result, 230 German experts from 17 industries, possessing specialized knowledge in procurement, purchasing, or sustainability, took part in a survey aimed at empirical as-

assessment of the identified criteria.

Finally, the data was analyzed employing the FAHP, encompassing four sequential steps. First of all, a hierarchical structure was established, followed by the construction of a pairwise comparison matrix based on linguistic terms. Subsequently, these linguistic terms were transformed into fuzzy numbers. Finally, the criteria ranks and weights were computed, and consistency was assessed (Torabzadeh Khorasani, 2018).

### **1.3.3 Essay III - Experimental, empirical research**

Essay III undertakes an exploration of the significance of distinct sustainable product attributes and assesses the efficacy of various label designs within the apparel industry through the application of choice experiments. Choice experiments stand as a preferable methodology in situations where empirical data from the field is absent, offering outcomes that exhibit greater resilience when contrasted with conventional questionnaire-based surveys (Hensher et al., 2015). Specifically, the mixed multinomial logit (MMNL) model is employed due to its advantages over other models, as it accommodates individual systematic and random components for each respondent, which allows for a more precise representation of real-world scenarios (Hensher et al., 2015).

As an initial step, the choice experiment is developed through the identification of paramount parameters influencing purchase decisions. This critical phase, considered pivotal in experiment design, is executed by means of an extensive review of relevant literature, identifying the essential general and sustainable attributes, their respective levels, and label designs associated with the four chosen clothing articles, specifically socks, t-shirts, pants, and suits (Brand et al., 2022). The selection of these four clothing articles is deliberate and based on multiple considerations. These include encompassing various price dimensions, involvement in the decision-making process, presence in a conventional wardrobe, and the frequency of wearing.

Following this, choice profiles were created using state-of-the-art Bayesian D-efficient designs, which were optimized using a genetic algorithm featuring 1,000 Sobol draws (Rose and Bliemer, 2008; Hensher et al., 2015; Bliemer and Rose, 2023). This process yielded

120 choice tasks for each design and each clothing article, which were organized into 60 blocks. Consequently, each participant was tasked with responding to two experiments per experimental session.

Approximately 800 participants were recruited for the experiment, with 733 remaining following data cleaning procedures. Each participant engaged in four choice tasks for every clothing article using SurveyEngine, with two choice tasks involving products devoid of sustainable characteristics and two involving products with sustainable attributes. This cumulatively amounted to eight choice tasks per respondent. Consequently, a grand total of 11,728 observations were made. The collected data was then analyzed with the mixed multinomial logit model using Apollo 0.3.0 on R 4.3.1 for Windows (Hess and Palma, 2019).

## 1.4 Results and contribution

This chapter provides insights into the results of each essay, along with their associated theoretical and practical implications. Towards the chapter's end, Table 1.1 is presented, delivering a comprehensive summary of the three essays with their essential characteristics and standing as a valuable reference point for readers throughout the remainder of the dissertation.

**Essay I.** The outcomes of Essay I elucidate five pivotal discoveries grounded in case-based evidence, drawing from the resource-based view and the principal-agent theory. Firstly, the findings demonstrate the contextual relevance of distinct governance criteria throughout various phases of supplier selection to select sustainable direct and indirect suppliers, which can help to improve a buying firm's competitive advantage. Specifically, the initial *registration* phase necessitates must-have criteria, whereas the subsequent *selection* phase incorporates different criteria into a scoring model. The concluding *review* phase functions as a mechanism to assess adherence to the criteria stipulated in the initial two phases.

Secondly, pertinent governance criteria are identified for each procedural stage. Within this framework, there are eleven pre-established governance criteria in the *registration*



phase as stipulated in the supplier code of conducts, along with the identification of five emerging governance criteria that have gained prominence in the *selection* phase. Furthermore, the analysis demonstrates that the criteria remain consistent across a company's customer base, but the extent of criterion evaluation varies depending on the supplier's risk profile. Additionally, the weighting of governance criteria can fluctuate compared to economic, environmental, and social criteria. Moreover, it becomes apparent that the primary impetus for incorporating governance criteria lies in the German Supply Chain Act. Nevertheless, the imperative is intensified by the influence exerted by diverse stakeholders, notably customers, investors, and the younger generation. Lastly, it becomes evident that a significant obstacle in incorporating governance criteria into the selection process is the absence of standardization and limitations in data accessibility.

This research extends the existing body of literature within the realms of sustainable supplier selection (e.g., Zimmer et al., 2016; Khan et al., 2018; Jain and Singh, 2020) and corporate governance (e.g., Post et al., 2011; Zhang et al., 2013; Velte, 2016; Ben-Amar et al., 2017). This is achieved by offering concrete and implementable governance criteria for the sustainable supplier selection process and by providing insights into the evolving influence of governance elements, which can affect various stakeholders. In terms of practical contributions, the findings from this study can serve as practical guidance for suppliers and buying firms seeking actionable strategies to enhance their ESG performance.

**Essay II.** In Essay II, a systematic approach, based on the FAHP, is employed to establish a comprehensive framework for selecting sustainable suppliers. This framework is built on a thorough examination of existing literature and comprises a total of twenty-four distinct criteria, categorized into four overarching dimensions: economic (comprising seven sub-criteria), environmental and social (each comprising six sub-criteria), and governance (comprising five sub-criteria).

The utilization of the FAHP yields valuable insights into the relative importance of these criteria. Specifically, the analysis reveals that the economic dimension carries the highest weight, accounting for 51% of the overall assessment. In contrast, the environmental dimension holds a weight of 22%, the social dimension of 16%, and the governance

criteria are assigned a weight of 11%. This distribution of weights quantifies the significance of each criterion within the sustainable supplier selection process, facilitating a more objective and data-driven approach to decision-making.

Through a comprehensive examination encompassing 17 diverse industries, a noteworthy observation emerges. It is discerned that the relative hierarchical ranking of the four criteria remains fairly uniform across these industries. However, the pivotal aspect lies in the disparities evident in the quantification of the weights assigned to these criteria. For instance, within the technology, media, and telecommunications industry, the economic criteria exhibit a relatively lower weight of 35%, whereas, conversely, the technology and hardware equipment industry allocates a notably higher weight of 61% to the same economic criteria. It should be acknowledged that there are a few exceptions to this general trend, such as in the case of the textile industry, where social criteria assume a paramount role, with a significant weight of 37%. These anomalies underscore the nuanced and industry-specific nature of criterion prioritization within the context of sustainable supplier selection.

In terms of theoretical contributions, it is established that the predominant selection criteria exhibit a remarkable degree of constancy to existing studies, particularly in the domains of economic and environmental considerations, and to a significant extent in the context of social criteria (e.g., Weber et al., 1991; Ho et al., 2010; Zimmer et al., 2016; Rashidi and Cullinane, 2019). Nevertheless, there is an evident uptrend in the significance attributed to working conditions and governance criteria, particularly subsequent to the implementation of the German Supply Chain Act. Furthermore, the research is extended through the provision of an industry-wide comparative analysis. This analysis serves as a fundamental framework for gaining improved insights into how companies prioritize and assess the significance of selection criteria in the supplier selection process across various industries while also revealing the distinctions between them.

In terms of practical implications, the findings offer a pathway for companies to formulate a decision support tool to enhance the assessment of suppliers, establish a competitive edge, and mitigate the risk of harm to the company's reputation. Specifically,

through the alignment of each supplier's performance metrics with individual sub-criteria, these metrics can be combined into a single evaluation criterion, empowering companies to systematically assess and rank their suppliers with respect to the establishment of a sustainable supply chain.

**Essay III.** Essay III presents valuable empirical insights into consumer preferences within the apparel industry, employing a foundation of experimental evidence garnered from choice experiments. When exclusively focusing on general attributes, the research elucidates that consumers exhibit a willingness to partially accept price premiums compared to the average product price exceeding 50% for superior quality products or those originating from Europe or Germany. Conversely, consumers often manifest disutility in scenarios involving products manufactured from polyester, recycled materials, or wool. In contrast, organic cotton, specifically in the context of suits, is the only material that imparts superior utility to consumers when compared to conventional cotton.

Following the introduction of sustainability attributes to the products, the overall trend in relation to the general attributes remains relatively constant. This leads to the conclusion that sustainable attributes should not be seen as a replacement for general attributes but rather as a complementary element. This suggests that study participants aim to optimize all factors that directly influence sustainability performance, such as ESG criteria, as well as those that indirectly affect it, such as product quality.

However, the significance of sustainable attributes for consumers is heavily contingent on the label's design used to convey this information. While certain label designs, such as a text-only label, do not result in any increased utility concerning improved sustainability performance for some products, labels that include a scorecard and impact factor lead to a notable increase in utility for at least one of the ESG dimensions across all products. This added utility translates into a heightened WTP compared to the average product price partly exceeding 200% for superior ESG performance.

The results of this study contribute to the existing body of knowledge in the field of fashion purchase decision-making in the context of sustainability (e.g., Hustvedt and Bernard, 2008; Casadesus-Masanell et al., 2009; Engle et al., 2018; Ma et al., 2017;

Williams and Hodges, 2022). This research represents pioneering efforts in the comprehensive integration of ESG criteria into the decision-making processes of fashion consumers while concurrently yielding insights into the effectiveness of various label designs.

The analyses also generate practical implications, offering explicit direction for corporate managers aiming to enhance the ESG performance of their products or revise their existing strategies. The findings demonstrate that consumers are willing to accept price premiums in exchange for enhanced sustainability performance. Therefore, managers can be confident that the additional costs associated with improving sustainability performance can be recuperated. Furthermore, the results unambiguously indicate that scorecard and impact labels should be employed as the preferred means of conveying sustainability information.

## 1.5 Dissertation structure

The structure of this dissertation is as follows: Chapter 2 features Essay I "The changing impact of governance criteria in the supplier selection process". This is succeeded by Chapter 3, which presents Essay II "Does sustainability matter? The relevance of ESG in sustainable supplier selection". Chapter 4 introduces the third and final essay, titled "Sustainable purchase preferences and ESG labeling: Experimental evidence from German consumers in the apparel industry". Chapter 5 serves as the concluding chapter, summarizing the dissertation's key findings and offering overall concluding remarks, in addition to discussing theoretical and managerial implications. This chapter also acknowledges the limitations of the three essays and suggests potential avenues for further research. Lastly, the appendix provides supplementary information and analyses.

It's important to emphasize that these three essays in this dissertation constitute separate research projects. As such, they can function as standalone pieces of work that can be read independently. Consequently, certain sections may contain shared content across the essays.

**Table 1.1** Overview of the three essays

Essay characteristics	Essay I (cf. Chapter 2)	Essay II (cf. Chapter 3)	Essay III (cf. Chapter 4)
<i>Title</i>	The changing impact of governance criteria in the supplier selection process	Does sustainability matter? The relevance of ESG in sustainable supplier selection	Sustainable purchase preferences and ESG labeling: Experimental evidence from German consumers in the apparel industry
<i>Research question</i>	How is the impact of governance criteria in the supplier selection process changing?	How important are the key selection criteria for sustainable supplier selection?	How does ESG information presented via different label designs affect consumer choices in the apparel industry?
<i>Research approach</i>	Qualitative	Quantitative	Experimental
<i>Methodology</i>	Multiple-case study	Multi-criteria decision making models (fuzzy analytical hierarchy process)	Choice experiments (mixed multinomial logit model)
<i>Units of analysis</i>	13 DAX and MDAX companies	230 German procurement and sustainability experts	733 German fashion consumers
<i>Contributions</i>	A comprehensive examination of the significance of different governance criteria across multiple stages of supplier selection, the driving factors behind their adoption, and the constraints associated with their practical implementation.	A comprehensive framework for the identification of sustainable suppliers, encompassing 24 distinct economic, environmental, social, and governance criteria, yielding valuable insights across 17 diverse industrial sectors.	A comprehensive overview of the relevance of general and ESG product attributes for apparel consumers, the associated willingness to pay premiums, and the effectiveness of different label designs.
<i>Managerial implications</i>	Overview and guidance for the implementation of governance criteria in the supplier selection process.	A systematic approach to develop a decision support tool aimed at improving the selection decision of suppliers.	Guidance for enhancing and presenting sustainability performance within the apparel sector.

## 2 | Essay I - The changing impact of governance criteria in the supplier selection process

**Abstract:** Supplier selection is one of the key challenges in supply chain management and significantly impacts a firm's business performance. Nowadays, literature on sustainable supplier selection considers economic, environmental, and social criteria. However, governance criteria have not been analyzed so far in contrast to practice. The increasing relevance of environmental, social, and governance (ESG) criteria and new regulations in Germany, namely the German Supply Chain Act, led to the question of how the impact of governance criteria is changing in the supplier selection process. Therefore German DAX and MDAX companies are investigated using an exploratory multiple-case study approach. Adding to current sustainable supplier selection research, results show the increasing relevance of governance in the selection process and the underlying motivation for this development. Moreover, different sets of criteria for the different identified process steps are proposed.

**Keywords:** ESG, governance, sustainable supplier selection, sustainability

*Author:* Christoph Köster

*Status:* Working Paper<sup>2</sup>

---

<sup>2</sup>This essay was presented at the 2023 Hawaii Accounting Research Conference in Hawaii, USA

## 2.1 Introduction

The selection of suppliers is an essential part of supply chain management as it strongly determines the success of outsourcing activities, significantly impacts quality, and thus affects the customer's business performance in general (Kannan and Tan, 2002; Thiruchelvam and Tookey, 2011; Govindan et al., 2013; Thornton et al., 2013). Supplier selection has attracted practitioners and researchers for several years and traditionally focused on economic criteria such as cost, quality, and delivery performance (Weber et al., 1991; Lin, 2013; Ghouschi et al., 2018). Due to the increased sustainable awareness of companies and customers, it developed to the so-called sustainable supplier selection in recent decades by also including environmental and social criteria besides only economic criteria (e.g., Bhutta and Huq, 2002; Huang and Keskar, 2007; Govindan et al., 2013; Badri Ahmadi et al., 2017; Rashidi et al., 2020).

However, the full range of ESG criteria has not been included, as governance criteria have not been investigated with respect to supplier selection in the existing literature. On the one hand, this seems reasonable because the acronym ESG, and thus the specific mention of the term governance with regard to sustainability, has first been used starting at the beginning of the 2000s (Assent, 2022). Prior to this, sustainable supplier selection has often been oriented to the triple bottom line concept of Elkington (1998), in which economic, environmental, and social dimensions are considered (e.g., Badri Ahmadi et al., 2017; Song et al., 2017). On the other hand, this non-inclusion of governance criteria is, however, surprising. First of all, ESG is seen as a core indicator for risk management and management competence (Galbreath, 2013). Moreover, it has been shown in extant literature that corporate governance factors, such as women's percentage on boards or diversity, can have a positive impact on environmental and sustainable performance (e.g., Post et al., 2011; Naciti, 2019). As environmental and sustainable performance plays an important role in the supplier selection process (Winter and Lasch, 2016), and as certain governance criteria can improve these factors, it can be argued that governance criteria should be included in the supplier selection process as well.

In contrast to research, companies already go further and include governance criteria in the selection of suppliers through supplier codes of conduct (e.g., Bayer AG (2019), Siemens AG (2019)). However, so far, it has not been analyzed whether these criteria only serve as minimum criteria for suppliers to be generally qualified as potential suppliers or whether these governance criteria, together with economic, environmental, and social criteria, are used to evaluate and select suppliers. Therefore, the first goal of this paper is to analyze which governance criteria are relevant and how these criteria impact the selection process.

Another goal of this paper is to analyze how the role of governance criteria is expected to change, especially in light of the enactment of the German Supply Chain Act, which was passed in 2021. From 2023, companies based in Germany with more than 3,000 employees and from 2024 onwards also smaller companies with more than 1,000 employees will be required to audit their global supply chains and implement legal obligations. The aim is that companies fulfill their social responsibility and due diligence obligations in their supply chains and thus improve the international human rights situation and protect the environment (German Federal Ministry for Economic Corporation and Development, 2022, 2021). The due diligence obligations include establishing a risk management system and laying down preventive measures in its own business area, which in turn include developing and implementing appropriate procurement strategies and purchasing practices (German Bundestag, 2021). The aforementioned requirements particularly impact governance factors, as these factors are structures that ensure "that decisions are made to determine long-term, sustainable value for an organization" (Monks and Minow, 2004).

From a theoretical perspective, two theories seem reasonable to explain the relevance of governance criteria in the supplier selection process. The first is the resource-based view from Barney (1991). It is stated that gaining competitive advantage can be derived by differentiation from competitors through valuable and rare resources that can only be imitated imperfectly and that have no substitutes (Barney, 1991). Social sustainability can be such an intangible resource and can be fostered by selecting sustainable suppliers (Bai et al., 2019), resulting in e.g., an improved image, lower costs, and enhanced continu-



ity of the business (Bai et al., 2019). In this context, the integration of governance criteria into the supplier selection and its increasing use allow potential competitive advantages, given the positive impact of governance criteria on sustainability (Bai et al., 2019; Gharaei et al., 2019). The second relevant theory is the principal-agent theory, which was further developed by Jensen and Meckling (1976). It states that a conflict of interest may arise between the principal (buying firm) and the agent (supplier). To mitigate this risk, the agent needs to be incentivized, e.g., through synchronizing goals or implementing effective governance criteria (Jensen and Meckling, 1976; Eisenhardt, 1989a; Chang et al., 2015; McColgan, 2001; Ampenberger, 2010).

Given the emerging new requirements through the German Supply Chain Act, the importance of supplier selection in general, and the increasing relevance of ESG factors, this paper raises the following question: *How is the impact of governance criteria in the supplier selection process changing?* To be specific, distinct governance criteria will be identified, and the degree to which these criteria will impact the supplier selection process in the future will be analyzed using an explorative interview-based approach.

As the current theoretical background in supplier selection regarding governance criteria is limited, a multiple-case study approach based on Eisenhardt and Graebner (2007) is applied. This approach is suitable for several reasons: It can be applied for cases with limited theoretical understanding, as in the present case, and if "how" questions are to be answered (Eisenhardt, 1991; Eisenhardt and Graebner, 2007; Yin, 2018). Moreover, it ensures robust, accurate, generalizable, and reliable results, primarily through conducting within- and cross-case analyses (Eisenhardt, 1989b, 1991; Yin, 2018).

The analyzed cases were selected through the theoretical sampling approach of Glaser and Strauss (1967), whereby it is reasonable to limit the number of cases (Eisenhardt, 1989b). Specifically, 13 German DAX and MDAX companies from eight industries were selected. The focus on Germany has been chosen as Germany is the largest national economy in Europe, and the German Supply Chain Act imposes specific human rights and environmental obligations on the supply chain of certain German companies (German Federal Ministry for Economic Corporation and Development, 2021; European Commis-

sion, 2022b). The focus on DAX and MDAX companies ensures that their size and purchasing volume imply the presence of professional processes, structures, and rules within their purchasing and sustainability departments. This, in turn, ensures gaining relevant knowledge.

Several research contributions have been developed by analyzing the cases. Namely, (1) the process design and the relevance of governance criteria in the different process steps, (2) the motivation to use governance criteria also for the selection decision and not only for the qualification of suppliers, (3) the specific criteria in each process step, (4) criteria variation across application cases, and (5) current challenges.

By analyzing the process, it is revealed that the supplier selection process is a three-step approach. In the first step, the registration process, governance criteria already have high relevance and are regarded as must-have criteria for suppliers to be qualified. In the second step, the selection process, governance criteria are becoming increasingly relevant. In contrast to the first step, criteria in the second step are not regarded as must-have criteria. However, they are instead included in a scoring model together with criteria from other categories. In the third step, the review process assesses whether suppliers adhere to the specified criteria after an order has been awarded. Moreover, by analyzing the relevance of governance criteria, it can be shown that the integration of governance criteria in the selection decision is mainly driven by upcoming regulatory requirements in Germany. However, expectations from investors, customers, potential hires, and employees also serve as motivation.

In investigating the process, distinct criteria for each step have been identified. In the first process step, it can be shown that there is a set of relatively uniform and established criteria among all interviewed companies. In the second step, criteria that are expected to become relevant in the future are identified. For the latter, these criteria include *ESG ratings, diverse ownership and management, sustainable strategies* and *targets at the executive level* of the suppliers, as well as *transparency*. Lastly, variations of criteria and challenges are examined. The findings reveal that governance criteria are largely the same, regardless of sector or type of customers. However, the lack of standardization and

automation has so far prevented efficient integration into the selection process.

In summary, the primary contribution of this paper lies in expanding existing research on the selection of sustainable suppliers (e.g., Noci, 1997; Genovese et al., 2013; Govindan et al., 2013; Zimmer et al., 2016; Badri Ahmadi et al., 2017; Khan et al., 2018; Li et al., 2019; Jain and Singh, 2020). Going beyond prior work, this paper demonstrates that governance criteria were mainly used as minimum criteria for suppliers to be generally qualified as potential suppliers in the past. In the meantime, governance criteria are also partly integrated into the selection decision, given regulatory requirements as well as expectations from customers, investors, and applicants. Moreover, this paper identifies relevant criteria for each process step of the supplier selection process.

Besides adding to academic research, this work is also important for practitioners. Whereas buyers can use the derived results in their decision-making process and scoring models, suppliers can utilize this information to gain a competitive advantage in future supplier selection processes.

The paper is further divided into five sections: Section 2.2 gives the theoretical background incl. a review of literature on supplier selection, and section 2.3 introduces the applied research methodology. In section 2.4, the analysis of the supplier selection process and relevant governance criteria are presented. This is followed by the discussion and conclusion in section 2.5. Finally, limitations and future research opportunities are presented in section 2.6.

## **2.2 Theoretical background**

### **2.2.1 Supplier selection**

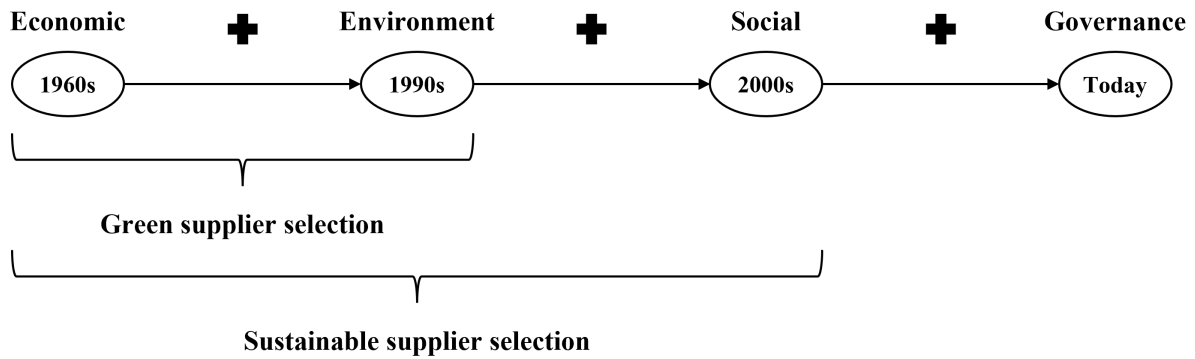
The literature on supplier selection originated in the 1960s when Dickson (1966) set the foundation for the supplier selection problem. The author sent out a questionnaire to almost 300 commercial American and Canadian organizations, primarily from the manufacturing sector, to identify criteria for supplier selection. Thereby, 23 economic criteria were identified to be relevant, among them quality, on-time delivery, and history of sup-

pliers' performance.

In the following years, numerous studies were published, of which Weber et al. (1991) reviewed 74 relevant articles published between 1966 and 1990. The results confirmed that the criteria largely remained unchanged compared to the study of Dickson (1966), with quality and delivery still being the most important criteria. However, the relevance of the remaining criteria changed, and the price was regarded as a further key criterion. In a subsequent study, Cheraghi et al. (2004) reviewed relevant articles published between 1990 and 2001 and found an additional 13 relevant criteria. They also concluded that the relative importance of criteria changed over time and especially that the relevance of price was decreasing compared to other criteria in the supplier selection process.

In the 1990s, increasing environmental awareness prompted companies to consider environmental criteria in supplier selection, a practice known as green supplier selection, as shown in Figure 2.1 (Noci, 1997). Genovese et al. (2013, p.2871) defines it "as a classical supplier selection problem in which, among the others, environmental criteria are also taken into account". Noci (1997) was the first to design a conceptual approach to identify a supplier's green performance by developing a rating system with the categories green competencies, current environmental efficiency, suppliers' green image, and net life cycle cost. The respective importance of the categories was then evaluated by applying the analytical hierarchy process based on a case study in the automotive industry. In the following years, many authors have contributed to green supplier selection literature by advancing mathematical decision models (e.g., Lee et al., 2009; Gupta et al., 2019, 2021) and/or empirically identifying new selection criteria and their practical importance (e.g., Chiou et al., 2008; Genovese et al., 2013). Moreover, numerous literature reviews have been published (e.g., Genovese et al., 2013; Igarashi et al., 2013; Nielsen et al., 2014; Govindan et al., 2015).

At the end of the last millennium, companies started to include social metrics in the evaluation of their behavior due to increasing awareness of social issues and pressure from various stakeholders (Elkington, 1998). This led to the emergence of the triple bottom line concept of Elkington (1998), covering the economic, environmental, and social dimen-



**Figure 2.1:** Evolution of supplier selection

sions. The concept motivated researchers to include social metrics in the supplier selection problem from the 2000s onward. Together with economic and environmental criteria, this is commonly known as sustainable supplier selection. The first research was done by Huang and Keskar (2007), who developed a set of comprehensive and configurable metrics with the categories reliability, responsiveness, flexibility, cost and financial, assets and infrastructure, safety, and environment. A total of 101 metrics were collected, providing management with the flexibility to configure them for supplier selection. Subsequently, many studies on sustainable supplier selection have been published that introduce advanced selection models (e.g., Govindan et al., 2013; Badri Ahmadi et al., 2017; Khan et al., 2018; Li et al., 2019; Jain and Singh, 2020) and/or empirically identify selection criteria and their importance from buying firms (Xu et al., 2013; Winter and Lasch, 2016). Respective literature was also reviewed by Zimmer et al. (2016), including 143 examined articles published between 1997 and 2014. Major findings included the rapidly increasing interest in this research field in recent years and the preponderance of the analytic hierarchy process, the analytic network process, and fuzzy-based approaches. They also stated the top ten most commonly applied economic, environmental, and social criteria in their sustainable supplier literature sample.

### 2.2.2 Governance

Companies already included governance criteria in the supplier selection process. However, they have not been found in academic research on supplier selection so far. One

explanation for the non-inclusion is the relatively late emergence of the acronym ESG starting in the 2000s and thus the late consideration of distinct governance criteria (Assent, 2022). Instead, supplier selection in existing literature has so far focused on economic, environmental, and social dimensions, according to the triple bottom line concept of Elkington (1998) intending to select suppliers with a good sustainable performance. Given this target, the inclusion of corporate governance factors in the sustainable supplier selection process seems reasonable, as governance factors can positively influence a firm's sustainability performance.

This positive impact has been proven by several studies. For example by Post et al. (2011), who found that companies with a board of directors with at least three females achieve better environmental performance. Furthermore, Zhang et al. (2013) demonstrated that a female presence on the board of directors positively impacts corporate social responsibility performance. Moreover, a study of de Villiers et al. (2011) showed that companies with specific board characteristics, such as higher board independence or larger boards, have a higher environmental performance. Given the results of the mentioned and additional further studies (e.g., Velte, 2016; Hussain et al., 2018; Naciti, 2019), it seems reasonable to argue that governance criteria should be included in the supplier selection process as it can lead to selecting more sustainable suppliers.

### **2.2.3 German Supply Chain Act**

Various drivers encourage or require companies to improve the sustainability performance of their supply chain and thus their suppliers. Thereby, these drivers can be of an external or internal nature (Saeed and Kersten, 2019). External drivers are those that originate from the market, society, or authorities. One of Germany's most current relevant external drivers is the German Supply Chain Act. It was passed in 2021 and will become effective in January 2023 for companies with more than 3,000 employees and in 2024 for companies with more than 1,000 employees (German Federal Ministry for Economic Corporation and Development, 2022). Under the act, companies are required to audit their global supply chains and implement legal obligations, with the goal of improving the international hu-

man rights situation and certain environmental aspects. Among others, the due diligence obligations include establishing a risk management system and laying down preventive measures in its own area of business (German Bundestag, 2021). The latter in turn, includes developing and implementing appropriate procurement strategies and purchasing practices. That means, among others, that human rights- and environmental-related expectations need to be considered when selecting a direct supplier and that a supplier contractually assures that it will comply with these expectations and address them along its supply chain (German Bundestag, 2021). Therefore, the act expands the scope of responsibility of a firm to its entire supply chain and includes all steps at home and abroad, from raw material extraction to delivery to the end-customer, covering direct and indirect suppliers (German Bundestag, 2021).

This new legislation highlights the relevance of identifying appropriate sustainability criteria for supplier selection and evaluation. Governance criteria might be of special interest, as governance is the structure that can ensure that decisions are taken to create sustainable long-term value (Monks and Minow, 2004). Selecting appropriate governance criteria has the potential to address not only the sustainable performance of direct suppliers, but also of indirect suppliers. This is due to the intrinsic motivation of suppliers to focus on the sustainable performance of their own supply chain through suitable governance mechanisms.

#### **2.2.4 Theories**

Regarding sustainable supplier selection from a theoretical lens, the resource-based view (RBV) and the principal-agent theory are both valuable theories to consider. The RBV, which was introduced by Barney (1991) states that companies can gain a competitive advantage through the possession or the use of "valuable, rare, inimitability, and non-substitutability" resources (Barney et al., 2001, p.625), the so-called VRIN resources. A differentiation is made between two main groups of resources: tangible resources (i.e., physical objects) and intangible resources (e.g., intellectual property rights, corporate reputation) (Heider, 2017). Sustainable suppliers can be seen as such intangible resources,

as these can help improve a company's image, lower its costs, and enhance the business's continuity of the business (Bai et al., 2019). The theory posits that VRIN resources can serve as differentiating factors from competitors, thereby contributing to a competitive advantage. Thus, it becomes clear that, when viewed through the lens of the RBV, governance criteria can play a crucial role in the selection of sustainable suppliers, as effective governance mechanisms can positively influence a firm's sustainability performance.

Besides the RBV, the principal-agent theory plays an important role. It is a theory further developed by Jensen and Meckling (1976) that deals with the relationship between principals and agents. A so-called principal-agent relationship occurs when a principal delegates a certain task to an agent, which the agent is to perform in the principal's interest. The relationship between a buying firm (principal) that outsources an activity to the supplier (agent) can be defined as such a principal-agent relationship (Whipple and Roh, 2010). The buying firm (principal) thereby grants the supplier (agent) a certain degree of decision-making power, resulting in the decoupling of ownership and control (Jensen and Meckling, 1976). Given the decoupling and under the assumption that both the principal and the agent want to maximize their individual personal benefit, a conflict of interest can arise between the principal and the agent (Jensen and Meckling, 1976). For example, a supplier might perform the delegated work not without any violations (e.g., child labor) to reduce their own production costs. In order to mitigate this risk, the supplier (agent) needs to be incentivized to support the interest of the buying firm (principal), e.g., through the application of effective corporate governance mechanisms or the harmonization of goals (Jensen and Meckling, 1976; Eisenhardt, 1989a; Chang et al., 2015; McColgan, 2001; Ampenberger, 2010). Thus, when viewed through the theoretical lens of principal-agent theory, the incorporation of governance criteria aligned with the buying firm's goals into the supplier selection decision can mitigate agency costs, thereby enhancing overall success with a supplier (Khan, 2011).

In summary, it has been shown that supplier selection has high relevance for researchers and practitioners. Whereas academic literature considers economic, environmental, and social criteria, companies also include governance criteria in the selection process. One



explanation for the difference is that research has based its analyses mainly on the triple bottom line concept of Elkington (1998), covering economic, environmental, and social dimensions. In contrast, ESG criteria, of which the acronym emerged in the 2000s, have become increasingly important in recent years, and thus, companies have already gone further and also included governance criteria in their supplier selection process. The inclusion of governance criteria, however, seems reasonable, as specific governance criteria have proven to improve a company's sustainability performance, can reduce agency costs, and thus improve the overall success with a supplier (e.g., Khan, 2011; Post et al., 2011; Zhang et al., 2013; de Villiers et al., 2011). However, so far, it has not been analyzed whether companies use governance criteria only as minimum qualification criteria or whether these governance criteria are applied in the selection decision. Going beyond the previous research, this paper proposes the following research question: *How is the impact of governance criteria in the supplier selection process changing?* Specifically, the degree to which these criteria are expected to impact the supplier selection process in the future will be analyzed, and distinct governance criteria will be identified using an interview-based approach.

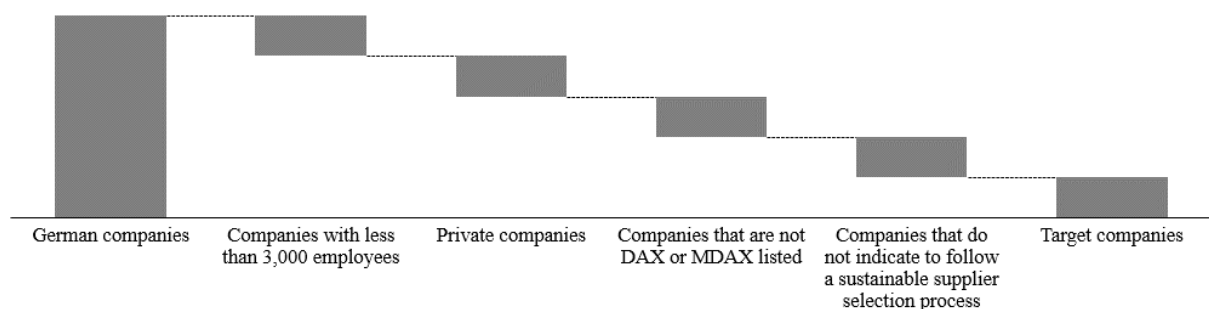
## 2.3 Research method

### 2.3.1 Research design and sampling

This research aims to analyze the change of impact of governance criteria in the supplier selection process. Therefore, this paper uses an exploratory multiple-case study approach as described by Eisenhardt (1989b). This approach is suitable for several reasons: First, it can be applied if "how" questions are to be answered (Yin, 2018). Moreover, it is especially suitable for cases with limited theoretical understanding, such as in the present case with governance criteria in the supplier selection problem (Eisenhardt, 1991; Eisenhardt and Graebner, 2007; Yin, 2018). Moreover, it ensures that results are robust, accurate, generalizable, and reliable, especially through conducting within- and cross-case analyses (Eisenhardt, 1989b, 1991; Yin, 2018).

This paper examines data from German DAX- and MDAX-listed companies, with each company representing one case. The focus on Germany has been chosen for two reasons. Firstly, Germany is the largest national economy in Europe (European Commission, 2022b). Secondly, the German Supply Chain Act covers German companies with more than 3,000 employees from 2023 onward. Therefore, they have special obligations in their supply chain regarding human rights and environmental concerns (German Federal Ministry for Economic Corporation and Development, 2021).

In order to select the most relevant cases, the theoretical sampling approach of Glaser and Strauss (1967) with four steps has been used, as shown in Figure 2.2. First, only companies with more than 3,000 employees were considered, as these are covered by the German Supply Chain Act from 2023 onward, as mentioned above. Next, only public companies were considered, as characteristics often differ between public and private companies (Kreipl, 2020). Thirdly, only DAX- and MDAX-listed companies have been chosen. The size and purchasing volume of these companies suggest the existence of professional processes, structures, and rules in the purchasing and sustainability departments and thus ensure the deduction of relevant learnings. Lastly, only companies that indicate following a sustainable supplier selection process are included. This suggests that sustainability regulations exist or are at least planned and that appropriate learnings can be derived.



**Figure 2.2:** Sampling process

In total, 13 German DAX- and MDAX-listed companies were included in the sample. To be specific, eight different industries, namely the chemical, consumer goods, health, industrial, IT, pharmaceutical, technological, as well as transportation and logistics sec-

tors, are covered. All companies stated on their websites that they had a supplier code of conduct integrated into their supplier selection process. The companies averaged a revenue of €~ 12bn with ~ 40k employees. The final sample selection is shown in Table 2.1. To ensure confidentiality, the names of the interview partners, as well as the company names, are kept anonymous.

**Table 2.1** Interview panel

Company			Interview			CoC
#	Sector	Index	Position	Type	Duration	
1	Chemistry	DAX	Vice president sustainability	Video call	35 min	✓
2	Chemistry	MDAX	Head of strategy for global procurement	Personal	60 min	✓
3	Chemistry	MDAX	Head of supplier and quality management	Video call	50 min	✓
4	Consumer goods	DAX	Head of global procurement	Video call	40 min	✓
5	Consumer goods	MDAX	Manager senior sustainability	Video call	50 min	✓
6	Consumer goods	MDAX	Sen. vice president global corporate responsibility	Video call	30 min	✓
7	Health	MDAX	Manager supplier quality and sustainability	Video call	45 min	✓
8	Industrials	MDAX	Head of sustainable procurement	Video call	35 min	✓
9	IT	MDAX	Head of sustainability	Video call	40 min	✓
10	Pharmaceutical	DAX	Head of sustainability and compliance	Video call	40 min	✓
11	Technology	DAX	Director sustainability	Video call	50 min	✓
12	Technology	DAX	Head of procurement strategy	Video call	50 min	✓
13	Transportation and logistics	MDAX	Manager procurement governance	Video call	35 min	✓

Legend: CoC = Supplier code of conduct

### 2.3.2 Data collection

The selection of the interviewees was based on thorough research. Potential candidates were contacted either via a publicly available e-mail address or LinkedIn. Thereby, the research was outlined and stated why the respective company fits the research question. By selecting potential interviewees, the focus was placed on experts indicating knowledge of the supplier selection process and sustainability on their LinkedIn profile or the company website. Care was taken to identify experts who reflect the view of a customer rather than a supplier. This is because customers specify the selection process, and suppliers must adapt. Therefore, customers significantly influence the development of the future.

The interviews were designed as semi-structured in-depth interviews, as they allow for the collection of information in a structured way while simultaneously leaving enough

room to gather new and unexpected information (Yin, 2018). For the interviews, an interview guide was created and pre-tested using a convenience sample. By doing so, attention was paid to selecting individuals without expert knowledge of supplier selection to ensure that the interview guide was understandable and easy to follow, even for non-experts. The interview guide included six sections: (1) the interviewees' background, (2) the supplier selection process, (3) expected changes in the process, (4) governance criteria, (5) case-specific application, and (6) current challenges. Additionally, archival data, specifically supplier codes of conduct (CoC), have been included in the interviews.

In total, 13 interviews with top management, as well as purchasing and sustainability managers from German companies, were conducted between April and June 2022. Overall, the interviews lasted more than 560 minutes, and more than 140 pages of transcripts were created. All interviews were held in German via video conference, except for one interview, which was held in person. The interviews lasted between 30 and 60 minutes.

Several actions were taken to ensure data validity and obtain an unbiased view. Firstly, companies were selected across industries. Secondly, interview partners of different functions and hierarchical levels were included. In order to gain the trust of the interview partners and address potential key informant bias, precautionary and corrective actions were undertaken, as proposed by Eisenhardt and Graebner (2007), Miles and Huberman (1994), and Miller et al. (1997): First of all, full anonymity and confidentiality were granted. Secondly, each interviewee was given a detailed project overview, the study objective, and an overview of the data collection process at the beginning of the interview. Thirdly, the interviewees were told they did not have to answer questions and could skip them if they felt uncomfortable answering. Moreover, all interviewees received the same questions to ensure consistency. Finally, additional archival data, especially the supplier code of conduct, was integrated into the interviews as well as in the evaluation and analysis of the interview. This use of multiple sources then allowed for triangulation, ensured the development of a profound understanding, and reinforced the derived results.

### 2.3.3 Data analysis

The data analyses followed the proposal of Eisenhardt and Graebner (2007). Word-by-word transcribed interviews and archival data were used to conduct within and across-case analyses, discover patterns and relationships, and thus develop theory inductively (Eisenhardt and Graebner, 2007). First of all, a within-case analysis was conducted. Individual results per case were received, and key results were summarized. Subsequently, a cross-case analysis was conducted. In the next section, only the results of the cross-case analysis are described, as they do not differ significantly from the within-case analysis.

For the within- and cross-case analysis, the transcribed interviews were systematically coded using MAXQDA. Thereby, codes emerged without a predefined coding scheme based on the grounded theory by Bryant and Charmaz (2007). Generally, the coding was conducted according to the process of Gioia et al. (2013). Following this process, first-order concepts were developed in the first step. Subsequently, these first-order themes were then synthesized into second-order themes. These, in turn, were used to develop a theoretical construct, which is explained in section 2.4.

## 2.4 Results

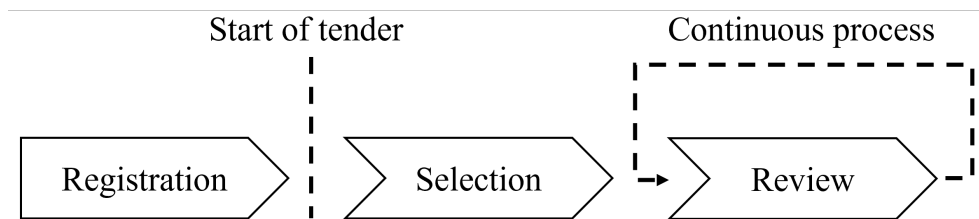
The analysis of the change of impact of governance criteria on the supplier selection process is divided into five subsections. First, the supplier selection process itself and the change of relevance of criteria within each sub-process are analyzed. Subsequently, the motivation to change the role of governance criteria in the supplier selection process is outlined. The analysis of the process then serves as a basic framework for identifying distinct criteria for each process step. The fourth step then examines the extent to which criteria differ across application cases. Finally, current challenges are discussed.

In analyzing the results, conclusions were drawn through the theoretical lens of the resource-based view from Barney (1991) and of the principal-agent theory from Jensen and Meckling (1976). The RBV helps to argue that selecting sustainable suppliers can build a competitive advantage in case the resource can be seen as "valuable, rare, inimitability,

and non-substitutability” (Barney et al., 2001, p. 265). As a prerequisite, the resource needs to be a differentiating factor from competitors. Sustainable suppliers can be seen as such a differentiating factor, and the selection can be fostered through integrating governance criteria in the selection process (Bai et al., 2019; Gharaei et al., 2019). The second valuable perspective is the principal-agent theory. Thereby, it can be argued that implementing effective governance criteria can mitigate risks of conflicts of interest between the principal (buying firm) and the agent (supplier) and can help to synchronize goals, such as sustainability along the entire value chain (Jensen and Meckling, 1976; Eisenhardt, 1989a; Chang et al., 2015; McColgan, 2001; Ampenberger, 2010).

### 2.4.1 Process

The analysis of the conducted case studies reveals that the supplier selection process is typically divided into three steps, namely registration, selection, and review, as shown in Figure 2.3:



**Figure 2.3:** Supplier selection process

In principle, economic, environmental, social, and governance criteria can be relevant in all three process steps. Due to the focus of this paper, only governance criteria will be discussed in the following.

#### Registration process

The registration (or qualification) process is used to include new potential suppliers to the supplier base without an underlying order. This event is usually triggered by the specialty department in case they see a need for additional supplier capacity. For suppliers to be accepted, must-have criteria, mainly documented in the supplier code of conduct, must

be accepted. These criteria are regarded as the basis for cooperation, as described by the expert from company three:

"Registration is really about whether a supplier is fundamentally suitable. In other words, whether we do business with this supplier at all."

A detailed review of the criteria does often not take place. Instead, the potential supplier must confirm adherence to them. Otherwise, a supplier will not be included in the supplier base, and no business relationship is established. Alternatively, to the acceptance of the supplier code of conduct, the supplier can submit their own code of conduct, which needs to be consistent with the supplier code of conduct of the customer. In general, supplier registration is an established process with limited expected changes in the future.

### **Selection process**

After a supplier has been registered, he can participate in tenders, and orders can be mandated to the supplier. In contrast to the registration process, criteria are not purely must-have criteria but are included in a scoring model for the assigning decision. Thereby, different criteria from different categories are weighted, and the suppliers are ranked according to their scores. Therefore, for example, it is possible that a supplier, despite having a higher price, may be mandated with an order due to its superior sustainability performance compared to its competitors. Typically, economic, environmental, and social criteria are included in the selection process. However, 8 of 13 analyzed companies are currently starting to systematically apply governance criteria in the selection process. Yet, mainly only with one criterion. Five further companies currently do not apply governance criteria in the selection process at all, yet plan to include them soon, as explained by the expert from company three:

"In the future, certain governance criteria will also be included in the individual awarding decision. When awarding a contract, the fulfillment of the individual criteria will then be taken into account."

## Review process

The third and last process step reviews the adherence to the criteria after an order has been assigned to a supplier. Currently, four companies apply a continuous review process, six review compliance with the criteria every one to three years, and one company has not yet established a standardized process. However, the latter is planning to implement a standardized review process. Generally, the process is evolving towards a regular review, given the progressive automation and standardization, as described by the expert from company five:

"It is not enough if we only check the criteria at the beginning of the supplier selection process. It must be consistently applied throughout the entire supplier lifecycle, i.e., compliance with the criteria must be checked regularly."

The consequences in the event of non-compliance are equal for all companies. After an exchange with the supplier, countermeasures are developed. Contractual relationships are only terminated as a final consequence.

### 2.4.2 Motivation

Prior research has shown that supplier selection has integrated sustainable criteria, i.e., environmental and social criteria, into the supplier selection within the past decades (Zimmer et al., 2016). Beyond that, the results of the analyzed cases show that companies have additionally included governance criteria, yet, only in the registration process so far. However, companies have also started to include them in the selection process, complementing the full range of ESG criteria. The reasons for this are manifold. One major reason for the integration into the selection process is justified by the introduction of the German Supply Chain Act, which will become effective beginning of 2023 (German Federal Ministry for Economic Corporation and Development, 2022, 2021), as explained by the expert from company five:

"We have to manage to create awareness for sustainability in the supply chain among our suppliers as well to ensure compliance with the German Supply



Chain Act. One building block for implementing this in the future is the preferred selection of suppliers who themselves pursue a sustainable strategy."

Additionally, the necessity to adapt the supplier selection process, given the requirements of the German Supply Chain Act, leads to companies enhancing their selection process entirely, as explained by the expert of company seven:

"Even though the legal requirements of the German Supply Chain Act mainly address human rights, we said to ourselves, while we are at it and trying to fulfill the legal requirements, we want to take the chance and look at all sustainability as a whole, including governance."

In addition to the effects resulting from the German Supply Chain Act, pressure from various stakeholders exists. Firstly, customers increasingly expect a high sustainability performance from their suppliers. This also includes the suppliers of the suppliers, resulting in an increasing demand for sustainable suppliers, as explained by the expert from company eight:

"We have pressure from our customer side, which is formulated very clearly and unambiguously. More and more customers want to cooperate with suppliers with a high ESG score. So we have to meet the sustainability criteria of our customers by focusing on all three sustainability dimensions. And that also includes our own suppliers. Otherwise, we will be removed as a supplier."

Besides, also investors increasingly demand the inclusion of sustainability aspects in supplier selection. In this context, the capital market pays particular attention to the issue of governance criteria, as the expert of company nine reports:

"The G is actually often observed in discussions with the capital market. Investors actually talk about ESG as a whole, whereas some other stakeholders often only talk about sustainability. In other words, we see that the capital market very much demands governance criteria."

Additionally to customers and investors, there is another important group whose interests need to be taken into account, namely applicants. The younger generation, in particular, is increasingly placing value on sustainability, as the expert from company four describes:

"I mean, we're talking about the war for talent. We have to recruit and attract new employees. You can't just talk about sustainability and then do business with suppliers known for sustainable nonsense. That's why we want to focus on ESG as a whole when selecting suppliers. And clearly, that also includes governance."

In summary, there are various sources of motivation for the inclusion of governance criteria in the supplier selection process, although they may not be clearly separable. However, it could be reasonably argued that the German Supply Chain Act compels companies to recognize an immediate need to adapt the supplier selection process.

### 2.4.3 Criteria

It has been shown that criteria are applied either as must-have criteria or are included in a scoring model, depending on the respective process step. In addition to the different applications of the criteria, also criteria themselves differ between the process steps.

#### Criteria in the registration process

In the registration process, a supplier has to accept the must-have criteria, which are mainly listed in the supplier code of conduct. The usage of a supplier code of conduct is regarded as a standard procedure in supplier selection and is applied by all examined companies. Table 2.2 gives an overview of the criteria applied in the registration process by the examined cases. The criteria are also described in the following using the analyzed codes of conduct and the experts' descriptions.

A large part of the criteria is consistent among most companies. However, only the criteria *compliance with (trade and tax) laws* and *business integrity* are used by all companies. The first can be described as compliance with all applicable laws and regulations, customs

**Table 2.2** Criteria registration process

Criterion	Company #													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Compliance with (trade and tax) laws	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	13
Business integrity	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	13
Data protection	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	12
No conflict of interests	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	12
Free competition		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	11
Protection of intellectual property	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		11
IT security			✓	✓	✓	✓			✓	✓	✓	✓		8
Management systems			✓	✓	✓		✓			✓	✓	✓		7
Combating economic crime		✓		✓	✓	✓		✓		✓				6
Business continuity							✓			✓	✓			3
Business relationship transparency		✓								✓				2

import and export laws, as well as tax regulations. This also includes non-participation in artificial practices solely established for tax-evasion purposes. *Business integrity* is the prohibition of any forms of extortion, misappropriation, bribery, and corruption. Latter two refer to any unlawful promises or offers of (financial) benefits to representatives of another party (e.g., government, international organization, private company) with the aim to change their decision-making in the interest of the giver.

Furthermore, the criteria *data protection* and *no conflict of interests* are used by almost all companies, except for one company. The first refers to compliance with laws and regulations when gathering, storing, processing, and disclosing (personal) information. The second is the prevention of a situation where personal interests are incompatible with the responsibilities of a position in the company, i.e., a circumstance that could impair one's ability to act with absolute objectivity with respect to the supply of products and provision of services.

*Free competition* and *protection of intellectual property* are also widely used, except by two companies each. *Free competition* refers to the commitment to fair and non-disruptive competition as well as compliance with all applicable antitrust laws. This also includes no conclusion of any anti-competitive agreements or no implementation of anti-competitive

practices with competitors, suppliers, dealers, distributors, and customers. *Protection of intellectual property* describes compliance with applicable intellectual property and trade secret laws as well as respect for intellectual property, including trademarks, patents, designs, copyrights, know-how, and trade secrets.

Surprisingly, *IT security* is less popular. It can be explained as the proper management and protection of information systems containing confidential or personal information against unauthorized access and usage (incl. e.g., disclosure and modification) of the data. Only eight companies include this criterion in the registration process. Also, *management systems* is only included by seven companies. It describes the implementation of a system to ensure compliance with relevant laws, regulations, and the supplier code of conduct. Moreover, the systems should identify and mitigate related operational risks and foster continuous improvement. Six companies also include the *combating of economic crime*, including money laundry and insider trade in the registration process.

Less use is made of criteria *business continuity* planning. Currently, only three companies require establishing a robust and resilient supply chain and processes to ensure an uninterrupted supply of products and services from their suppliers. Least common criteria is *transparency* as criteria for supplier registration. Only two companies require adherence to transparent business relationships that are accurately reflected in the books and records for the registration process. This also includes disclosure of information on e.g., financial situation, business activities, performance, and structure. However, especially in light of crises and wars *business relationship transparency* and *business continuity* planning are expected to gain relevance in the future, as described by the expert from company seven:

"The recent past and present events are also a wake-up call that we need to look in detail at the suppliers or regions where we source. And that we need to define more specific criteria for the entire company regarding transparency and business continuity planning."

## Criteria in the selection process

Governance criteria are expected to become more relevant in the selection process of suppliers in the future, as confirmed by the expert from company four:

"I think these will be topics that will actually rank rather high in the future.

Why do I say that? Because these are exactly the topics that everyone is looking at right now, and our customers are asking for to an increasing extent."

However, since governance criteria are already largely applied in the registration process, it is expected that only a few criteria will be relevant in the future compared to other criteria (e.g., environment or social) in the selection process. Nevertheless, the interviewed experts expect some criteria to become relevant in the selection process in the future, as illustrated in Table 2.3.

**Table 2.3** Criteria selection process

Criterion	Company #													Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	
ESG rating	✓	✓	✓	✓	✓			✓		✓			✓	8
Diverse ownership and management				✓	✓		✓			✓	✓	✓	✓	7
Sustainability strategy					✓	✓	✓			✓				4
Sustainability targets at executive level							✓			✓		✓	✓	4
Supply chain transparency							✓			✓		✓	✓	4
Board independence and structure														0

The most frequent criterion is *ESG Rating*. Eight companies have already included or are planning to include the suppliers' ESG score of independent external rating agencies (e.g., Ecovadis) in the evaluation. The better the ESG score, the better a supplier performs in the supplier selection process. Although ESG ratings do not exclusively include governance criteria, but rather all ESG criteria, it is regarded as a governance criterion by the analyzed cases.

The second most frequently mentioned criterion is *diverse ownership and management*. Seven of the companies surveyed stated that they want to strive for a more diverse supplier base in the future. This includes, in particular, companies that are managed or owned by women or minorities, such as disabled people or from the LGBTQ<sup>3</sup> community, as well as social suppliers, i.e., partly working without payment and non-profit organizations.

The criteria *sustainable strategy*, as well as *sustainable targets at executive level*, are only mentioned by four companies each. Yet, both are expected to gain relevance in the future. These companies indicated that they would not only pay attention to the current sustainability performance of their suppliers but also include targets and strategies in their evaluation to ensure the long-term sustainability performance of their suppliers in the future. Lastly, as stated by four companies, *Supply chain transparency*, which refers to the transparency of the supplier's supply chain, is also expected to influence the selection process.

Regarding *board independence and structure*, none of the interviewed companies expect this criterion to influence supplier selection in the future. On the one hand, this is surprising, as a positive effect of board independence and structure on sustainability has been shown in the literature. On the other hand, companies argue that their supplier base is too heterogeneous in terms of size, so this factor cannot be used reasonably.

#### 2.4.4 Variation of criteria

Besides identifying the relevant criteria, it was also analyzed whether criteria differ depending on the case of application, between suppliers and service providers or sectors. This is of particular interest, as it has been shown in the literature that criteria might differ, e.g., among industries or countries (Nielsen et al., 2014; Zimmer et al., 2016). However, all experts stated that the governance criteria are the same for all their customers, as explained by the expert from company four:

"Especially all the governance criteria like anti-corruption and IT security are very important standard criteria. Therefore, we do not distinguish between

---

<sup>3</sup>Lesbian, gay, bisexual, queer and transgender

our suppliers; all must fulfill the same criteria at the same level."

Although criteria are equal among customers, the depth of criteria assessment can vary. The companies classify regions into risk clusters. Suppliers located in a high-risk country have to undergo a more detailed criteria assessment than a company from a lower-risk country.

Besides the depth of analysis, the weights of the criteria can also differ, especially in the case of varying product groups. Thereby, weights remain unchanged among the governance criteria themselves. However, the relevance of governance criteria as a whole compared to other criteria as, e.g., environmental and social criteria, changes, as explained by the expert from company ten:

"The basic criteria set is the same for everyone. However, the weights for the criteria change depending on the regarded division and product group. This is due to the fact that the products have different requirements, and for some, it might, for example, be more important to focus on low carbon emissions than governance criteria."

Diverging weights appear, however, only in the selection process, as criteria in the registration process are regarded as must-have criteria and are therefore not included in the scoring model and thus not weighted against other criteria.

### **2.4.5 Challenges**

Whereas the registration process and the respective criteria are already well established in the supplier selection process, governance criteria have been underrepresented and have just started to be integrated into the selection process. This can be traced back to several reasons. First of all, the COVID pandemic and the Ukrainian war have led to a shortage of several products, such as microchips or corn. Hence, supplier options are constrained, prioritizing the ability to secure any available source, while sustainability criteria, including governance criteria, are relegated to a lower priority. Moreover, the lack of standardization and availability of data prevents efficient integration into the supplier selection process, as stated by the expert from company twelve:

"If there was the intelligence to immediately receive all relevant information for all criteria or even directly the scores at the push of a button and to tell the system directly to consider these criteria for the selection, then governance criteria will also become properly relevant in the selection process. Today, however, many processes are still manual, and in some cases, it might even be necessary to manually go through annual reports. That is why I think the time component is related to technology and data availability."

Accordingly, the data collection effort must be minimized in order to ensure that governance criteria are included in supplier selection in the long term. For this purpose, it is necessary to develop cross-industry standards to enable uniform measurement and to automate this measurement.

## 2.5 Discussion and conclusion

Supplier selection is of major importance for any company and has therefore received considerable attention from researchers and practitioners (Govindan et al., 2013; Wetzstein et al., 2016; Rashidi et al., 2020). Over the years, supplier selection has developed from a purely economic view to including environmental and social criteria, the so-called sustainable supplier selection (Wetzstein et al., 2016). However, to the author's knowledge, none of the existing literature has so far included governance criteria, although some companies already include them in their selection process. Given the increasing importance of ESG criteria, the forthcoming entry into force of the German Supply Chain Act, and the positive influence of certain governance factors on sustainability, this research examines the change of impact of governance criteria in the supplier selection process. The resulting findings therefore add to the research of sustainable supplier selection (e.g., Dickson, 1966; Noci, 1997; Weber et al., 1991; Cheraghi et al., 2004; Huang and Keskar, 2007; Govindan et al., 2013; Genovese et al., 2013; Nielsen et al., 2014; Govindan et al., 2015; Zimmer et al., 2016; Badri Ahmadi et al., 2017; Khan et al., 2018; Liu et al., 2019; Jain and Singh, 2020; Gupta et al., 2021).



Beyond to existing research, the supplier selection process is analyzed with respect to governance criteria. By interviewing 13 experts from German DAX and MDAX companies and analyzing the respective supplier codes of conduct, the changing relevance of governance criteria in the three phases, namely registration, selection, and review, are elaborated. Furthermore, additional governance criteria that were not investigated previously are identified.

The registration process is a well-established process used to add suppliers to the supplier base. It has been shown that the criteria *compliance with (trade and tax) laws, business integrity, data protection, no conflict of interests, free competition, protection of intellectual property, IT security, management systems, combating economic crime, business continuity, and business relationship transparency* are applied in this process step. These criteria are largely homogeneous among the interviewed companies and are regarded as must-have criteria. Whereas it is expected that a large part of the criteria in this process step will remain unchanged, business continuity and business relationship transparency planning are expected to gain relevance, especially due to recent events (i.e., the COVID crises and the Ukrainian war).

Regarding the selection process, the research reveals that the inclusion of governance criteria in the selection process has not been extensively exercised so far. However, it is expected that the criteria *ESG ratings, diverse ownership and management, sustainably strategy and targets at executive level* at the suppliers, as well as *supply chain transparency*, are expected to become relevant in the future. In contrast to the criteria in the registration process, the criteria in the selection process are not regarded as must-have criteria. However, they are planned to be included in a scoring model with criteria from other categories, especially economic, environmental, and social. The scoring model then allows to rank potential suppliers according to the criteria and choose the best-performing one.

However, governance criteria have so far been used relatively rarely in the selection process. This can be explained by the missing uniform standards and definitions as well as a lack of data availability. Given the increasing attention companies pay to sustain-

ability, including governance criteria in the supplier selection process, these hurdles can be expected to be overcome in the future. Consequently, governance criteria will also be added to the standard criteria set in the supplier selection process.

In the last process step, adherence to the criteria is reviewed. As criteria are only reviewed, no further criteria are applied in this step. Consequences of non-adherence can range from simple warnings to immediate termination of contractual relationships.

Moreover, this paper reveals that governance criteria are similar for all application cases and industries. Only criteria weights might differ. This is contrary compared to existing literature (e.g., Nielsen et al., 2014; Zimmer et al., 2016), which reports differences in criteria along industries. However, it seems reasonable, as prior research did not consider governance criteria. Additionally, governance criteria, compared to e.g., environmental criteria, are non-industry specific.

Besides contributing to sustainable supplier selection research, this paper also adds to the corporate governance literature stream. The findings show that corporate governance criteria do not only have a high company internal relevance for the own sustainability performance but are also important for selecting sustainable suppliers. One example is the female management share, which has already been analyzed in the corporate governance literature (Ben-Amar et al., 2017; Post et al., 2011; Zhang et al., 2013; Velte, 2016). Another example is *diverse management* that has also been proven relevant in selecting sustainable suppliers. In contrast, the criteria *board independence and structure* seems irrelevant on the supplier side when selecting sustainable suppliers. This is somehow surprising, as research has shown that this criterion positively impacts a firm's sustainability (de Villiers et al., 2011; Hussain et al., 2018; Naciti, 2019). Sustainability, in turn, has high relevance in the supplier selection process (Badri Ahmadi et al., 2017). Conversely, companies contend that the diversity within their supplier base renders the reasonable application of this criterion challenging.

This work contributes to researchers and practitioners equally. Regarding academia, the identified criteria can be used to complement the criteria set for future research in the extensive research field of sustainable supplier selection and, therefore, obtain a holistic

view including all ESG criteria together with economic criteria. Besides, this work is also important for practitioners, especially for sustainability or purchasing experts from the buying company, as well as for suppliers. The derived criteria can serve as relevant learning or even industry best practices. Whereas buyers can integrate the criteria in their decision-making process and scoring models, suppliers can utilize this information to gain a competitive advantage in future supplier selection processes.

## 2.6 Limitations and future research

This paper aims to provide an overview of the relevance of governance criteria in the supplier selection process at German DAX and MDAX companies. Nonetheless, this research is not without limitations, which can also pave the way for future research.

Firstly, the identified criteria' definitions might differ across the interviewed experts. To mitigate this limitation, meanings and definitions of the criteria have been explicitly clarified during the interviews.

Secondly, the selection of companies is not exhaustive. Rather, it is limited to a sample of 13 DAX and MDAX companies. Thereby, only companies that indicated following a sustainable supplier selection process were chosen. Moreover, the study shows geographical, cultural, and temporal scope limitations. This is because only German companies were surveyed between April and June 2022. Therefore, interesting research opportunities exist in the future by extending the analysis to other countries and a broader scope of companies, especially smaller ones. The resulting findings can then be compared with the present ones, although deviating results are unexpected.

Thirdly, the view of customers rather than suppliers has been chosen, as customers specify the selection process, and suppliers have to adapt to this. In future research, suppliers' perspectives can be analyzed to compare their views with the ones of the customers.

Besides the variation of the cases, further research opportunities exist. Firstly, the determination of the weights of the governance criteria poses an exciting research question. On the one hand, the weights of governance criteria can be determined in relation to each

other. On the other hand, the combined weight of all governance criteria can be compared to that of economic, environmental, and social criteria collectively. Furthermore, there is interest in the manner by which information pertaining to governance criteria can be disclosed and rendered transparent.

### 3 | Essay II - Does sustainability matter? The relevance of ESG in sustainable supplier selection

**Abstract:** Supplier selection is one of the key issues in supply chain management with a growing emphasis on sustainability driven by increasing stakeholder expectations and proactivity. In addition, new regulations, such as the German Supply Chain Act, fostered the inclusion of sustainable incl. governance selection criteria in the selection process. In order to provide a systematic approach for selecting the most suitable sustainable suppliers, this study quantifies the importance of and prioritizes the relevant selection criteria across 17 German industries using the fuzzy analytical hierarchy process. Results show that economic criteria are still the most important in the selection decision, averaging a global weight of 51%. However, environmental, social, and governance (ESG) criteria are combined, on average, almost equally important, with global weights of 22%, 16%, and 11%, respectively. While the type of industry influences criteria weights, other factors, such as type of purchasing or demographic factors, appear to have little impact.

**Keywords:** ESG, Fuzzy Analytical Hierarchy Process, Sustainable Supplier Selection, Sustainability

*Author:* Christoph Köster

*Status:* Working Paper<sup>4</sup>

---

<sup>4</sup>This essay was presented in 2023 at the 40th USAEE/IAEE North American Conference in Chicago, USA

### 3.1 Introduction

Sustainability is considered one of the greatest current challenges and is, therefore, on the agenda of most companies and departments. For good reason, 90 percent of all German DAX companies include at least one of the ESG components in their top management's remuneration, proactively promote sustainable initiatives, and attach importance to selecting sustainable suppliers (Sarkis, 2006; Zimmer et al., 2016; Deutsche Schutzvereinigung für Wertpapierbesitz e.V., 2022).

German legislators have also recognized the urgency and passed the German Supply Chain Act, which came into force at the beginning of 2023 and aims to hold companies responsible for improving human rights and certain environmental concerns along their entire supply chain, thus also including indirect suppliers (German Federal Ministry for Economic Corporation and Development, 2022, 2021). The new legislation significantly impacts the selection of suppliers, leading to companies revising their supplier selection procedures, especially focusing on the suppliers' governance mechanisms as selection criteria (Köster, 2023). Considering the principal-agent theory, this appears plausible, since governance mechanisms can synchronize the goals of an agent (suppliers in this case), with the goals of a principal (buying firm in this case), and thus increase control over the agent (Jensen and Meckling, 1976; McColgan, 2001; Chang et al., 2015).

Although supplier selection has already been widely studied in the literature, there still seem to be unanswered questions. Previous research has focused on economic, environmental, and social criteria, for which criteria weights were identified in several research projects (e.g., Genovese et al., 2013; Igarashi et al., 2013; Zimmer et al., 2016). In contrast, governance criteria have so far only been analyzed qualitatively. Despite the increased relevance of the governance criteria through the German Supply Chain Act, as mentioned above, the weights for governance criteria have not yet been taken into account in studies so far. Moreover, to the author's best knowledge, no research has considered the effects of the German Supply Chain Act with respect to supplier selection.

The new requirements emerging from the German Supply Chain Act for the supply

chain and, therewith, for supplier selection clearly show that a current set of quantified decision criteria, including governance criteria, is still missing in the academic literature. Thus, this paper raises the following research question: *How important are the key selection criteria for sustainable supplier selection?*

To be specific, relevant criteria were identified by reviewing the literature on sustainable supplier selection. Subsequently, experts were surveyed to empirically evaluate the identified criteria. The survey results were then used to calculate ranks and weights for the criteria and respective sub-criteria using the FAHP, a combination of the AHP with fuzzy sets. The application of FAHP seems reasonable, given its superior performance compared to other methods and its widespread use in academic literature for the supplier selection process (Chai et al., 2013; Genovese et al., 2013; Govindan et al., 2015; Zimmer et al., 2016; Alkahtani et al., 2019).

Participants were selected according to the theoretical sampling approach of Glaser and Strauss (1967) in two steps, focusing on experts working for German companies with specific knowledge in procurement, purchasing, or sustainability across industries. The focus on Germany is driven by the applicability of the German Supply Chain Act, and Germany being the largest national economy in the European Union, with limited existing studies addressing the European or German market (Zimmer et al., 2016; European Commission, 2022a). The resulting sample consists of 230 experts from 17 industries.

The relevance of an up-to-date set of quantified decision criteria, and thus the relevance of the research question, can also be explained by considering the theoretical approach of the RBV. It states that companies can gain a competitive advantage if they have valuable, rare, imperfectly imitable, and non-substitutable (VRIN) resources (Barney, 1991; Teece et al., 1997; Barney et al., 2001). Sustainability can be considered as such an intangible resource that can be fostered through the selection of sustainable suppliers, which in turn requires the availability of an up-to-date set of quantified decision criteria (Bai et al., 2019). The importance can also be elucidated by the fact that selecting the wrong supplier is one of the main reasons for outsourcing activities to fail (Juras, 2007).

This paper contributes to the literature through an up-to-date ranked and weighted

criteria set for the sustainable supplier selection process for the German market. Thereby it extends existing research on sustainable supplier selection (e.g., Noci, 1997; Genovese et al., 2013; Govindan et al., 2013; Zimmer et al., 2016; Khan et al., 2018; Li et al., 2019). Going beyond prior work, this paper presents novel results as it is the first to include governance criteria for the selection decision. Further, it extends current research by analyzing the industry-specific importance of criteria and the influence of different factors such as type of purchasing (i.e., direct vs. indirect purchasing), demographic factors, and experience of the experts.

On average, the results show that economic criteria are still the most important, with a global weight of 51%. However, they are equally important as all ESG criteria together, with global weights of 22%, 16%, and 11% for environmental, social, and governance criteria, respectively. However, analyzing the various industries shows that the relative importance of economic criteria ranges from a low of 31% up to 61%. When analyzing the other factors mentioned (e.g., type of purchasing or demographic factors), no major impact on criteria weights was identified.

In addition to new complementary insights for research, this work is also valuable for practitioners. The results can be beneficial when designing a supplier selection process to evaluate and rank suppliers in terms of a sustainable supply chain and thus ensure the selection of the best potential supplier and compliance with legal requirements.

The paper is further divided into five sections: The following section presents the theoretical background, including supplier selection literature for criteria formulation as well as method selection and development. Section 3.3 introduces the criteria identification methodology, the fuzzy analytical hierarchy process as the applied method, the data collection and sampling process, the data sample, and the analysis. In section 3.4, ranks and weights for economic, environmental, social, and governance criteria, as well as their respective sub-criteria, are presented. The sections are followed by the discussion and conclusion in section 3.5. The last section 3.6 presents limitations and research opportunities.

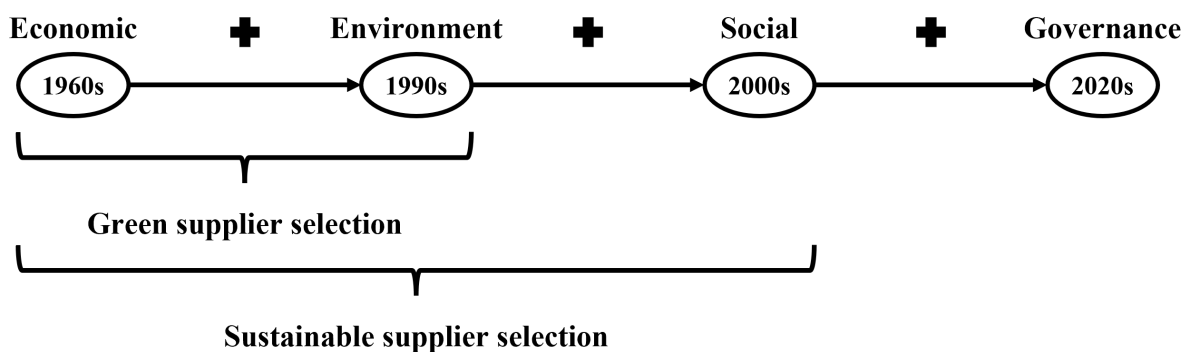


## 3.2 Theoretical background

Supplier selection is a multi-criteria decision making (MCDM) problem, which aims to find the best supplier from a group of potential suppliers by evaluating a set of selection criteria (Haeri and Rezaei, 2019). This process includes three steps. Firstly, the relevant criteria need to be identified. Subsequently, the criteria ranks and weights are calculated. Finally, the best-performing supplier is selected (Che and Chang, 2016). This paper focuses on steps one and two, described in detail in this chapter.

### 3.2.1 Criteria formulation

The first literature record on supplier selection dates back to the 1960s, when Dickson (1966) introduced the problem to the academic world and empirically identified 23 economic criteria (e.g., quality, on-time delivery, and history of suppliers' performance) relevant to select suppliers. In the following years, the problem has been extensively analyzed and multiple literature reviews have been published (e.g., Weber et al., 1991; Cheraghi et al., 2004). However, not only economic criteria were examined, but also other criteria, particularly environmental, social, and governance criteria, gradually found their way into the supplier selection problem, as shown in Figure 3.1 (Zimmer et al., 2016; Köster, 2023).



**Figure 3.1:** Evolution of supplier selection (based on Köster (2023))

The first research on green supplier selection was published by Noci (1997), who developed a conceptual approach to assessing a supplier's environmental performance and proposed a set of environmental criteria, such as green competencies, current environ-

mental efficiency, suppliers' green image, and net life cycle cost. In the 2000s, supplier selection research developed by additionally including social criteria. The first publication in the commonly known field of sustainable supplier selection was published by Huang and Keskar (2007), who developed a set of relevant metrics, such as the number of accidents, safety training, and safety audits, through literature review and online sources that can be used for effectively selecting suppliers.

The comprehensive literature on sustainable supplier selection was reviewed by Zimmer et al. (2016). Analyzing 143 articles published between 1997 and 2014, they identified the top ten economic (e.g., quality, flexibility, price), environmental (e.g., environmental management system, resource consumption, eco-design), and social criteria (e.g., involvement of stakeholders, staff training, health and safety) mentioned in their literature sample for each of the above-mentioned categories. However, they also showed that only a limited number of studies consider the European market and that many industries, such as the textile or chemicals industry, are only insufficiently addressed and conclude that further research is required to address the current gaps (Zimmer et al., 2016).

Also, Rashidi et al. (2020) reviewed sustainable supplier selection literature published between 1990 and 2018. They applied a quantitative bibliometric, network, co-word, and co-citation analysis and considered almost five thousand documents, of which 66 papers were selected for the final analysis. Among others, the most mentioned economic (e.g., quality, delivery, cost), environmental (e.g., environmental management system, eco-design, energy consumption), and social (work safety & labor health, employment practices, social responsibility) criteria in their literature sample were identified.

Recently, also governance criteria found their way into the supplier selection problem. By analyzing the supplier selection process of German DAX and MDAX companies, Köster (2023) found that governance criteria have only been used as must-have criteria in the qualifying process in the past. However, further criteria, namely ESG rating, diverse ownership and management, sustainability strategy, sustainability targets at the executive level, and transparency, have started to become relevant in the selection process. They are included in a scoring model together with criteria from other categories. Yet, this

study has not analyzed the weights for the criteria.

### 3.2.2 Supplier selection method

After the criteria formulation, the next step of the supplier selection process is to select an adequate mathematical decision method, which is used to calculate criteria ranks and weights (Che and Chang, 2016; Gupta et al., 2019).

Multiple methods exist, such as the analytical hierarchy process, TOPSIS, or the analytic network process. For a detailed overview, the review of Zimmer et al. (2016) is recommended, who reviewed more than 140 articles and provided a detailed overview of supplier selection methods. They also concluded that the analytical hierarchy process and the fuzzy logic are the most used methods in their reviewed papers on sustainable supplier management. The reason for this is mainly the possibility of combining fuzzy logic with mathematical analytical methods, processing expert linguistic judgments, and combining subjective opinions with objective data (Zimmer et al., 2016).

Similarly, further publications reviewing quantitative methods concluded that AHP, especially together with fuzzy concepts, is the most applied multi-criteria decision making approach in the academic literature (Chai et al., 2013; Genovese et al., 2013; Govindan et al., 2015). Besides frequency, also the performances of different approaches were analyzed. Alkahtani et al. (2019) conducted a comparative analysis and showed that AHP outperforms other methods in terms of computational complexity. Moreover, they also state that it is well suited for decision-makers in practice for the supplier selection process.

### 3.2.3 Resource-based view

The resource-based view is a valuable theory when analyzing the sustainable supplier selection process (Bai et al., 2019). The theory states that the possession or the use of "valuable, rare, inimitability, and nonsubstitutability" resources (Barney et al., 2001, p.625) can be seen as differentiating factors from competitors and can lead to a competitive advantage for companies (Barney, 1991). These resources can either be tangible such as physical products, or intangible, such as intellectual property rights, corporate

reputation, or sustainability performance (Heider, 2017; Bai et al., 2019). Latter, in turn, can be strengthened by selecting suppliers, that show a high sustainability performance themselves (Bai et al., 2019). Reasoning considering the RBV thus justifies the need for an up-to-date set of quantified decision criteria to adapt the supplier selection process to changing circumstances, especially due to the introduction of the German Supply Chain Act, in order to ensure the selection of the most suitable suppliers.

### **3.2.4 German Supply Chain Act**

The German Supply Chain Act is the major promoter for improving sustainability and safeguarding human rights in international supply chains taken by the German government so far (Mittwoch and Bremenkamp, 2021). The law came into force beginning at the beginning of 2023 for companies with more than 3,000 employees (around 700 companies in Germany) and one year later for companies with more than 1,000 employees (around 3,000 companies in Germany) (Mittwoch and Bremenkamp, 2021; German Federal Ministry for Economic Corporation and Development, 2022).

The act aims to ensure that companies fulfill their social responsibility and due diligence obligations throughout the supply chain by creating more transparency about the origin of products or services and production conditions, thereby improving environmental protection and the international human rights situation (German Federal Ministry for Economic Corporation and Development, 2021, 2022; Koos, 2022). The due diligence obligations require companies to implement a risk management system and preventive measures, including the development and implementation of appropriate procurement strategies and purchasing practices, consequently also the establishment of sustainable criteria for supplier selection (German Bundestag, 2021; German Federal Ministry for Economic Corporation and Development, 2022). A company's responsibility in this respect relates to the entire supply chain, i.e., all the steps in Germany and abroad that are required for the product manufacturing or service provision, from the mining of raw materials to delivery to the end-customer, and covers all direct and indirect suppliers as well as the company's own business processes (German Bundestag, 2021).

In summary, it has been shown that changing circumstances, such as the German Supply Chain Act, are pushing companies to update their criteria for supplier selection. Especially the relative importance of governance criteria, which have recently been included in the selection process by companies and gained relevance in their selection decision, have not yet been analyzed in the academic literature. To close this research gap, applying the fuzzy analytical hierarchy process seems reasonable due to its proven superior performance compared to other MCDMs. Therefore, this paper goes beyond previous research and proposes the following research question: *How important are the key selection criteria for sustainable supplier selection?*

### 3.3 Research method

This paper aims to evaluate the relative importance of relevant criteria and sub-criteria for selecting sustainable suppliers. Therefore, this chapter starts by describing how the most used criteria in the academic literature were identified. Subsequently, the fuzzy analytical hierarchy process is introduced as chosen MCDM. Next, data collection, data sampling, and the data set are described. The chapter closes with an explanation of the data analysis.

#### 3.3.1 Criteria identification

The first step in the sustainable supplier selection process is the identification of relevant criteria and sub-criteria. As discussed in the previous chapter, it has been shown that economic, environmental, social, and governance criteria with their respective sub-criteria are used for selecting sustainable suppliers.

The sub-criteria are identified through literature review and mainly based on the reviews of Zimmer et al. (2016) and Rashidi et al. (2020) for economic, environmental, and social criteria, who identified the most used criteria in their respective literature sample. The two reviews are the latest and most extensive relevant reviews available and therefore seem suitable for selecting sub-criteria.

All top ten criteria identified by Zimmer et al. (2016) and all criteria identified by Rashidi et al. (2020) used at least four times in the respective literature samples are chosen for the analysis. However, a maximum of seven (sub-)criteria can be used applying the FAHP in order not to confuse survey participants (Saaty, 1980). Therefore, the identified sub-criteria are partly condensed based on similarity and summarized in order not to exceed the maximum number of possible factors. The detailed procedure for this step can be found in appendix 6.1.1. Regarding governance criteria, the sub-criteria identified in the study of Köster (2023) are used, which are included in the scoring model, as this represents the only available relevant study in the area of supplier selection. After criteria identification, descriptions for all sub-criteria were derived from several studies (e.g., Dickson, 1966; Thiruchelvam and Tookey, 2011; Shen et al., 2013; Zimmer et al., 2016; Köster, 2023).

### **3.3.2 Multi-criteria decision making method**

This paper applies the fuzzy analytical hierarchy process as multi-criteria decision making, which combines the analytical hierarchy process, introduced by Saaty (1988), and fuzzy sets. FAHP is an exact method to calculate criteria ranks and weights from empirical data, specifically from the linguistic evaluation of decision criteria from experts (Saaty, 1988). The advantages of AHP are manifold: It is relatively easy to handle multiple criteria and also allows the use of quantitative and qualitative data within the same problem (Kahraman et al., 2003). Moreover, it shows an increased likelihood of finding an optimal solution by encouraging specific statements about the relative importance of criteria and taking different points of view into account (Matemane et al., 2022). On the other hand, AHP also comes with some disadvantages, namely the inability to adequately handle the uncertainty that arises from the perceptions of decision-makers (Kwong and Bai, 2003). Yet, the human assessment of criteria weights is always subjective, imprecise, and includes beliefs and experiences (Kwong and Bai, 2003; Torabzadeh Khorasani, 2018). Triangular fuzzy numbers will be used to overcome this shortage, as they allow the handling of vague data (Kahraman et al., 2003).

### Triangular fuzzy numbers

The fuzzy set theory was first introduced by Zadeh (1965) and was developed to handle problems where sharply defined criteria are not available (Zadeh, 1965). It can convert linguistic estimations in fuzzy numbers, resulting in a better understanding of uncertainty (Torabzadeh Khorasani, 2018; Wang et al., 2020) and the possibility to handle these problems mathematically (Alinezad et al., 2013).

Triangular fuzzy numbers (TFNs) are one of the most used fuzzy sets (Alinezad et al., 2013). A TFN  $\tilde{a}$  is a fuzzy set and defined as  $(l, m, u)$  with  $l$ ,  $m$ , and  $u$  as parameters.  $l$  represents the lower bound,  $m$  the modal value, and  $u$  the upper bound of  $\tilde{a}$  (Chang, 1996; Lee et al., 2009). The membership function is in the range of  $[0; 1]$  and is defined as follows (Chang, 1996):

$$u_{\tilde{a}}(x) = \begin{cases} (x - l)/(m - l), & l \leq x \leq m \\ (x - u)/(m - u), & m \leq x \leq u \\ 0, & otherwise \end{cases} \quad (3.1)$$

The main mathematical laws for TFNs (e.g.,  $\tilde{a}_1$  and  $\tilde{a}_2$ ) are defined as follows (Kaufmann and Gupta, 1991):

$$\tilde{a}_1 \oplus \tilde{a}_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_2) \quad (3.2)$$

$$\tilde{a}_1 \otimes \tilde{a}_2 = (l_1 \times l_2, m_1 \times m_2, u_1 \times u_2) \quad (3.3)$$

$$\lambda \otimes \tilde{a}_1 = (\lambda \times l_1, \lambda \times m_1, \lambda \times u_1), \lambda \geq 0, \lambda \in \mathbb{R} \quad (3.4)$$

$$\tilde{a}_1^{-1} = \left( \frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1} \right) \quad (3.5)$$

Further details regarding the fuzzy set theory and fuzzy numbers can be found in Zadeh (1965), Bellmann and Zadeh (1970), Bede (2013).

### Fuzzy analytical hierarchy process

The fuzzy analytical hierarchy process has been widely used for supplier selection problems and allows determining criteria weights and ranking alternatives in a MCDM problem (Zimmer et al., 2016). Thereby, the criteria can be of qualitative and/or quantitative nature (Torabzadeh Khorasani, 2018).

The main steps of the FAHP are as follows: After establishing a hierarchical structure, a pairwise comparison matrix is created based on linguistic terms. The linguistic terms are then converted to fuzzy numbers (Torabzadeh Khorasani, 2018). In the last step, consistency is checked and criteria weights are calculated (Torabzadeh Khorasani, 2018).

**Establishment of hierarchical structure.** The first step of the FAHP is the creation of a hierarchical structure (Kwong and Bai, 2003; Badri Ahmadi et al., 2017). The present study comprises three different hierarchical levels, specifically sustainable supplier, criteria, and sub-criteria, for which the respective (sub-)criteria are introduced in section 3.4. The structure is necessary to evaluate the relative or local weights (LWs) of the criteria at every hierarchical level and to obtain the global weights (GWs).

**Creation of pairwise comparison matrix.** The next step of the FAHP is the creation of the pairwise comparison matrices, as shown in equation 3.6, for all hierarchical levels, with  $\tilde{a}_{ij}$  representing the value of the comparison between criterion (or sub-criterion)  $i$  with criterion (or sub-criterion)  $j$  and  $n$  being the number of criteria (or sub-criteria) of each comparison matrix (Torabzadeh Khorasani, 2018).

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{a}_{12} & \cdots & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & \cdots & \tilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & \cdots & 1 \end{bmatrix} \quad (3.6)$$

Thereby,  $\tilde{a}_{ij}$  can be expressed as  $(l_{ij}, m_{ij}, u_{ij})$ . Furthermore, the conditions  $\tilde{a}_{ii} = 1$  as well as  $l_{ij} = \frac{1}{l_{ji}}$ ,  $m_{ij} = \frac{1}{m_{ji}}$ , and  $u_{ij} = \frac{1}{u_{ji}}$  need to be met (Saaty, 1988; Chang, 1996; Chiou et al., 2008).



In this study, one comparison matrix will be created for the criteria level comprising the four criteria (i.e., economic, environmental, social, and governance), resulting in a  $4 \times 4$  matrix. Additionally, four matrices will be generated for the sub-category level, one for each criterion, with each matrix comprising the respective sub-criteria. Thus, five matrices are created in total.

After the matrices are established, experts conduct the pairwise comparison for each matrix (Chang, 1996). Commonly, a standardized nine-point scale is therefore applied (Wang et al., 2020). With this scale, the decision maker can state whether one criterion  $i$  is equally important, or moderately, strongly, very strongly, or extremely preferred to another criterion  $j$ . Also, intermediary values can be selected (Kwong and Bai, 2003). The expert opinions are then converted to fuzzy numbers, as shown in Table 3.1. For example, an expert states that criterion  $i$  is strongly preferred to criterion  $j$ , then  $a_{ij}$  is set to  $(4, 5, 6)$ . Consequently, criterion  $j$  is strongly less important than criterion  $i$  and  $a_{ji} = (\frac{1}{6}, \frac{1}{5}, \frac{1}{4})$ .

**Table 3.1** Conversion of linguistic variables to triangular fuzzy numbers (Chiou et al., 2008)

Linguistic variable	Crisp number	TFN	Reciprocal TFN
Equally important	1	(1, 1, 1)	(1, 1, 1)
Intermediate	2	(1, 2, 3)	$(\frac{1}{3}, \frac{1}{2}, 1)$
Moderately preferred	3	(2, 3, 4)	$(\frac{1}{4}, \frac{1}{3}, \frac{1}{2})$
Intermediate	4	(3, 4, 5)	$(\frac{1}{5}, \frac{1}{4}, \frac{1}{3})$
Strongly preferred	5	(4, 5, 6)	$(\frac{1}{6}, \frac{1}{5}, \frac{1}{4})$
Intermediate	6	(5, 6, 7)	$(\frac{1}{7}, \frac{1}{6}, \frac{1}{5})$
Very strongly preferred	7	(6, 7, 8)	$(\frac{1}{8}, \frac{1}{7}, \frac{1}{6})$
Intermediate	8	(7, 8, 9)	$(\frac{1}{9}, \frac{1}{8}, \frac{1}{7})$
Extremely preferred	9	(9, 9, 9)	$(\frac{1}{9}, \frac{1}{9}, \frac{1}{9})$

Usually, more than one decision maker is involved in the pairwise comparison. In order to condense the matrices from all decision makers of one category to one matrix, the arithmetic mean, using equation 3.2, is taken of each  $\tilde{a}_{ij}$  (Chang, 1996).

**Check of consistency.** The third step of the FAHP is the calculation of the consistency index (CI), which is used to evaluate the consistency of the pairwise comparisons and whether the determined values can be used for ranking the alternatives (Kwong and Bai,

2003). The primary step for this is to de-fuzzify the fuzzy comparison matrix, applying equation 3.7, to obtain a crisp comparison matrix (Kwong and Bai, 2003).

$$a_{ij} = \frac{l_{ij} + m_{ij} + u_{ij}}{3} \quad (3.7)$$

Subsequently, the consistency index  $CI$  and the consistency ratio  $CR$  can be calculated as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3.8)$$

$$CR = \frac{CI}{R.I.} \quad (3.9)$$

Thereby,  $n$  is the number of compared criteria,  $\lambda_{max}$  the largest eigenvalue, and  $R.I.$  a random consistency index depending on  $n$ , as shown in Table 3.2.

**Table 3.2** Consistency index (Golden et al., 1989)

n	1	2	3	4	5	6	7	8	9
$RI(n)$	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

The calculation of  $\lambda_{max}$  is subdivided into four steps. Firstly, the normalized comparison matrix is calculated by dividing each matrix value  $a_{ij}$  by the respective column sum of the matrix, as indicated by equation 3.10.

$$a_{ij\_normalized} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}}, \quad \forall i, j = 1, \dots, n \quad (3.10)$$

Secondly, the criteria weights  $cw_i$  are obtained by averaging the values of each row:

$$cw_i = \frac{\sum_{j=1}^n a_{ij\_normalized}}{n}, \quad \forall i = 1, \dots, n \quad (3.11)$$

Thirdly, weighted sums for each row need to be calculated. Therefore, a new matrix is created in which each  $a_{ij}$  is multiplied by  $cw_j$ . Subsequently, the weighted sum  $ws_i$  is obtained by taking the sum of each row. Finally  $\lambda_{max}$  can be calculated as follows:

$$\lambda_{max} = \frac{\sum_{i=1}^n \frac{ws_i}{cw_i}}{n} \quad (3.12)$$

In order for the results to be acceptable,  $CR$  must be less or equal to 10% for each comparison matrix (Saaty, 1988). However, some exceptions exist: The literature supports the departure from the threshold of 10% in a certain context, such as a pure online survey design without direct face-to-face interaction or avoidance of a reduction in data richness by excluding records with a consistency ratio above 10% (Apostolou and Hassell, 1993; Matemane et al., 2022). If these exceptions are not met, the pairwise comparison must be repeated until consistency can be established.

**Calculation of criteria weights.** Once all matrices are obtained and consistency is checked, the relative importance, i.e., global weights (GWs) and local weights (LWs) of the criteria can be calculated. Local weights indicate the importance of the criteria within one comparison matrix. Its calculation is divided into four steps (Torabzadeh Khorasani, 2018). Firstly, the fuzzy geometric mean  $\tilde{r}_i$  is calculated, according to equation 3.13.

$$\tilde{r}_i = (\tilde{a}_{i1} \otimes \tilde{a}_{i2} \otimes \dots \otimes \tilde{a}_{in})^{\frac{1}{n}} \quad \forall i = 1, \dots, n \quad (3.13)$$

Secondly, fuzzy local weights are obtained, as shown in equation 3.14.

$$\tilde{w}_i = \tilde{r}_i \otimes (\tilde{r}_1 \oplus \tilde{r}_2 \oplus \dots \oplus \tilde{r}_n)^{-1} \quad \forall i = 1, \dots, n \quad (3.14)$$

Thirdly, the fuzzy local weights are de-fuzzified, according to equation 3.15, by taking the mean of each fuzzy weight  $\tilde{w}_i$ , resulting in  $w_i$ .

$$w_i = \frac{l_i + m_i + u_i}{3} \quad \forall i = 1, \dots, n \quad (3.15)$$

Finally, the local weights need to be normalized, following equation 3.16.

$$w_{i\_normalized} = \frac{w_i}{\sum_{i=1}^n w_i} \quad \forall i = 1, \dots, n \quad (3.16)$$

Once all local weights are obtained, global weights can be calculated. Global weights indicate the overall importance of each criterion and can be derived by multiplying the local weights of the respective hierarchical levels, i.e., multiplying the weight of a sub-

criterion with the weight of the overlying criterion (Torabzadeh Khorasani, 2018). Ranking the criteria according to the global and local weights then results in the global ranks (GRs) and local ranks (LRs), respectively.

### **3.3.3 Data collection**

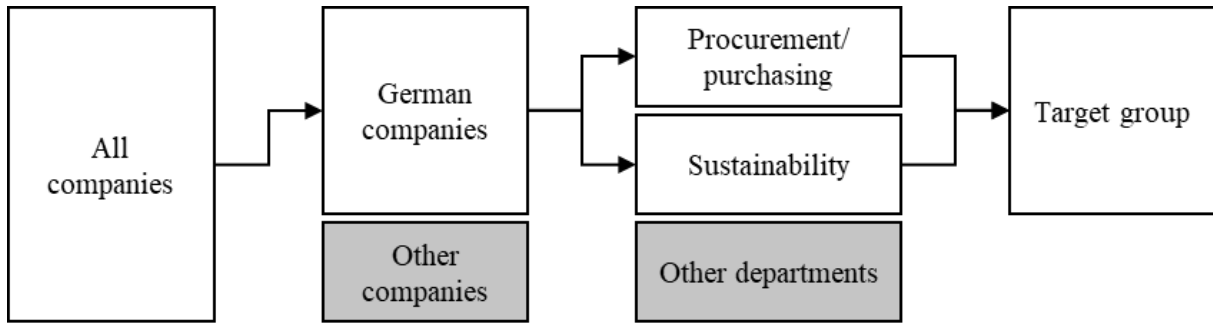
This paper examines data from experts working for German companies by collecting data through an online survey between October 2022 and February 2023 and subsequently applying the FAHP. The survey was implemented using Qualtrics and covered seven sections. The first section provided a project overview incl. contact details, a survey description, and assured confidentiality. The second section covered the assessment of the relative importance of the criteria economic, environmental, social, and governance to each other. The following four sections analogously analyzed the relative importance of the respective sub-criteria of the above-mentioned criteria and contained definitions for each sub-criterion, as described in section 3.3.1. The final section queried personal and company information, including gender, age, industry, and personal experience.

To ensure the comprehensibility of the survey, it was tested with other researchers in advance. Care was taken to choose participants without expert knowledge to ensure that the survey was understandable and easy to follow, even for non-experts.

### **3.3.4 Data sampling and sample**

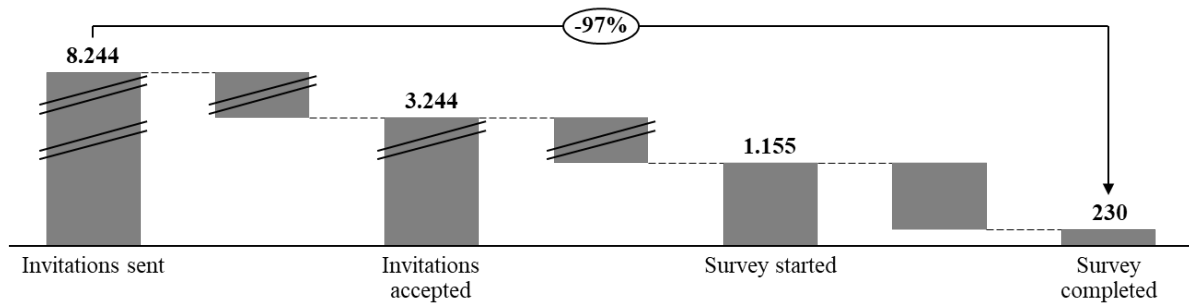
In order to select relevant participants for the online survey, the theoretical sampling approach of Glaser and Strauss (1967) with two steps has been used, as shown in Figure 3.2. First, only German companies, without any further limitations (e.g., size, industry, ownership), were chosen. Secondly, only employees with a focus on either procurement/purchasing or sustainability were selected, as the supplier selection process is typically anchored in these departments.

Participants were selected via the LinkedIn search function in combination with the LinkedIn automation tool Waalaxy using the search terms (strategic) procurement, (strategic) purchasing, or sustainability, and the German equivalents. In total, 8,244 potential



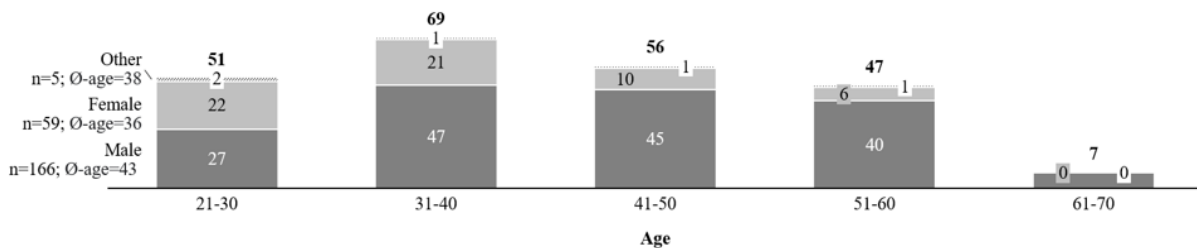
**Figure 3.2:** Sampling process

participants were identified, an invitation to the survey was sent using Waalaxy, and the survey was completed by 230 participants, as shown in Figure 3.3. This equals a response rate of 3%, which is a little lower compared to other empirical studies, but still acceptable, as there is no minimum response rate for surveys in existing literature (Hsu et al., 2006; Rashidi and Cullinane, 2019).



**Figure 3.3:** Sample selection

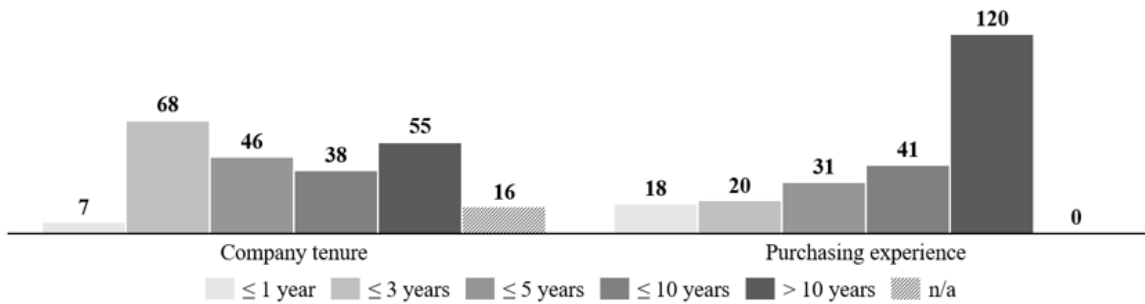
Of the 230 participants completing the survey, 166 were male, 59 were female, and five did either not state their gender or described themselves as diverse (labeled as other). The age range of the participants was between 21 and 70. The detailed distribution is shown in Figure 3.4.



**Figure 3.4:** Age and gender distribution of participants

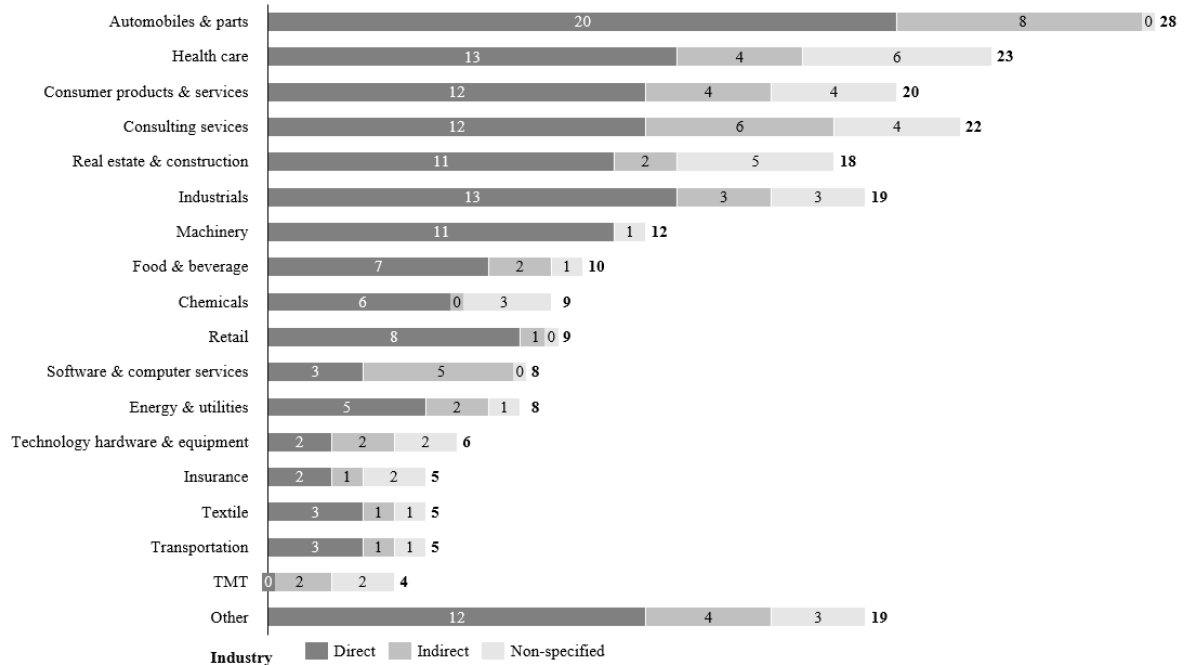
In the online survey, participants were also asked about their tenure with their current

employer and their purchasing experience. Thereby, the results show a distribution over the entire range for each dimension, as shown in Figure 3.5.



**Figure 3.5:** Tenure and experience of participants

Besides, it was also queried whether the participants answered the questions through the view of direct or indirect purchasing and in which industry their employer is active. Thereby, it was observed that the companies are active in various industries, ranging from *automobile & parts*, where 28 companies were registered, to *technology, media and telecommunications (TMT)* with four observations, as shown in Figure 3.6.



**Figure 3.6:** Participants per industry and type of purchasing

### 3.3.5 Data analysis

The data analysis followed a multi-step approach using Qualtrics, Excel, and RStudio. After collecting data in Qualtrics, it was exported using Excel and then used as the input source for RStudio. Incompletely answered questions were excluded using RStudio. Subsequently, the linguistic variables were converted to triangular fuzzy numbers using the conversion Table from section 3.3.2. This data set was then used to perform the FAHP, starting with a computation of the average comparison matrices, using the arithmetic mean, and then calculating the criteria weights, ranks, and the consistency ratio in RStudio. Moreover, different data cuts, e.g., by industry, were taken, and the calculation was performed again for each case. The results are illustrated in section 3.4.

## 3.4 Results

The analysis of the relevance of ESG criteria in the sustainable supplier selection process is divided into six sections, starting with the identification of relevant criteria. Subsequently, the weights and ranks of the overall criteria and sub-criteria are calculated, and different data cuts are analyzed, namely the relevance of criteria by industry, type of purchasing, demographic factors, and expert experience.

### 3.4.1 Criteria

The criteria for sustainable supplier selection include four dimensions: economic, environmental, social, and governance. Within these dimensions, respective sub-criteria have been identified based on the publications of Zimmer et al. (2016), Rashidi et al. (2020), and Köster (2023), condensed based on similarity, and summarized as described in section 3.3. The final selection criteria are described in Table 3.3:

**Table 3.3** Criteria and sub-criteria (based on Zimmer et al. (2016), Rashidi et al. (2020), and Köster (2023))

Criteria	#	Sub-criteria	Description
Economic	1.1	Quality	The consistent compliance with quality requirements
	1.2	Flexibility	Quick adaptability to changes
	1.3	Price (incl. costs)	The net price of a product or service and all associated costs with the purchase
	1.4	Delivery performance	Adherence to the agreed delivery time and quantity (incl. reverse logistics)
	1.5	Lead time	Time between order submission and completion
	1.6	Relationship	Duration and quality of a business relationship
	1.7	Technical/ technological capability	Technical, technological, and design capability as well as innovation and R&D competence of a supplier
Environmental	2.1	Environmental management system	Availability of system and processes to manage and monitor environmental performance to reduce the environmental impact
	2.2	Resource consumption (incl. energy and water)	Consumption of raw materials, energy, and water (incl. the resulting generation of waste water)
	2.3	Eco-design	Design of products to minimize material and energy consumption as well as the possibility to maximize reuse or recycling
	2.4	Recycling and reuse	Activity of a supplier related to recycling and reuse, i.e., the conversion of waste products to new (raw) materials and the use of waste products for another application
	2.5	Air emission	Emission of gaseous or particles to the atmosphere
	2.6	Environmental code of conduct (CoC)	Availability of set of rules and norms with focus on environmental topics
Social	3.1	Health and safety	Availability of laws, rules, and guidelines to prevent accidents, injuries, or diseases
	3.2	Working conditions	Establishment of working conditions that meet standards of employment practices and human rights

*Continued on next page*



**Table 3.3** – continued from previous page

Criteria	#	Sub-criteria	Description
Social	3.3	Staff training	Availability of trainings for employees to improve skills and knowledge
	3.4	Stakeholder management	Involvement of stakeholders in decisions, consideration of their rights and maintenance of good relationships
	3.5	Social responsibility	Donations and activity of a firm for sustainable projects and social management commitment
	3.6	Social code of conduct	Availability of set of rules and norms with focus on social topics
Governance	4.1	ESG rating	The ESG score of a supplier from a rating agency
	4.2	Diverse ownership and management	Share of supplier's diverse management and ownership (e.g., women, minorities, or disabled people)
	4.3	Sustainability strategy	Availability of sustainability strategy at supplier
	4.4	Sustainability targets at executive level	Defined sustainability targets at supplier's executive level
	4.5	Transparency	Transparency of supplier's supply chain

### 3.4.2 Overall results

The overall analysis includes all 230 participants. The weights and ranks of all criteria as well as the consistency ratios are shown in Table 3.4.

**Table 3.4** Overall criteria weights and ranks

Criteria	#	Overall (n=230)		
		Global weight	Global rank	Consistency ratio
Economic	1	51%	1	7%
Environmental	2	22%	2	
Social	3	16%	3	
Governance	4	11%	4	

Experts evaluate *economic* criteria as still most important with a relative importance of 51%. However, all *ESG* criteria together have almost the same weight with a relative importance of 22% for *environmental* criteria, 16% for *social* criteria, and 11% for *gover-*

nance criteria. Given the consistency ratio of 7%, the results can be considered consistent (Saaty, 1988).

Regarding the sub-criteria, Table 3.5 shows the respective results:

**Table 3.5** Overall sub-criteria weights and ranks

Criteria	#	Sub-criteria	Overall (n=230)				Consistency ratio
			Local weight	Local rank	Global weight	Global rank	
Economic	1.1	Quality	33%	1	16%	1	9%
	1.2	Flexibility	14%	3	7%	3	
	1.3	Price (incl. costs)	20%	2	10%	2	
	1.4	Delivery performance (incl. reverse logistics)	13%	4	7%	4	
	1.5	Lead time	8%	5	4%	8	
	1.6	Relationship	6%	6	3%	13	
	1.7	Technical/ technological capability	6%	7	3%	15	
Environmental	2.1	Environmental management system	24%	1	5%	5	5%
	2.2	Resource consumption	23%	2	5%	7	
	2.3	Eco-design	15%	4	3%	12	
	2.4	Recycling and reuse	16%	3	4%	10	
	2.5	Air emission	13%	5	3%	14	
	2.6	Environmental CoC	9%	6	2%	19	
Social	3.1	Health and safety	32%	1	5%	6	5%
	3.2	Working conditions	26%	2	4%	9	
	3.3	Staff training	14%	3	2%	17	
	3.4	Stakeholder management	10%	5	2%	22	
	3.5	Social responsibility	10%	4	2%	21	
	3.6	Social CoC	8%	6	1%	24	
Governance	4.1	ESG rating	31%	1	3%	11	3%
	4.2	Diverse ownership and management	16%	4	2%	20	
	4.3	Sustainability strategy	22%	2	2%	16	
	4.4	Sustainability targets at exec. level	17%	3	2%	18	
	4.5	Transparency	14%	5	2%	23	

Analyzing the sub-criteria in the economic cluster, *quality*, *price (incl. costs)*, *flexi-*

*bility*, and *delivery performance (incl. reverse logistics)* rank highest, with both the local and the global rank and a summarized global weight of 40%. Comparing the ranks with existing literature reveals unchanged top-criteria (Weber et al., 1991; Ho et al., 2010; Zimmer et al., 2016; Rashidi et al., 2020).

Findings regarding *environmental* criteria are also largely consistent with existing literature (Zimmer et al., 2016), showing that *environmental management systems*, *resource consumption*, and *recycling and reuse* rank highest. The respective global weights are 5%, 5%, and 4% with global ranks of five, seven, and ten, respectively.

Most relevant *social* criteria include *health and safety*, *working conditions*, and *staff training* with global weights of 5%, 4%, and 2% and global ranks of six, nine, and 16, respectively. Whereas *health and safety* as well as *staff training* also rank high in recent literature, surveyed experts evaluate *working conditions* more relevant than in existing literature.

Within the governance criteria set, *ESG rating*, *sustainable strategy*, and *sustainable targets at the executive level* have been evaluated as the most important criteria with global weights of 3%, 2%, and 2% and global ranks of eleven, 16, and 18, respectively. Although ranking relatively low compared to the other sub-criteria, it can be assumed that *governance* criteria have proven to be relevant and have gained importance, as these criteria have so far not been taken into consideration for the selection process in the existing literature. Overall, the consistency ratios are lower or equal to 10% and thus results can be considered consistent (Saaty, 1988).

Companies can use these results to select suppliers by combining the individual performance metrics of each sub-criterion into a single number. However, not every company has sufficient capacity to include all (sub-)criteria in the assessment. Therefore, it can be helpful to cluster the criteria according to their importance and then select the number of considered clusters according to the available capacity (Lee et al., 2011).

Analyzing all sub-criteria together, it is found that these can be divided into three clusters, as shown in Figure 3.7. The seven sub-criteria in the first cluster can be regarded as key success factors (KSFs) and should be included in every supplier selection

decision. The cluster includes four *economic* criteria (*quality (1.1)*, *price (1.3)*, *flexibility (1.2)*, and *delivery performance (incl. reverse logistics) (1.4)*), two *environmental* criteria (*environmental management system (2.1)* and *resource consumption (2.2)*) as well as one *social* criterion (*health and safety (3.1)*). Although the ideal number of KSFs is between three and six, these seven criteria are chosen, as all of these criteria are the only ones with a global weight above 5% (Daniel, 1961).

The second cluster includes ten criteria with global weights between 2% and 5%, of which three are *economical*, three are *environmental*, two are *social*, and two are *governance* criteria. Lastly, the third cluster includes the least important criteria with global weights of less than 2%. It consists of seven criteria, including one *environmental*, three *social*, and three *governance* criteria.

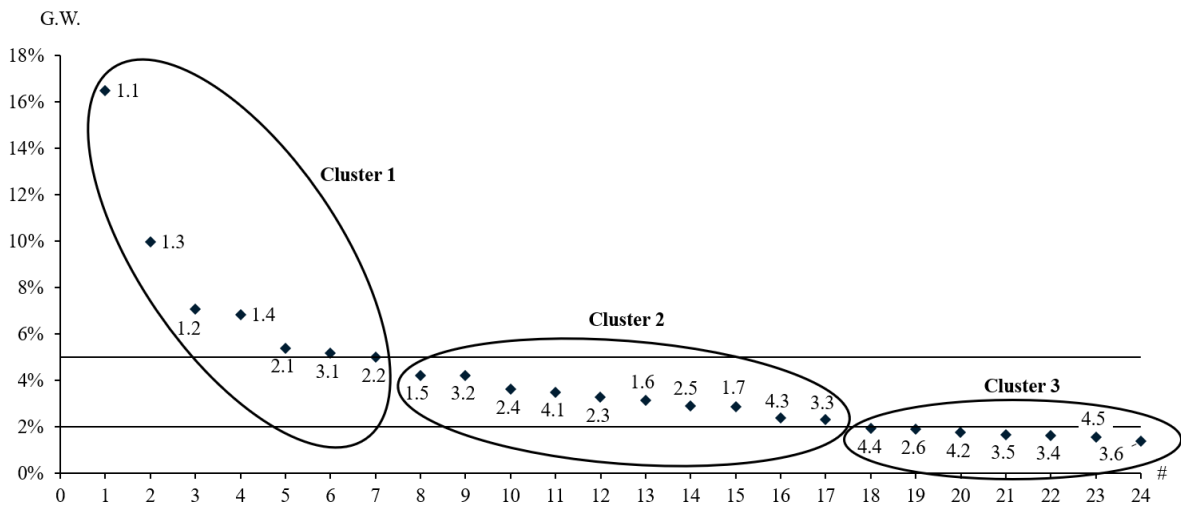


Figure 3.7: Sub-criteria clusters by global weight

### 3.4.3 Results by industry

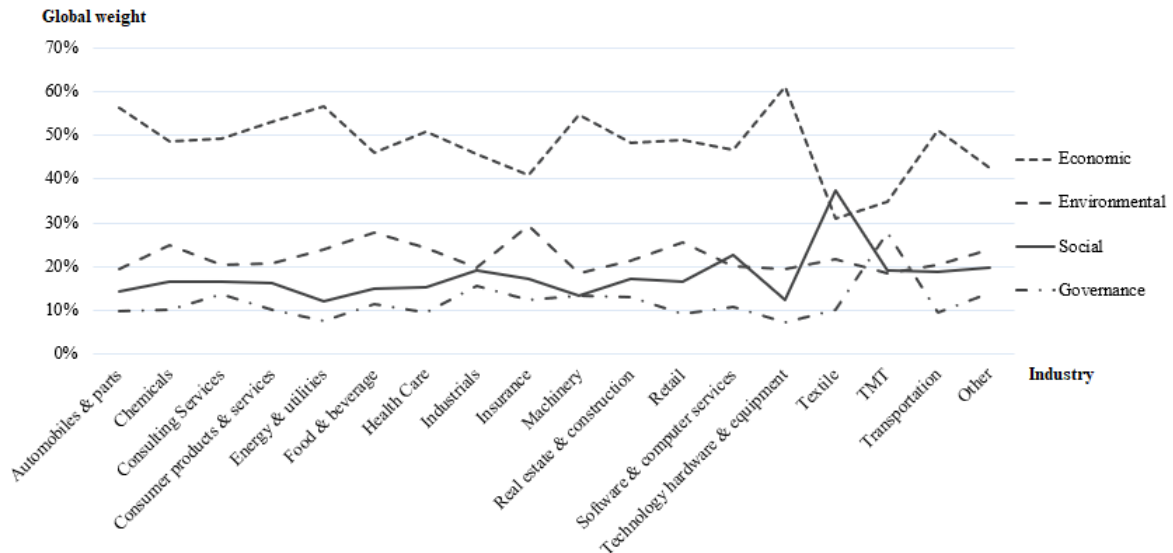
In addition to the overall results presented above, an industry comparison is given in the following Table 3.6. For reasons of readability, only the number of experts surveyed, global weight, global rank, and consistency ratio are displayed. Additionally, a summarizing graph is presented in Figure 3.6 to increase the comparability of the results. The detailed evaluation can be found in appendix 6.1.2.

**Table 3.6** Criteria weights and ranks by industry

Industry type	n	Global weight (rank)				CR
		Economic	Environmental	Social	Governance	
Automobiles & parts	28	56% (1)	20% (2)	14% (3)	10% (4)	9%
Chemicals	9	48% (1)	25% (2)	16% (3)	10% (4)	12%
Consulting services	22	49% (1)	20% (2)	17% (3)	14% (4)	6%
Consumer products & services	20	53% (1)	21% (2)	16% (3)	10% (4)	10%
Energy & utilities	8	57% (1)	24% (2)	12% (3)	8% (4)	10%
Food & beverage	10	46% (1)	28% (2)	15% (3)	11% (4)	9%
Health care	23	51% (1)	24% (2)	15% (3)	9% (4)	8%
Industrials	19	46% (1)	20% (2)	19% (3)	15% (4)	8%
Insurance	5	41% (1)	29% (2)	17% (3)	12% (4)	2%
Machinery	12	55% (1)	19% (2)	13% (3)	13% (4)	4%
Real estate & construction	18	48% (1)	21% (2)	17% (3)	13% (4)	7%
Retail	9	49% (1)	25% (2)	16% (3)	9% (4)	10%
Software & computer services	8	47% (1)	20% (3)	23% (2)	11% (4)	9%
Technology hardware & equipment	6	61% (1)	19% (2)	12% (3)	7% (4)	12%
Textile	5	31% (2)	22% (3)	37% (1)	10% (4)	2%
TMT	4	35% (1)	18% (4)	19% (3)	28% (2)	6%
Transportation	5	51% (1)	21% (2)	19% (3)	10% (4)	2%
Other	19	43% (1)	24% (2)	20% (3)	14% (4)	10%

*Economic* criteria rank first for almost all industries with global weights ranging from a low of 35% for the *TMT* industry to a high of 61% for the *technology hardware & equipment* industry. The only exception is the *textile* industry, for which *economic* criteria only rank second with a global weight of 31%.

With regard to *environmental* criteria, a similar uniform picture emerges. For all but three industries, *environmental* criteria represent the second most important criteria with global weights ranging from a low of 19% for the *machinery* industry to a high of 29%



**Figure 3.8:** Criteria weights by industries

for the *insurance* industry. For the *software & computer services* and *textile* industries, it ranks third and the *TMT* industry fourth, with GWs of 20%, 22%, and 18%, respectively.

*Social* criteria represent the third most important criteria for all but two industries with global weights ranging from a low of 12% for the *energy & utilities* industry to a high of 37% for the *textile* industry. In the *software & computer services* industry, it represents the second most important criterion, and in the *textile* industry even the most important criterion with global weights of 23% and 37%, respectively.

For all industries, except for the *TMT* industry, *governance* represents the last important criterion, with global weights ranging from a low of 7% for the *technology hardware & equipment* industry to a high of 15% for the *industrials* sector. In contrast, the *TMT* industry attaches particular importance to these criteria, ranking it second with a global weight of 28%.

For all except two industries, consistency ratios are lower or equal to 10%, and results can be seen as consistent (Saaty, 1988). Only for the industries *chemicals* and *technology hardware & equipment* is it slightly above. However, given the mentioned exceptions in section 3.3.2 and as the consistency ratios are only slightly above 10%, the results can also be regarded as consistent.

### 3.4.4 Results by type of purchasing

In addition to the industry analysis, the results were also analyzed with respect to the type of purchasing, i.e., comparing *direct* and *indirect* purchasing. The results are shown in the following table:

**Table 3.7** Criteria weights and ranks by type of purchasing

Type of purchasing	n	Global weight (rank)				CR
		Economic	Environmental	Social	Governance	
Direct	143	51% (1)	22% (2)	16% (3)	11% (4)	8%
Indirect	48	49% (1)	23% (2)	17% (3)	11% (4)	8%
Non-specified	39	51% (1)	20% (2)	16% (3)	13% (4)	5%

In analyzing the type of purchasing, a relatively homogeneous picture emerges with *economic* criteria as the most important criteria, followed by *environmental*, *social*, and *governance* criteria for all types. With 49%, experts from *indirect* purchasing assign *economic* criteria only slightly less global weight than experts from *direct* or *unspecified* purchasing. Overall, the results can also be regarded as consistent with consistency ratios of a maximum of 8% in each case (Saaty, 1988). The detailed analysis can be found in appendix 6.1.3.

### 3.4.5 Results by demographic factors

Furthermore, also demographic factors, namely gender and age, have been analyzed. The results can be seen in the following Table 3.8. When considering gender, no major differences between *males* and *females* can be identified. Only experts who either did not specify their gender or assigned themselves to non-binary (summarized as other) assigned greater importance to the *ESG* criteria than to the *economic* criteria. When analyzing the results sorted by age, a similarly uniform pattern emerges. The consistency ratio is below 10% for all categories and criteria, and results can thus be regarded as consistent (Saaty, 1988). The detailed analysis can be found in appendix 6.1.4.

**Table 3.8** Criteria weights and ranks by demographic factors

Demo- graphics	Type	n	Global weight (rank)				CR
			Economic	Environmental	Social	Governance	
Gender	Male	166	51% (1)	22% (2)	16% (3)	11% (4)	7%
	Female	59	49% (1)	23% (2)	16% (3)	11% (4)	9%
	Other	5	41% (1)	23% (2)	16% (4)	19% (3)	4%
Age	≤ 30	51	52% (1)	21% (2)	15% (3)	11% (4)	8%
	≤ 40	69	50% (1)	23% (2)	17% (3)	10% (4)	8%
	≤ 50	56	51% (1)	21% (2)	17% (3)	11% (4)	7%
	≤ 60	47	48% (1)	24% (2)	16% (3)	12% (4)	7%
	> 60	7	51% (1)	14% (3)	22% (2)	13% (4)	1%

### 3.4.6 Results by expert experience

In addition to the analysis shown above, also the impact of different expert experiences has been analyzed. Thereby, the experience with the purchasing process in general and the tenure at the current company has been considered, as shown in Table 3.9:

**Table 3.9** Criteria weights and ranks by expert experience

Type	Experience (years)	n	Global weight (rank)				CR
			Economic	Environmental	Social	Governance	
Purchasing	≤ 1	18	41% (1)	20% (2)	20% (3)	19% (4)	4%
	≤ 3	20	54% (1)	23% (2)	14% (3)	9% (4)	10%
	≤ 5	31	52% (1)	22% (2)	15% (3)	10% (4)	7%
	≤ 10	41	53% (1)	21% (2)	16% (3)	10% (4)	8%
	> 10	120	50% (1)	22% (2)	17% (3)	11% (4)	7%
Tenure	≤ 1	7	41% (1)	26% (2)	19% (3)	14% (4)	9%
	≤ 3	68	52% (1)	22% (2)	15% (3)	10% (4)	9%
	≤ 5	46	49% (1)	22% (2)	17% (3)	12% (4)	6%
	≤ 10	38	52% (1)	20% (2)	17% (3)	11% (4)	8%
	> 10	55	49% (1)	24% (2)	17% (3)	11% (4)	7%
	n/a	16	53% (1)	18% (2)	18% (3)	11% (4)	6%

The results with regard to the experience of the experts are relatively homogeneous.



While experts with very little purchasing experience or company tenure attach comparatively less importance to *economic* criteria, with a global weight of 41% in each case, experts with more experience give these criteria greater weight, with global weights between 49% and 54%. All results show a consistency ratio of a maximum of 10% and can thus be regarded as consistent (Saaty, 1988). The detailed analysis can be found in appendix 6.1.5.

### 3.5 Discussion and conclusion

Selecting sustainable suppliers plays a major role in reaching sustainability targets and is therefore considered as one of the key tasks for business enterprises (Govindan et al., 2013; Wetzstein et al., 2016; Jain and Singh, 2020). Decision makers are faced with the challenge of comparing the suppliers' performance based on sustainability criteria and selecting the best-performing supplier. The enactment of the German Supply Chain Act led to new requirements for supplier selection, resulting in companies revising their selection procedure. This development does not only lead to a change in the selection criteria itself but also to a shift in their relative importance.

This paper proposes a comprehensive set of selection criteria based on the literature consisting of seven *economic*, six *environmental*, six *social*, and five *governance* criteria. The criteria set is then applied to collect linguistic ratings from 230 experts, working for German companies of more than 17 industries. The ratings are used to evaluate criteria ranks and weights with the fuzzy analytical hierarchy process. The paper contributes to the existing literature on sustainable supplier selection (e.g., Dickson, 1966; Noci, 1997; Cheraghi et al., 2004; Govindan et al., 2013; Badri Ahmadi et al., 2017; Gupta et al., 2021), as it is the first to determine criteria weights after the enactment of the German Supply Chain Act, specifically for *governance* criteria. Moreover, it fills the existing research gap for a cross-industry analysis (Chiou et al., 2008; Winter and Lasch, 2016).

The results show that *economic* criteria are the most important, with a global weight of 51%, followed by *environmental*, *social*, and *governance* criteria, with global weights of 22%, 16%, and 11%, respectively, with global weights for the sub-criteria ranging from

1% for the *social code of conduct* up to 16% for *quality*. Comparing this with the results of Zimmer et al. (2016), it seems that the attention given to *economic* criteria remains stable, while the distribution within *ESG* criteria shifts, resulting in more attention given to *social* and *governance* criteria.

In examining the various industries individually, a relatively balanced pattern appears with regard to the ranking of the criteria emerges, with *economic* criteria being in the first place, followed by *environmental*, *social*, and *governance* criteria for all but three industries, namely *textile*, *TMT*, and *software & computer services*. However, global weights differ considerably, e.g., weights for *economic* criteria range from 31% to 61%, depending on the industry. This finding is in line with existing research concluding an industry-dependent application of supplier evaluation criteria (Wang et al., 2005). Of all the industries, two are particularly noteworthy for their emphasis on sustainability. One is the *TMT* industry, with a global weight for the *ESG* criteria of 65%. The other is *textile* with a combined global weight for the *ESG* criteria of even 69% and a particular emphasis on *social* criteria with a global weight of 37%. Especially latter can be explained by the ongoing social issues in this industry (Shen et al., 2017).

Comparing *direct* and *indirect* purchasing, no major differences were found. Also, by analyzing the personal information of the experts, namely demographic factors (i.e., age and gender), expert experience with the purchasing process, and tenure to the current company, a relatively even image is obtained. This leads to the conclusion that criteria ranks and weights are primarily determined by the industry in which a buying firm is active, whereas other factors only play a subordinate role.

The findings of this study are equally beneficial to researchers and practitioners. From a theoretical perspective, the results can be used to better understand the prioritization and importance companies attach to the selection criteria in the supplier selection process. In addition, the results of this study can be useful to recognize and explain the differences in the various industries, especially with regard to sustainability measures.

From a buying company's perspective, the results can be used to guide the development of a decision support tool to improve supplier evaluation, create a competitive

advantage, and avoid reputational damage. Specifically, by linking each supplier's performance metrics to each sub-criteria, these can be combined into a single evaluation criterion that allows companies to evaluate and rank their own suppliers in terms of a green supply chain. However, due to limitations such as capacity constraints or data unavailability, a buying firm might not be able to implement all criteria. In this case, companies should focus on the most important criteria, as shown in Figure 3.7, including four *economic*, two *environmental*, and one *social* criteria with a combined total global weight of 56%. Certainly, further criteria should be incorporated if spare capacity is available. Moreover, the results can help to ensure compliance with legal requirements as well as stakeholder demands, such as from customers or investors. From a supplier perspective, the results can be used as a reference to identify the most important sustainability dimensions and to identify opportunities to improve their sustainability performance and obtain an advantage in the selection process.

### 3.6 Limitations and future research

Although this study provides theoretical and practical contributions, it is not without limitations, which at the same time can provide guidance for future research: One of the key limitations is the application of a single evaluation method, namely FAHP, which results in a dependency of the results on the method assumptions. Future research can, therefore, apply further evaluation methods to the expert rankings and compare the results with the ones of this study. Secondly, this paper applies the same criteria for the analysis of ranks and weights across all industries. Therefore the evaluation of potential differences in the criteria itself might be of interest. Thirdly, this paper focuses on German companies, which leads to interesting research opportunities by extending this study to further countries and subsequently drawing comparisons. Moreover, this paper shows limitations regarding the temporal scope, as data were collected between October 2022 and February 2023. Consequently, the analysis of temporal changes in criteria, ranks, and weights, especially with regard to the German Supply Chain Act, could yield exciting research findings. In particular, companies with more than 1,000 employees can be

analyzed, as these will also be affected by the German Supply Chain Act starting from January 2024. In addition, this study focuses on the perspective of the buying company. In future studies, the supplier's perspective and the comparison with the buying firm's view may be the focus of the analysis.

Besides, further research opportunities exist by investigating how necessary data can be collected and made available by companies. Particular attention may be paid to developing uniform standards that would help companies to standardize and simplify the selection process. In addition, it might be interesting to analyze the development of criteria and their relevance over time or after special events, such as the enactment of the Supply Chain Act. Furthermore, the view of the end-customer is of particular interest. Future research could investigate the importance of a sustainable supply chain from their point of view and how a selling firm can optimally signal its own degree of sustainability.

## 4 | Essay III - Sustainable purchase preferences and ESG labeling: Experimental evidence from German consumers in the apparel industry

**Abstract:** Despite the growing awareness of sustainability among end-consumers, a substantial number of consumers still purchase non-sustainable clothing, contributing to the persistent shortfall in sustainability practices within the apparel industry. To improve this situation, it is necessary to examine what influence ESG criteria might have on the choice of fashion products, as well as to investigate the impact of different label designs for communicating ESG outcomes. Hence, consumer preferences for ESG criteria and the effectiveness of four different label designs involving more than 700 German study participants are analyzed through the application of choice experiments. Results show a willingness-to-pay of more than 200% to the average product price to enhance the entire ESG performance. Yet, general product characteristics, such as country of manufacturing and quality, also remain of high importance. Moreover, it is revealed that the ESG scorecard label with impact valuation, combining visual and text information, is the most effective approach for driving sustainable fashion purchases.

**Keywords:** ESG, Sustainability, Fashion, Consumer, Theory of Planned Behavior, Choice Experiment

*Authors:* Christoph Köster, Matthew J. Beck<sup>5</sup>, and John M. Rose<sup>5</sup>

*Status:* Working Paper

---

<sup>5</sup>Institute of Transport and Logistics Studies, The University of Sydney, Australia

## 4.1 Introduction

The apparel industry ranks among the foremost contributors to global environmental degradation, as evidenced by its approximate 10% share in global greenhouse gas emissions (Niinimäki et al., 2020; Dhir et al., 2021; Fallon, 2022). This industry further exacerbates its environmental impact by annually consuming approximately 215 trillion liters of water, generating nearly 100 million tonnes of waste, and accounting for approximately 20% of industrial water pollution (Niinimäki et al., 2020; Fallon, 2022; United Nations Environment Programme, 2022). Moreover, the apparel industry's activities are intertwined with biodiversity loss and the perpetuation of subpar social standards, encompassing extended working hours, child labor, meager wages, and perilous working conditions (Koszewska, 2021; Fallon, 2022; United Nations Environment Programme, 2022).

A major reason for these dramatic numbers is fast fashion, leading to the frequent introduction of new collections on a nearly weekly basis and a substantial reduction in the longevity of clothing items, causing a notable increase in fashion consumption (Gwozdz and Müller, 2017; Köksal et al., 2017). Since 1975, global fashion production has nearly tripled, and European consumers now exceed an annual consumption of more than 25 kilograms (European Environment Agency, 2019; Niinimäki et al., 2020).

Many companies, such as Patagonia, have acknowledged the issue and understood the importance of sustainable development, administration, and consumption (Patagonia Works, 2021). Consequently, they have integrated these principles into their corporate strategies, as documented in prior studies (White et al., 2019; Muresan et al., 2021). It's important to note that this shift towards sustainability is not (solely) driven by altruistic motives. In the contemporary business landscape, pricing and product quality are no longer sufficient to establish a unique selling proposition. Instead, competition in the marketplace is increasingly influenced by sustainability factors (Gillespie and Rogers, 2016; White et al., 2019). This transformation has led to the heightened importance of environmental and social aspects as pivotal considerations within the realm of sustainable supply chain management (Gillespie and Rogers, 2016).

Moreover, there is an ongoing trend of increasing consumer knowledge regarding sustainability matters (Kozar and Hiller Connell, 2013). This trend fosters a greater consciousness about sustainability and a simultaneous increase in ethical considerations within the apparel industry (Cervellon and Wernerfelt, 2012; Ellis et al., 2012; Dodds et al., 2016; Wiederhold and Martinez, 2018). These ethical concerns encompass various dimensions, including environmental factors, social considerations, implications for health, and the welfare of animals (Wiederhold and Martinez, 2018). This emphasizes the critical necessity of delving into and understanding consumer behavior within this context. In past research, it has already been shown that consumers are theoretically not only willing to pay price premiums for organic materials but also for sustainable practices (Cervellon and Wernerfelt, 2012; Hustvedt and Bernard, 2008; Nakano, 2019). However, the intention does not necessarily lead to actual behavior (Muresan et al., 2021). Consumers perceive numerous hurdles to convert their intention to purchase completely sustainably into actual behavior (Aitken et al., 2020; Ribeiro, 2022). These barriers obviously include price and availability, but also other factors, such as information asymmetry, mistrust, or uncertainty of the sustainable impact (Aitken et al., 2020; Ribeiro, 2022).

In order to overcome these barriers and provide consumers with valuable information about a product's sustainable performance, sustainability labels (also known as e.g., green-, organic-, or eco-labels) can be a useful marketing tool (White et al., 2019; Ribeiro, 2022; Siraj et al., 2022). In fact, it has been proven in the academic literature that labels can be an effective measure in various contexts, including food purchases, to increase consumers' WTP (Kalish and Nelson, 1991; Vlaeminck et al., 2014; Žurga and Tavčer, 2014; Engle et al., 2018). Despite the extensive WTP research in the fashion industry, there is only very limited research available regarding the effectiveness of different label designs in the apparel industry. Yet, the design of a label can be considered an important task in creating an informative and effective label, which is highly requested by customers (European Commission, 2019).

Nevertheless, labels represent just a single facet in the equation, and establishing universally applicable conclusions proves challenging. Instead, the ultimate purchase decision

appears to be contingent on an intricate interplay of factors, reinforcing the necessity to comprehend the sustainable product attributes that hold significance for consumers (Joshi and Rahman, 2015). Yet, only limited research is available on the relationship between various sustainability attributes to each other or even in the context of the full range of ESG factors (Tully and Winer, 2014; Koh et al., 2022).

In order to close this research gap, this paper proposes a choice experiment to test for changes in consumers' WTP across different clothing articles with a range of product attributes (incl. sustainability dimensions) and different label designs to answer the following research question: *How does ESG information presented via different label designs affect consumer choices in the apparel industry?*

Specifically, relevant product attributes, their respective levels, and label designs are identified through an exhaustive review of existing literature. From this review, a choice experiment is developed in order to examine purchasing behavior with respect to fashion and the role of ESG labeling in influencing that choice, which, after cleaning, was completed by a final sample of 733 respondents from Germany. The utilization of choice experiments is justified given the absence of accessible real-world market data and their capacity to yield more lifelike outcomes compared to traditional questionnaire-based surveys (Hensher et al., 2015). Germany is chosen as the focal point of analysis due to its status as the European Union's largest economy and its pioneering efforts in the implementation of sustainable development goals (Lafortune et al., 2021; European Commission, 2022a).

The findings reveal that consumers place considerable value on sustainable product attributes, as evidenced by their willingness to pay premiums exceeding 200% in comparison to the average product price, with the goal of enhancing the overall ESG performance. Additionally, consumers are willing to pay premiums for general product characteristics that influence sustainability, such as superior quality leading to extended product durability. Furthermore, it is discerned that the label design, which combines a scorecard with an impact valuation, incorporating both textual and visual elements, proves to be the most effective. With this label, consumers exhibit a significantly heightened WTP for sustainable performance compared to other label designs.



This paper contributes to the literature on WTP for sustainable fashion (e.g., Hustvedt and Bernard, 2008; Casadesus-Masanell et al., 2009; Ha-Brookshire and Norum, 2011), the WTP for labels (e.g. Žurga and Tavčer, 2014; Engle et al., 2018) as well as effectiveness of label designs (Ma et al., 2017; Williams and Hodges, 2022). Firstly, this study represents the first comprehensive investigation into the relevance of the entire ESG spectrum for end-consumers in the apparel sector. Secondly, it furnishes clear recommendations regarding the most effective label options to enhance transparency concerning product sustainability performance. Thirdly, from a managerial perspective, these insights can assist corporate managers in refining or reshaping their current approach of ESG integration.

This paper is divided into five sections. Section 4.2 summarizes the existing literature on willingness-to-pay for sustainable fashion, the attitude-behavior gap, and labels and introduces the theory of planned behavior (TPB). This is followed by the description of the methodology in section 4.3. In sections 4.4 and 4.5, the results are presented, followed by the discussion and conclusion of the results in section 4.6. Finally, the paper closes with limitations and avenues for future research in section 4.7.

## **4.2 Theoretical background**

Researchers have long been investigating sustainability and information provision in the apparel industry (e.g., Dickson, 2001; Hustvedt and Bernard, 2008). Not surprisingly, it thus covers various aspects and methods, such as choice experiments (e.g., Nakano, 2019) and surveys (e.g., Ha-Brookshire and Norum, 2011). Since this paper focuses on identifying a causal effect, this literature review is centered on scientific studies with comparable analyses and structured studies related to the apparel industry, its sustainability aspects, and the type and scope of information provision.

### **4.2.1 Willingness-to-pay for sustainable fashion**

Sustainable products are often more expensive than their comparable non-sustainable options, as eco-friendly raw materials and production circumstances are more expensive

and production processes are more complex (Steg, 2015; Chekima et al., 2016). This higher price, however, is one of the main barriers for consumers to buy sustainable (Aitken et al., 2020). Consequently, the question arises of how much consumers are willing to pay for sustainable alternatives.

In the past, research has often focused on product materials (e.g., conventional vs. organic cotton) or country of origin when analyzing the WTP (Saricam and Okur, 2019). For example, Hustvedt and Bernard (2008) investigated the WTP using experimental auctions and Tobit regression analysis among Texan students for socks as a function of production method, fiber origin, and type with and without labels<sup>6</sup>. When these characteristics were indicated through labels, they found an increased WTP of up to USD 0.80 for socks produced in Texas, compared to imported or US-produced socks and a price premium of USD 1.86 for organically produced socks compared to conventional and non-genetically modified materials. In another study, Casadesus-Masanell et al. (2009) used internal company data of Patagonia, Inc, and applied a difference-in-difference estimation approach to analyze the WTP of consumers for organic cotton. Their findings reveal that consumers were willing to pay an average surplus of USD 6.58 (i.e., -36%) for a shirt made from organic cotton compared to conventional cotton. Also, Ha-Brookshire and Norum (2011) found an increased WTP by collecting data through a telephone survey of almost 20% on average when the shirt was manufactured from organic, sustainable, or US-grown cotton. Besides these studies, multiple other studies exist that come to similar conclusions, i.e., found a higher WTP for organic materials or local production (e.g., Ellis et al., 2012; Bernard et al., 2013; Hustvedt et al., 2013; Sandra and Alessandro, 2021; Brand et al., 2022; Boufous et al., 2023).

Beyond analyzing the impact of environmental attributes, only limited research deals with further sustainable and ethical dimensions or even the interplay of multiple dimensions in the apparel industry (Tully and Winer, 2014; Boufous et al., 2023). One of the few studies is by Dickson (2001), who analyzed the influence of better working conditions

---

<sup>6</sup>Labels have been employed diversely in the literature: Certain studies did not explicitly delineate the visual characteristics of the labels, some merely indicated the provision of information to study participants, while others referenced highly specific designs.

in production among US consumers by comparing two men's shirts with different product characteristics indicated through labels. The author found that better working conditions only influence a small group of consumers' purchasing decisions. However, it is also stated that further research is required to analyze price sensitivity, as only two price points were covered in their study. In another study, Hustvedt and Bernard (2010) analyzed the WTP for t-shirts regarding labor-related information, using experimental auctions and Tobit regression analysis. They found that especially Hispanic study participants showed an increased WTP for higher social responsibility. The increased WTP for social responsibility was confirmed by Nakano (2019), who used a choice experiment, specifically a conditional logit model and latent class models, to investigate Japan's consumer preferences for towels regarding employees' working long hours. They found that consumers WTP decreased by JPY 230 (i.e., +23%) on average when the producing company employed workers who showed more than 80 hours of overtime per month. Beyond these studies, to the authors' knowledge, there are no further studies available that comprehensively examine sustainability or ethical dimensions in relation to the prices consumers are willing to pay in the context of fashion.

#### **4.2.2 Attitude-behavior gap**

Although it has been shown that consumers are theoretically willing to pay premiums for sustainable attributes, the intention does not always end up in actual behavior. This disconnect between what consumers say and do is one of the biggest challenges that businesses and policymakers face when seeking to promote sustainable consumption and is commonly known as the attitudinal-behavior gap (Johnstone and Tan, 2015; White et al., 2019). Whereas multiple studies exist, only some address the apparel market: Wiederhold and Martinez (2018) used a qualitative research approach to understand the reasons for the attitude-behavior gap in the German green apparel industry. They identified seven barriers, including price, availability, transparency, and knowledge. The latter also includes insufficient labeling of sustainable clothing and the respective criteria. Also, Dhir et al. (2021) examined the drivers of green apparel buying behavior to understand

the attitude-behavior gap in the Japanese market in 2020. The main findings include that green trust, environmental attitude, and labeling satisfaction (i.e., satisfaction which arises when consumers effortlessly identify sustainable apparel through their labels) have a positive impact on green buying behavior. Therefore, it is not only important to understand what drives consumer WTP, but also to gain a clear understanding of the barriers that arise from the attitude-behavior gap and to develop strategies to overcome these barriers effectively.

### **4.2.3 Effect of labels on willingness-to-pay**

In the context of sustainable consumption, labels indicate the sustainable performance of a product, e.g., the environmental impact of consumption (Tsay, 2009). The aim is to provide reliable and independent information in a transparent manner to increase consumer confidence and help in the selection of sustainable products (Thøgersen, 2002; Proto et al., 2007). Thus, labels can promote sustainable purchases and increase a consumer's WTP, but on the other hand, the lack of labels can also hinder sustainable purchasing. Regarding the fashion industry, this has been proven by Žurga and Tavčer (2014), who explored the effect of existing eco-labels and the resulting WTP for sustainable products among Slovenian fashion consumers. They found that about two-thirds of the consumers state they would pay a minimum of 10% more for a sustainable labeled product. However, they also concluded that the desired success of eco-labels has not been achieved so far and thus needs to be further developed, e.g., by introducing more transparent labeling systems. Another study by Engle et al. (2018) yielded similar results. They conducted interviews with millennial-aged US consumers to analyze the impact of life cycle assessment labels on the purchase of sustainable jeans. They concluded that demand for sustainability labels exists and label existence would result in a higher WTP. Moreover, they state that the ease of reading a label is important for its effectiveness, also stating that this should be further investigated in the future.

#### 4.2.4 Labels and label design

Labels have been utilized for a long time, and their relevance in reinforcing sustainable consumer behavior has been highlighted in numerous studies for a variety of industries (e.g., Proto et al., 2007; Thøgersen, 2002). Since the introduction of the first German national eco-label "Blauer Engel" in 1978, many sustainability labels, such as "Fairtrade", "Bio" or "Demeter" have been introduced (Tsay, 2009). However, a particular label can only influence purchasing decisions if the consumers trust it (Thøgersen, 2002). Yet, the growing number of labels with different quality and credibility levels is unsettling and overwhelming customers through the flood of information (Moon et al., 2017). Given the concerns with information overload and potential consumer mistrust, it is not surprising that some in the literature have adopted an approach using hypothetical labels, which is the approach this study also adopts.

In the context of the apparel industry, there is also a notable absence of studies that comprehensively cover the entire ESG spectrum. There are even only a handful of studies that analyze the design and its effectiveness of labels and the resulting impact on consumers without specifically addressing existing labels. One of these is a qualitative study by Williams and Hodges (2022), who found that labels should be easily accessible, have a certain level of detail (e.g., information on child labor and working conditions) while maintaining simplicity, and include the impact of production on people and the planet. Moreover, they propose that future research should investigate consumer preferences for label designs through experimental studies. Ma et al. (2017) came to a similar conclusion: By collecting data from more than 900 US apparel customers to analyze their perceptions of sustainability labels applying the technology acceptance model, they found that sustainability labels need to be easy to understand and useful in order for customers to use them.

Extending the scope of research to industries other than fashion, further valuable insights regarding the type of communication and design can be gained. By analyzing a total of ten product categories (e.g., potato chips, washing powder, and printer paper) among a sample of 234 students of a university in Hong Kong, Tang et al. (2004) found

that a combination of visual and verbal components on labels had significant individual and additive effects on green product spending. Extending these findings by conducting a framed field experiment on Belgian consumers' preferences for eco-friendly food, Vlaeminck et al. (2014) revealed that labels with a standardized color scale and environmental impact score outperform labels with pure raw data information. In a separate investigation conducted by Neumayr and Moosauer (2021), statistical analyses, including t-tests and Mann-Whitney U tests, were employed to assess the impact of diverse label designs within the context of food consumption, for which data was collected through an online experiment. The findings indicate that intuitive eco-label designs with traffic light colors yield the most pronounced effect. This effect is particularly prominent among consumers who typically prioritize price as a primary factor influencing their decision-making process. Partly similar results were also achieved by Muller et al. (2019). They experimentally tested three different label designs, namely single traffic lights, multiple traffic lights, and a kilometric format (i.e., indicating the CO<sub>2</sub> impact in kilometers as of driving with a car) and showed that labels, especially multiple traffic lights, generally result in a positive impact on sustainable consumption. Similar results, yet in a different environment, were found by Rombach (2022): Applying a scenario-based experiment, he showed that providing ESG information via a scorecard leads to higher investments in sustainable products in corporate investment decisions as compared to information provision via an impact valuation, traffic lights, or unlinked information. Numerous further studies exist that have partly been included in the meta-analysis of Bastounis et al. (2021) investigating more than 40 papers published between 2002 and 2018. Besides confirming the mentioned results, they also conclude that a combination of text and logo can also result in a higher WTP compared to single-format labels.

Research within the fashion sector in the field of WTP for sustainability and label designs has occurred but is still relatively immature, especially compared to areas such as the food sector with fairly different characteristics. Moreover, most studies only focus on the impact of selected ESG information, predominately shedding light on the effect of environmental attributes. However, only analyzing selected sustainability elements

neglects the complexity that consumers are confronted with in order to make holistic decisions. Even though some studies examined the interaction of some sustainability dimensions, the interaction of all ESG dimensions together has, to the authors' knowledge, not yet been studied.

#### **4.2.5 Theory and development of hypotheses**

Ajzen's (1991) theory of planned behavior is the most comprehensive and widely used theory for studying behavioral intentions and consumer behavior (Chekima et al., 2016). It provides a helpful framework to predict behavioral intentions for a broad spectrum of consumption behaviors, including organic food, green personal care, organic fashion, and green purchasing (Maloney et al., 2014; Moser, 2015; Chekima et al., 2016; Aitken et al., 2020). Therefore, this paper uses this theory as basis for formulating a set of questions aimed at elucidating consumers' purchase behavior regarding sustainable fashion products, which are then utilized to interpret the results derived from the choice experiment.

The theory states that consumers' intentions are the best predictors for their actual behavior (Ajzen, 1991; Fishbein and Ajzen, 2010). The intention, in turn, depends on three factors: attitude toward a behavior, subjective norms, and perceived behavioral control (Ajzen, 1991; Fishbein and Ajzen, 2010). The attitude component relates to whether the individual values a particular behavior positively or negatively, subjective norm addresses the individual's perception of social influences, norms, or pressures to engage in or avoid the behavior, and perceived behavioral control is defined as the individual's perception of how easy or difficult it is to perform the behavior (Ajzen, 1991; Fishbein and Ajzen, 2010).

In everyday life, many consumers are willing to integrate sustainability into their purchasing behavior and place great value on sustainable properties when buying food or clothing (e.g., Aitken et al., 2020; Boufous et al., 2023). While subjective norms are positively influenced by the current trend towards a more sustainable way of living, consumers are often faced with challenges regarding implementation (Aitken et al., 2020). The theory of planned behavior addresses this with the concept of perceived behavioral

control and maps this with non-motivational factors that may cause consumers to engage in a particular behavior (Ajzen, 1991). Specifically, it reflects a consumer's perception of their role in controlling their behavior to align with a desired manner. One barrier related to sustainable consumption is the product price (Gleim et al., 2013; Paul and Rana, 2012; Moser, 2015). However, a higher price is not necessarily a barrier to purchasing sustainable products, as they are generally perceived as more expensive and customers are willing to pay a higher price in return for more sustainable product attributes (Moser, 2015). Instead, the WTP is crucial and a possible barrier to purchasing a sustainable product (Moser, 2015).

Another known barrier related to purchasing sustainable clothing is a missing or badly designed label, with a potential impact on purchase intentions as well as a customer's WTP (Žurga and Tavčer, 2014; Sogari et al., 2015; IHEMEZIE et al., 2018; Wiederhold and Martinez, 2018; Aitken et al., 2020; Dhir et al., 2021). Thus, while the perceived control element of TPB is theorized to be positively influenced by the use of labels that convey sustainability information to the consumer, providing them with better control over sustainable choices, the use of labels also needs to consider another concept known as bounded rationality. It states that rational decision-making is limited because of cognitive and time limitations of consumers (Simon, 1972, 1997). For instance, a decision-maker may be overwhelmed by the information provided on a label and consequently employ heuristics in their decision-making, which can sometimes lead to violations of rational decision-making. This, in turn, could limit the adoption of sustainable products (Filippini et al., 2020). It is therefore assumed that labels with better-processed information, with the right mix and depth of details while maintaining simplicity, will result in more robust assessments of the role of ESG information. Ultimately, this can impact how much a consumer would be willing to pay for more sustainable clothes. Understanding different label designs is thus crucial to increasing purchase intention, which is one objective of this study.

Attitude toward a behavior is the third factor of the theory of planned behavior that can substantially impact consumers' intentions. It reflects their personal assessment of



the sustainable purchase, i.e., an evaluation of the perceived benefits and consequences, which lead to a positive or negative attitude and is impacted by the awareness and knowledge about the product (Maloney et al., 2014; Saricam and Okur, 2019). Especially in behavioral low-cost domains, such as shopping behavior, attitude has been proven to be a good predictor of sustainable behavior (Diekmann and Preisendörfer, 2003; Moser, 2015). Therefore, understanding which sustainable product characteristics are in the customers' interest is essential to positively impact the purchase intention, resulting in a higher WTP for sustainable clothes. As a result of the increasing awareness of sustainability among customers, it is generally expected that sustainability performance is of value to customers, resulting in the formulation of the following hypotheses:

**H1:** *Higher sustainable performance results in a higher WTP*

**H1a:** *Higher environmental performance results in a higher WTP*

**H1b:** *Higher social performance results in a higher WTP*

**H1c:** *Higher governance performance results in a higher WTP*

## 4.3 Methodology

This paper aims to estimate the willingness-to-pay for different sustainable product characteristics and label types in the apparel industry by analyzing collected stated preference choice sets via the mixed multinomial logit (MMNL) model. This chapter starts with a description of the development of the choice experiment and the experimental design. Subsequently, the empirical method of choice experiments, specifically the MMNL, is described. This chapter closes by explaining the data collection and analysis.

### 4.3.1 Development of the choice experiment

One of the most crucial steps in designing an experiment is identifying the most important factors for the purchase decision (Brand et al., 2022). For this purpose, an intensive literature review was conducted, which resulted in four different choice sets consisting

of one of four clothing articles: socks, t-shirts, pants, and suits. Since the alternatives are generally the same articles of clothing within each choice set that differ only in the levels for each attribute, it is assumed that an unlabeled-choice experiment would be most appropriate for this study.

The selection of these four clothing articles is deliberate and based on multiple considerations. Firstly, they encompass various price dimensions, spanning from relatively inexpensive socks to high-priced suits. The different price categories can have a significant influence on the purchasing decision process. For instance, the purchasing process for socks, being low-priced and everyday wear, tends to be straightforward and swift. In contrast, the decision-making process for expensive suits is typically more protracted and intricate. Furthermore, a conventional wardrobe typically encompasses numerous pairs of socks, with a relatively lower quantity of t-shirts and pants, and only a sparse presence of suits. Moreover, the various clothing articles are worn with disparate frequencies. Socks, t-shirts, and pants constitute everyday attire, whereas suits are predominantly worn either in professional settings or for special occasions.

Following the alternative specification, a comprehensive review of the literature (e.g., Bernard et al., 2013; Brand et al., 2022; Boufous et al., 2023) and well-known fashion supplier websites (e.g., C&A, Hugo Boss, H&M, Marc O'Polo, Tom Tailor, Zara) was conducted to identify general attributes and their corresponding levels in a multi-step process. First, informal qualitative research was conducted to identify the most important attributes influencing the selection among alternative options. Particular emphasis was placed on ensuring the attributes could exhibit universality across the four clothing articles, enabling an examination of how consumers assess them across this spectrum. Subsequently, in a second step, the attribute levels were derived through an analysis of market data, incorporating factors such as production volume by country and material. In summary, four relevant general attributes, along with their respective levels, were identified, as shown in Table 4.1, and included in the choice experiment.

In addition to considering general attributes, particular emphasis was placed on evaluating the sustainable impact of cloth and assessing the efficacy of various label designs.

**Table 4.1** General attributes and levels for the choice experiment

Attribute	Clothing	Level				
		1	2	3	4	5
Price (€)	Socks	2.50	6	9	12	15
	T-shirt	10	25	40	50	60
	Pants	25	45	60	75	110
	Suit	120	240	360	480	600
Material	All	Conventional cotton	Organic cotton	Wool	Recycled materials	Polyester
Country of manufacturing (CoM)	All	China	Europe	Bangladesh	Vietnam	Germany
Quality	All	Low	Medium	High		

The ESG dimensions are used to categorize the sustainable impact and relevant attributes and levels were again identified through a review of literature (e.g. Chapagain et al., 2006; Rahman and Haque, 2016; Köksal et al., 2017; Textile Exchange, 2017; Waste and Resources Action Programme, 2017; Niinimäki et al., 2020). CO<sub>2</sub> emissions, water consumption, waste production, and energy consumption have been identified as the most relevant environmental attributes and are chosen for the experiment.

The respective levels were established through a four-step approach. Initially, the average environmental impact for a typical product across all clothing articles was computed from existing literature for all four environmental dimensions. Subsequently, the determinants influencing these attributes were delineated. A prominent determinant affecting environmental impact is the material used. For instance, conventional cotton yields 2.2 kg of CO<sub>2</sub> emissions, consumes around 1,600 liters of fresh water, and requires 48 kWh of energy per kg of fiber, whereas polyester necessitates only 21 liters of fresh water but produces 3.3 kg of CO<sub>2</sub> emissions and requires 108 kWh of energy per kg of fiber (Niinimäki et al., 2020). Beyond material, additional factors primarily encompass product quality, transportation distance resulting from the manufacturing country, mode of transport, the utilization of recycling measures, and alternative, more sustainable production methods. For each factor, the potential impact on all environmental dimensions and for each clothing article was delineated. In the final step, the potential range of environmental impact was simulated based on the compiled data.

The identification of social and governance factors followed a two-step approach. In the first step, the most relevant social and governance performance indicators in the fashion

industry were derived from the literature (Köksal et al., 2017). However, the direct observation of the impact of social and governance factors on companies is somewhat challenging and spans across various individual key performance indicators. Therefore, in the second step, the identified factors were matched to Refinitiv's<sup>7</sup> overarching scores. As a result, four specific scores were leveraged to reflect the performance of fashion retailers: the workforce score (incl. salary gaps, employee satisfaction, and health & management system certified sites), human rights score (incl. child labor policy, forced labor policy, and human rights policy), management score (incl. executive pay levels compared to average employer salary, ESG performance, gender and cultural diversity at senior levels), and CSR strategy score (incl. communication of sustainable practices in the daily business). Table 4.2 shows the selected sustainable attributes and the respective levels.

**Table 4.2** Sustainable attributes and levels for the choice experiment

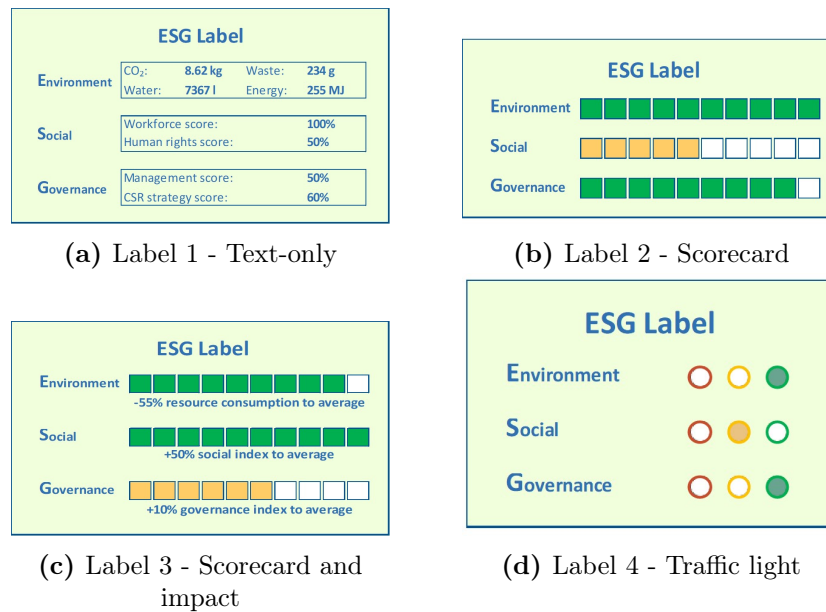
ESG dimension	Attribute	Clothing	Level						
			1	2-3	4	5-6	7	8-9	10
Environment	CO <sub>2</sub> (kg)	Socks	3.5	...	2.4	...	1.2	...	0.1
		T-shirt	35	...	24	...	12	...	1
		Pants	57	...	39	...	21	...	3
		Suit	181	...	122	...	63	...	4
	Water consumption (l)	Socks	345	...	231	...	117	...	3
		T-shirt	3,450	...	2,369	...	1,289	...	208
		Pants	12,650	...	8,688	...	4,725	...	763
		Suit	18,605	...	12,777	...	6,949	...	1,122
	Energy consumption (MJ)	Socks	18	...	12	...	7	...	2
		T-shirt	191	...	134	...	77	...	19
		Pants	777	...	545	...	312	...	79
		Suit	2,650	...	1,887	...	1,124	...	361
	Waste production (g)	Socks	6.4	...	5.6	...	4.8	...	4.1
		T-shirt	64	...	56	...	48	...	41
		Pants	255	...	224	...	194	...	163
		Suit	383	...	337	...	291	...	245
Social	Workforce score	All	10%	...	40%	...	70%	...	100%
	Human rights score	All	10%	...	40%	...	70%	...	100%
Governance	Management score	All	10%	...	40%	...	70%	...	100%
	CSR strategy score	All	10%	...	40%	...	70%	...	100%

Note: The full table can be found in Table 6.19 in the appendix

The ESG measures were presented to study participants through four distinct label designs, which are based on the studies delineated in section 4.2.4. The first label only contains textual information for the ESG dimensions without any interpretation. Labels

<sup>7</sup>Refinitiv is a U.S.-based service company that compiles and offers economic data, including ESG ratings, to a diverse range of organizations

two and three interpret the ESG dimensions using a scorecard system from one to ten for each of the ESG dimensions and a red, yellow, and green color code. Label three additionally displays the sustainable impact compared to the average impact of comparable products. Label four shows the sustainable impact through traffic lights for each ESG dimension. Examples for each label can be found in Figure 4.1:



**Figure 4.1:** Label designs

The rationale behind selecting these four labels stems from their representation of a diverse range of attributes encompassing complexity, information processing, and presentation format. Specifically, labels 1 and 4 occupy opposing ends of the spectrum. Label 1 exclusively presents raw data without interpretation, resulting in a more intricate processing requirement. While not easily understood, it facilitates specific and nuanced comparisons among the ESG impacts of different products. In contrast, label 4 employs a visual traffic light logic, presenting ESG performance in a highly simplified manner with built-in interpretation. This approach is assumed to be easily understood by consumers for making quick comparisons, but it lacks specificity. Labels 2 and 3 occupy intermediary positions between labels 1 and 4. Both labels offer heightened detail owing to the utilization of a 10-point scale as opposed to the simplicity of a traffic light system. Simultaneously, they maintain a higher level of comprehensibility in comparison to the text-only label but are consequently less detailed. Furthermore, label 3 enhances informa-

tion delivery by incorporating impact evaluations, seamlessly blending visual and textual elements for a comprehensive understanding.

### 4.3.2 Design

In designing the choice profiles (i.e., the combinations of attribute levels that will be displayed for each alternative product within each choice task shown to study participants), a Bayesian D-efficient design, optimized through a genetic algorithm with 1,000 Sobol draws that ran for several hours, was deployed to ensure an efficient estimation of model parameters (Rose and Bliemer, 2008; Hensher et al., 2015). Efficient designs are regarded as state-of-the-art and aim to create a stated choice experiment that minimizes the standard errors of the estimated parameters and maximizes statistical efficiency. This involves identifying the 'optimal' attribute combinations from a large subset of all possible combinations. The process includes iterating over designs to search for the one that, on average, minimizes the elements within the expected asymptotic variance-covariance matrix (Bliemer and Rose, 2023).

An experimental design was generated for each of the four product categories, with each design containing a total of 120 choice tasks to ensure an even balance of attribute levels over all alternatives. Given that each respondent was to complete choice tasks for each of the four clothing articles under two different conditions: without sustainability labeling and with sustainability labeling, these designs were blocked into 60 design subsets, with each block consisting of two choice tasks. This was done to ensure that the respondent could reasonably complete the entire sequence of choice tasks without burden. In total, a respondent would complete two choice tasks for each product type. The initial phase involved conducting experiments without sustainability-related information for each clothing article. After completing all experiments in this initial condition, the relevant sustainability information was introduced, and the experiments were repeated. The designs of the experiments without sustainable information aligned with those of the experiments containing this information for the available attributes. As a result, each respondent completed a total of 16 choice tasks throughout the survey.

Initially, uninformative Bayesian priors were applied to get an indication of the presumed direction of the parameter estimates. The mean of each prior was then selected to assure an even weighting to the overall contribution of the attributes towards utility. For the final experimental design, the priors were updated using pilot survey data, resulting in Bayesian D-errors, which state the design's efficiency, between 0.013 for the suits and 0.053 for the socks experiment. Although D-errors are case-specific without any existing universal threshold, D-errors below one are generally accepted (Bliemer and Rose, 2023).

### 4.3.3 Model

This paper applies choice experiments, which is a method to collect and analyze stated preferences from participants in a hypothetical choice situation. It is considered a favorable alternative when revealed preference data is not available (Hensher et al., 2015). Specifically, the mixed multinomial logit model (cf. Revelt and Train (1998), Hensher and Greene (2003), Train (2009), Hensher et al. (2015), and Merkert and Beck (2020)) is applied to analyze the collected stated preference choice data. The primary benefit of this model lies in its ability to provide a more accurate depiction of reality: for every alternative in a choice set, each respondent possesses their own systematic and random components, thus relaxing the assumption of constant marginal utilities among all individuals.

Let  $U_{nsj}$  be respondent  $n$ 's perceived utility for alternative  $j$  in choice situation  $s$ , which consists of two separate components: the non-stochastic (observable) component  $V_{nsj}$ , reflecting the population's preferences, and a stochastic (unobservable) component  $\varepsilon_{nsj}$ , reflecting the individuals' specific preferences. Formally, it can be written as

$$U_{nsj} = V_{nsj} + \varepsilon_{nsj} \tag{4.1}$$

According to Hensher et al. (2015), the first component, the non-stochastic (observable) component  $V_{nsj}$ , is assumed to be linear. It consists of the observed attribute levels  $x_{nsjk}$  of attribute  $k$  for respondent  $n$  and the respective parameter weight  $\beta_{nk}$ , such that

$$U_{nsj} = \sum_{k=1}^K \beta_{nk} x_{nsjk} + \varepsilon_{nsj} \quad (4.2)$$

The second component, the stochastic (unobservable) component  $\varepsilon_{nsj}$  is assumed to be independently and identically extreme value type 1 distributed (Hensher et al., 2015). Apart from containing information on attribute levels,  $x$  in eq. (4.2) also includes a maximum of up to  $J - 1$  alternative specific constants (ASCs). These ASCs account for the remaining mean influences of unobserved effects linked to that specific alternative.

Moreover, as it is generally considered not feasible in practice to estimate parameter weights for each respondent individually, they are typically calculated for the population instead of for each individual, resulting in

$$\beta_{nk} = \bar{\beta}_k + \eta_k z_{ns} \quad (4.3)$$

Thereby,  $\bar{\beta}_k$  represents the sample's mean for the distribution of marginal utilities, while  $\eta_k$  denotes the spread of preferences around the mean. The variable  $z_{ns}$  represents random draws with an analyst-specified distribution (e.g., normal or Halton) that are needed to find the integrals via simulation, as the model structure has no closed-form solution. In practice, marginal utility is usually estimated over  $n$ , but not over  $s$ , so that  $z_{ns}$  is reduced to  $z_n$ .

This paper operates on the assumption that preferences exhibit variability between respondents but remain stable within each individual respondent, signifying that preferences are considered to be consistent across all choice sets. Thus, the pseudo-panel aspect of repeated choice observations is taken into account (Revelt and Train, 1998; Train, 2009). As a result, the log-likelihood function is estimated differently for the cross-sectional and panel version of the model. The first one assumes choices made over  $S$  choice tasks to be independent within and between respondents so that the simulated log-likelihood function is

$$\log E(L) = \sum_{n=1}^N \sum_{s=1}^S \sum_{j=1}^J y_{nsj} \log E(P_{nsj}) \quad (4.4)$$



with the binary variable  $y_{nsj}$  being 1 if respondent  $n$  chooses alternative  $j$  in choice set  $S$ .  $E(P_{nsj})$  represents the expected choice probabilities computed based on the random draws  $z_{ns}$ .

In contrast, the panel version does not assume that the  $S$  choice tasks of respondents  $j$  are independent, resulting in a simulated log-likelihood function of

$$\log E(L) = \sum_{n=1}^N \log E(P_n^*) \quad (4.5)$$

with

$$P_n^* = \prod_{s=1}^S \prod_{j=1}^J (P_{nsj})^{y_{nsj}} \quad (4.6)$$

Ultimately, the willingness-to-pay  $WTP_k$ , which can be interpreted as the marginal rate of substitution between the price  $p$  and a specific attribute  $k$ , can be calculated through the parameters for the marginal utilities  $\beta_k$  as follows:

$$WTP_k = -\frac{\beta_k}{\beta_p} \quad (4.7)$$

For more detailed information and discussion of the panel and cross-sectional random parameters logit, Train (2009), Hensher et al. (2015), and Bliemer and Rose (2023) are recommended.

#### 4.3.4 Data collection and analysis

Data was collected from German participants aged 18 and over between June and August 2023 through an online survey using SurveyEngine, whereby respondents were paid a small incentive (around 5€) to complete the questionnaire. The focus has been set on Germany, as it is the largest economy in the European Union and also one of the pioneers in implementing the sustainable development goals (Lafortune et al., 2021; European Commission, 2022a).

The questionnaire was structured into four main sections. The first section introduced the experiment to the participants without mentioning sustainability-related topics,

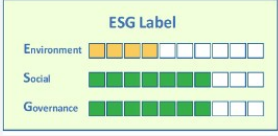

queried their current shopping behavior, and aimed to reduce hypothetical bias through cheap talk (see Haghani et al. (2021) for a review of common methods to reduce hypothetical bias). The following section presented the first set of eight choice tasks (two for each clothing article) to the respondents, with each choice task containing two clothing alternatives and a no-choice option, as shown in Figure 4.2.

	Option 1	Option 2	Weder noch, kaufe weiter ein
Produkt	Lange Hose (z.B. Jeans)	Lange Hose (z.B. Jeans)	
Preis	€ 45	€ 60	
Material	Polyester	Polyester	
Herstellungsland	China	Deutschland	
Qualität im Vergleich zu anderen Hosen	Hoch	Gering	
Welche Option würden Sie am ehesten wählen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Welche Option würden Sie am unwahrscheinlichsten wählen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Figure 4.2:** Exemplary choice task without ESG information

The clothing choices were described by four general attributes and their respective levels, as presented in Table 4.1, and participants were asked to choose their most and least likely options. After completion of the choice tasks, the general meaning of ESG, the sustainable measures described in Table 4.2, and the labels were introduced and explained to the participants. The same choice tasks as in section two of the survey, enriched with ESG information, were then presented to the participants, as shown in Figure 4.3. Thus, each participant completed 16 choice tasks (i.e., two for socks without sustainable information, two for socks with sustainable information, two for t-shirts without...)

This was followed by a section asking participants about understanding and perceived usefulness of the presented labels and 15 questions related to the theory of planned behavior (refer to section 4.2.5), based on the studies of Cerri et al. (2018), Aitken et al. (2020), Borriello et al. (2022), and Siraj et al. (2022). Finally, the survey collected socio-demographic information, including gender, household size, and income. Before distributing the survey, it was pre-tested using a convenience sample in order to help ensure comprehensibility. While a convenience sample was used, an effort was made to sample those

	Option 1	Option 2	Weder noch, kaufe weiter ein
Produkt	Lange Hose (z.B. Jeans)	Lange Hose (z.B. Jeans)	
Preis	€ 45	€ 60	
Material	Polyester	Polyester	
Herstellungsland	China	Deutschland	
Qualität im Vergleich zu anderen Hosen	Hoch	Gering	
Nachhaltigkeit			
Welche Option würden Sie am ehesten wählen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Welche Option würden Sie am unwahrscheinlichsten wählen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Figure 4.3:** Exemplary choice task with ESG information

who did not have expert knowledge.

After data collection, data from the received sample was quality checked: respondents who answered the questionnaire faster than one-third of the median duration and duplicate IP addresses were excluded. The remaining data sample with 789 respondents was exported into Excel and transferred for the analysis. Transformation steps included merging of all experimental data, mapping of attribute levels, and conversion of dummy variables into binary variables. The data was then again quality checked and 56 further responses were removed due to conspicuous patterns in the answers. The cleaned data set was analyzed with the MMNL model, as described in section 4.3.3, using Apollo 0.3.0 on R 4.3.1 for Windows (Hess and Palma, 2019).

## 4.4 Descriptive results

After data cleaning, 733 valid respondents are kept for the analysis, each performing two choice tasks per product category, resulting in 1,466 observations for each of the eight distinct experiments, thus 11,728 observations in total. In the first step, this data is analyzed with regard to sample characteristics and descriptive statistics, applying simple

statistical tests such as factor analysis, one-way ANOVA, and t-tests. Relevant results are shown in appendix 6.2.2.

#### 4.4.1 Sample characteristics

Comparing the final data sample to the socio-demographic details of the German population as reported by the Federal Statistical Office of Germany (2022), the sample shows similar gender distribution, household size, and income, as shown in Table 4.3. The age distribution differs with a shift in the direction of the older generation. However, this is not surprising, given the exclusion of underage participants. Overall, the sample can be regarded as broadly representative to the German population.

**Table 4.3** Sample characteristics

Variable	Category	Sample	Population
Gender	Female	46%	51%
Age	0-18	0%	17%
	18-20	3%	2%
	20-40	30%	25%
	40-60	38%	27%
	60 and older	29%	29%
Household income after taxes (€)	0-1,000	12%	8%
	1,000-2,000	23%	25%
	2,000-3,000	27%	24%
	3,000-4,000	20%	16%
	4,000-5,000	9%	11%
Household size	5,000 and more	9%	16%
	1	30%	41%
	2	36%	34%
	3	16%	12%
	4	9%	10%
	5 or more	8%	4%

Note: sample's net income estimated based on gross income

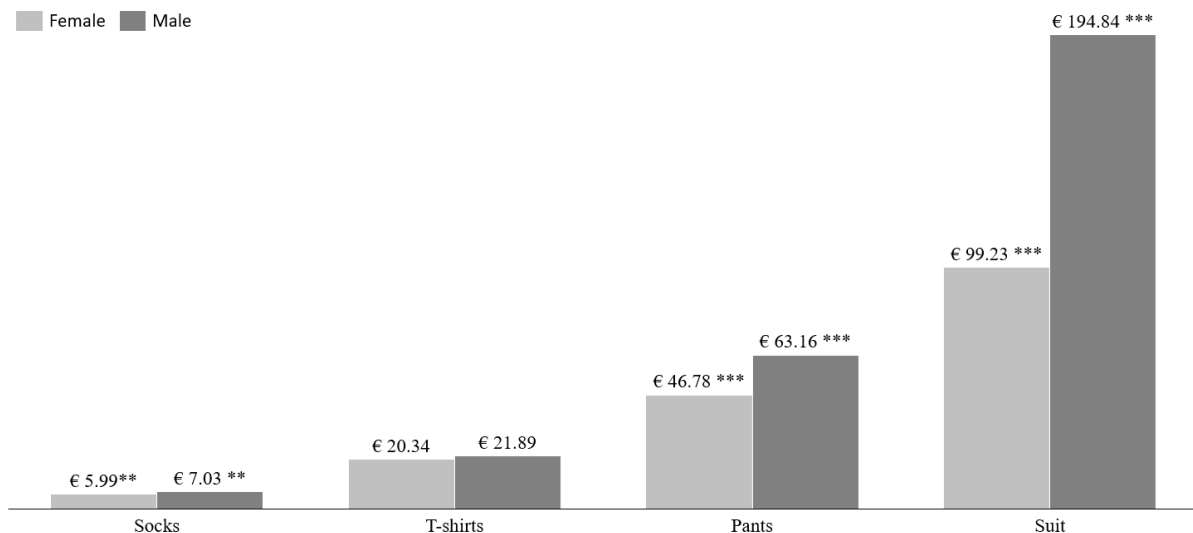
#### 4.4.2 Shopping behavior

The sample characteristics from Table 4.3 are utilized to analyze shopping behavior. Examining shopping frequency, it is determined that gender does not significantly<sup>8</sup> influence shopping frequency. Also, there is no significant difference between the timing of the last purchase of socks and t-shirts between men and women. However, with respect to pants,

<sup>8</sup>Significance is referred to at least a 5% level (2-tailed) within this chapter

women are found to have significantly more recent purchasing experiences, whereas men are significantly more likely to have purchased suits on a more recent basis. In addition, it can be observed that shopping frequency decreases significantly with age, increases with income, and that the last purchase of younger respondents is less far back for all products than for older participants. However, when differentiating between the products, income only partly showed a significant influence on the timing of the last purchase. In total, 176 respondents (over 30% of the females and just under of the 20% males) have never purchased a suit. These are primarily older people with low incomes. However, this is not unexpected, as a suit is worn less often than other articles of clothing and is mainly required only by white-collar workers.

More significant differences can be found when analyzing the prices respondents stated they would typically pay for socks, t-shirts, pants, and suits. Not surprisingly, higher incomes show higher prices for all products. Also, it can be observed that men state higher prices for all products, except for t-shirt, for which no significant difference was found, as shown in Figure 4.4.



Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Figure 4.4:** Stated average prices per clothing article and gender

With regard to age, it can be determined that young participants state a significantly higher price for cheaper products, i.e., socks and t-shirts, while this is reversed for more

expensive products, i.e., pants and suits, for which older respondents stated a higher price.

Almost all respondents (93%) reported that they shop by themselves. Comparing males and females, a significant difference was found: while 97 % of females shop for themselves, only 90 % of men do this. Further, almost 10% of men let their partner do the shopping, whereby these are mainly older men. Income has been found to have no significant influence on the individual engaged in shopping activities.

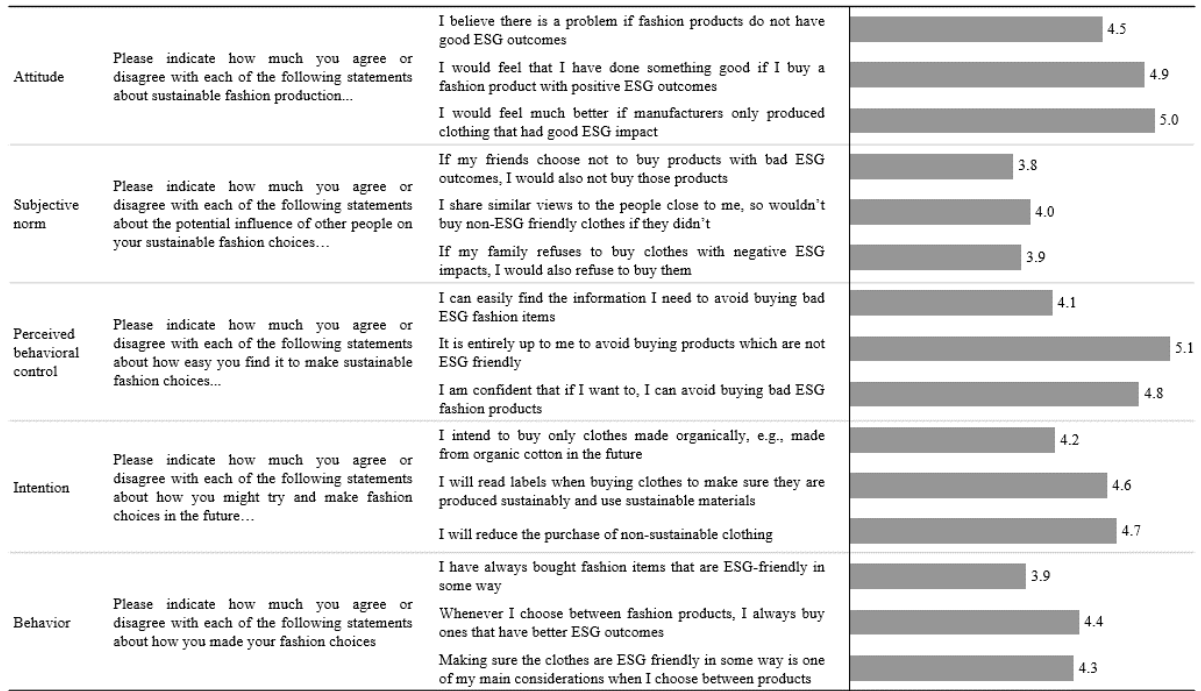
### 4.4.3 Attitude and behavior

In the context of the theory of planned behavior, respondents were asked 15 questions with three questions for each dimension of the theory, i.e., attitude, subjective norm, perceived behavioral control, intention, and behavior, as shown in Figure 4.5. The findings indicate a robust and affirmative attitude among respondents toward sustainability within the fashion context, with subjective norms exerting a comparatively minor influence. Regarding perceived behavioral control, respondents consistently express confidence in their ability to engage in sustainable shopping practices, although they occasionally encounter challenges in accessing requisite information. Despite generally high intentions to make sustainable purchases, respondents acknowledge instances where they have not consistently made sustainable choices in the past. Notably, when presented with a choice between two products, they tend to favor the more sustainable option.

Besides analyzing the questions individually, confirmatory factor analysis was conducted, and the factors were analyzed with respect to the sample characteristics as outlined in Table 4.3. Also, the reliability of these factors has been tested, which can be seen in Table 4.4.

As Cronbach's alpha is at least 0.747, surpassing the recommended threshold of 0.70, the KMO measures is between 0.668 and 0.751, and as the p-value for Bartlett's test of sphericity is less than 0.001 for all factors, it can consequently be concluded that applying factor analysis is deemed appropriate (Bartlett, 1951; Kaiser, 1974; Cortina, 1993).

Analyzing these five factors, it is shown that age has a significant influence on two factors: older participants are less influenced by subjective norms and are less likely to



Range from 1 (strongly disagree) to 7 (strongly agree)

**Figure 4.5:** Questions and results in the context of the theory of planned behavior

actually buy sustainably (i.e., behavior). The latter is also significantly and positively influenced by higher incomes. In contrast, gender does not show any significant influence on the factors. This is interesting, considering that one might be inclined to assume that especially factors such as subjective norms could hold greater significance for females.

#### 4.4.4 Label usefulness

Besides determining the label usefulness through the choice experiments, respondents were also asked to state their perceived usefulness for the used labels. Among all respondents, 49% indicated that they found the scorecard and impact label to be the most valuable. The scorecard label and the traffic light label were deemed relatively equally beneficial, with 18% and 17% of respondents expressing this view, respectively. In contrast, only 3% of respondents found the text-only label to be the most useful, while 13% indicated that none of the presented labels were helpful.

The latter two options (text-only label or no label) were specially chosen by older participants. Younger participants rather stated that labels with processed information,

**Table 4.4** Results factor analysis

Question	Factor loading	Cronbach's Alpha	KMO <sup>1</sup>	Bartlett's test of sphericity
Attitude 1	0.793	0.841	0.678	< 0.001
Attitude 2	0.908			
Attitude 3	0.910			
Subjective norm 1	0.907	0.892	0.751	< 0.001
Subjective norm 2	0.906			
Subjective norm 3	0.909			
Perceived behavioral control 1	0.765	0.747	0.668	< 0.001
Perceived behavioral control 2	0.824			
Perceived behavioral control 3	0.858			
Intention 1	0.897	0.896	0.743	< 0.001
Intention 2	0.926			
Intention 3	0.906			
Behavior 1	0.865	0.887	0.725	< 0.001
Behavior 2	0.924			
Behavior 3	0.919			

Note: KMO: Kaiser-Meyer-Olkin Measure of Sampling Adequacy

i.e., traffic light, scorecard, and scorecard and impact valuation, are more useful to them. In contrast, gender and income do not show a significant difference. Looking at the factors regarding the theory of planned behavior, it appears that participants who responded with a low level of agreement, e.g., have a reluctant attitude toward sustainable purchasing, are more likely to find that labels provide no value to them.

## 4.5 Choice results

### 4.5.1 Experiment 1 - Fashion without sustainable characteristics

The first experiment elicited consumer behavior pertaining to fashion purchases without specifying any sustainability impacts of each of the product alternatives, as shown in Table 4.5. First of all, it can be observed that the ASCs "*no choice*" for all product options reveals a significant preference towards selecting a product rather than opting out. The respondents' affirmation of the reasonableness of the choices and their willingness to express a preference for the presented alternative products suggest that the experimental designs and attribute levels therein were realistic enough for respondents to make informed decisions, reinforcing the validity of the study. In the context of socks and t-shirts, the



ASC "*left choice*" is significant and positive, indicating the presence of a potential left-to-right bias, a phenomenon occasionally observable in cultures that follow a left-to-right reading orientation. Unsurprisingly, significant preferences for lower pricing across all products are evident, as indicated by the negative price coefficient, albeit with significant variances around the mean. This variance might be attributed to participants' tendency to associate higher prices with superior brands and heightened prestige, leading them to exhibit a proclivity for higher expenditures.

Regarding material preferences, a relatively uniform pattern becomes apparent across the product categories. Notably, polyester consistently manifests as a substantial source of disutility across all products. Moreover, both wool and recycled materials emerge as noteworthy sources of consumer disfavor when selecting socks and pants. Especially concerning recycled materials, there is a significant spread around the mean, suggesting that some respondents favor these eco-friendly options. This observation aligns with the growing environmental consciousness seen in contemporary times. Remarkably, the only material that is more appealing to the study respondents is organic cotton, yet only in the context of suits.

A significant preference is observed towards the production of all products within the European region, with an even more pronounced preference for Germany as a preferred production location. Moreover, there is a significant preference for better quality, although a partially significant high standard deviation indicates that quality is not of high importance for all participants. In contrast to Europe and Germany, Bangladesh and Vietnam are found to have no effect on utility compared to the base country China.

Furthermore, an examination was conducted to determine the extent to which respondents were willing to pay for the considered attributes, as illustrated in Table 4.5. The concept of WTP is calculated as the ratio between the mean estimated cost value and the mean parameter estimate of interest. It follows a logical premise that consumers express a readiness to invest in attributes that enhance their overall utility. Thereby, the WTPs exhibit an increase commensurate with the average prices, ascending from the lower-priced socks to the more premium-priced suits.

**Table 4.5** Experiment results - Clothing articles without sustainable characteristics

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP		
Socks	ASC "left choice"		0.193**	0.098	1.979			
	ASC "right choice"		-	-	-			
	ASC "no choice"		-2.982***	0.297	-10.052			
	Price	$\mu$		-0.253***	0.025	-10.126		
		$\sigma$		0.221***	0.029	7.712		
	Material	Conventional cotton	Base level					
			$\mu$	-	-	-	-	
		Organic cotton	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
		Wool	$\mu$	-0.487***	0.164	-2.964	-1.92	
			$\sigma$	-	-	-	-	
		Recycled materials	$\mu$	-0.430**	0.187	-2.303	-1.70	
			$\sigma$	1.054**	0.466	2.264		
		Polyester	$\mu$	-1.174***	0.181	-6.470	-4.64	
			$\sigma$	-	-	-	-	
		Country of manufacturing	China	Base level				
				$\mu$	0.621***	0.160	3.887	2.45
	Europe		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Bangladesh		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Vietnam		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Germany		$\mu$	1.174***	0.221	5.302	4.64	
$\sigma$			1.696***	0.715	-2.371			
Quality	Low	Base level						
		$\mu$	0.500***	0.169	2.955	1.98		
	Medium	$\mu$	1.074***	0.359	-2.995			
		$\sigma$	0.940***	0.185	5.079	3.72		
	High	$\mu$	1.398***	0.331	4.218			
		$\sigma$	-	-	-	-		
T-shirt	ASC "left choice"		0.192***	0.079	2.424			
	ASC "right choice"		-	-	-			
	ASC "no choice"		-1.728***	0.200	-8.621			
	Price	$\mu$		-0.049***	0.004	-11.88		
		$\sigma$		0.036***	0.005	-6.867		
	Material	Conventional cotton	Base level					
			$\mu$	0.023	0.134	0.172	-	
		Organic cotton	$\mu$	1.042***	0.360	2.897		
			$\sigma$	-	-	-	-	
		Wool	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
		Recycled materials	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
		Polyester	$\mu$	-1.055***	0.196	-5.371	-21.53	
			$\sigma$	1.466***	0.387	3.785		
		Country of manufacturing	China	Base level				
				$\mu$	0.752***	0.136	5.511	15.35
	Europe		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Bangladesh		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Vietnam		$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
	Germany		$\mu$	0.946***	0.141	6.726	19.31	
$\sigma$			-	-	-	-		
Quality	Low	Base level						
		$\mu$	0.621***	0.128	4.860	12.67		
	Medium	$\mu$	-	-	-	-		
		$\sigma$	1.044***	0.139	7.517	21.31		
	High	$\mu$	1.044***	0.139	7.517	21.31		
		$\sigma$	-	-	-	-		
Pants	ASC "left choice"		0.056	0.082	0.687			
	ASC "right choice"		-	-	-			
	ASC "no choice"		-1.998***	0.281	-7.117			
	Price	$\mu$		-0.026***	0.003	-8.293		
		$\sigma$		0.021***	0.003	-5.988		
	Material	Conventional cotton	Base level					
			$\mu$	-	-	-	-	
		Organic cotton	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	

Continued on next page

Table 4.5 – continued from previous page

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP		
	Wool	$\mu$	-0.359***	0.147	-2.448	-13.81		
		$\sigma$	-	-	-	-		
	Recycled materials	$\mu$	-0.337**	0.152	-2.214	-12.96		
		$\sigma$	1.014***	0.426	2.381	-		
	Polyester	$\mu$	-1.086***	0.188	-5.776	-41.77		
		$\sigma$	1.231***	0.390	-3.159	-		
	Country of manufacturing	China	Base level	-	-	-	-	
			$\mu$	0.865***	0.160	5.395	33.27	
		Europe	$\sigma$	-	-	-	-	
			$\mu$	0.045	0.161	0.280	-	
		Bangladesh	$\sigma$	0.876*	0.482	-1.819	-	
			$\mu$	-	-	-	-	
		Vietnam	$\sigma$	-	-	-	-	
			$\mu$	1.128***	0.158	7.138	43.38	
		Germany	$\sigma$	-	-	-	-	
			$\mu$	0.917***	0.144	6.382	35.27	
		Quality	Low	Base level	-	-	-	-
				$\mu$	1.060***	0.356	2.976	-
	Medium		$\sigma$	1.407***	0.153	9.212	54.12	
			$\mu$	-	-	-	-	
	High	$\mu$	-	-	-	-		
		$\sigma$	-	-	-	-		
	Suit	ASC "left choice"		-0.184	0.122	-1.512	-	
				-	-	-	-	
			-1.844***	0.321	-5.739	-		
ASC "right choice"			-	-	-	-		
			-	-	-	-		
ASC "no choice"			-	-	-	-		
			-	-	-	-		
Price		$\mu$	-0.007***	0.001	-7.342	-		
		$\sigma$	0.007***	0.001	-6.138	-		
Material		Conventional cotton	Base level	-	-	-	-	
			$\mu$	0.581***	0.205	2.833	83.00	
		Organic cotton	$\sigma$	-	-	-	-	
			$\mu$	-	-	-	-	
		Wool	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
		Recycled materials	$\mu$	-0.041	0.222	-0.186	-	
			$\sigma$	1.722***	0.564	3.052	-	
		Polyester	$\mu$	-1.255***	0.271	-4.626	-179.29	
			$\sigma$	-	-	-	-	
		Country of manufacturing	China	Base level	-	-	-	-
				$\mu$	1.311***	0.292	4.494	187.29
Europe			$\sigma$	2.263***	0.752	3.012	-	
			$\mu$	-	-	-	-	
Bangladesh			$\sigma$	-	-	-	-	
	$\mu$		-	-	-	-		
Vietnam	$\mu$		-0.133	0.240	-0.555	-		
	$\sigma$		2.134***	0.707	-3.018	-		
Germany	$\mu$		1.354***	0.233	5.813	193.43		
	$\sigma$		-	-	-	-		
Quality	Low		Base level	-	-	-	-	
			$\mu$	1.048***	0.237	4.43	149.71	
	Medium	$\sigma$	1.585***	0.446	-3.556	-		
		$\mu$	1.541***	0.265	5.815	220.14		
High	$\mu$	1.924***	0.524	3.670	-			
	$\sigma$	-	-	-	-			

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

The presence of significant standard deviations suggests substantial differences in the utility of individual parameters within the sample, which may rely on other factors. To explore these dependencies, relevant factors that were collected and describe the sample, specifically age, income, shopping frequency, stated average prices per clothing article, and gender, were analyzed. Results show that while age, shopping frequency, and stated average prices per clothing article often significantly influence the parameters, income and gender seldom do. However, it's noteworthy that outcomes vary across different product

categories. Detailed results for this analysis can be found in the appendix 6.2.3.

### 4.5.2 Experiment 2 - Fashion with sustainable characteristics

In the second experiment, sustainable characteristics are introduced. As in the first experiment, all ASCs "*no choice*" reveal a significant preference towards selecting a product rather than opting out. Moreover, significant and negative price coefficients exist across all products.

With respect to the fabric/material that items are made from, the overall pattern remains unaltered for the majority of products, with the exception of wool in the context of socks, which no longer exert a significant impact on utility. Polyester is still a significant source of disutility for all products, which is also true for recycled materials in the case of socks, as well as wool and recycled materials in the case of pants. Although the impact on utility changes for all products, no clear pattern is observable.

A similar trend emerges when examining the choice of manufacturing countries. Both Europe and Germany maintain significance across all products. Notably, for more affordable items such as socks and t-shirts, the relevance of Europe increases, while the relevance of Germany diminishes. This leads to a convergence of the parameters, resulting in an average WTP falling within the range of 40-50%. Besides, Bangladesh also became positively significant in the case of t-shirts. Conversely, for higher-priced products (i.e., pants and suits), all parameters either stayed relatively stable or lost relevance and, except for Germany in the case of pants, also converged to the same range as for socks and t-shirts.

The relevance of sustainable characteristics has been assessed through four distinct labels. Label 1 (text-only) primarily reveals significant parameters in the context of socks, particularly with regard to less CO<sub>2</sub> consumption and a better CSR strategy score. For pants, different parameters, specifically less energy consumption and a better management score, exhibit a significant and, in the case of the latter, also substantial preference.

Nonetheless, the overall importance of label 1 appears to be diminishing across the course of the experiments. This trend could indicate potential learning effects or participant fatigue. Moreover, label 1, being the most information-dense, might have over-

whelmed respondents, leading to a phenomenon known as attribute non-attendance, where participants disengage or stop paying attention to that specific label type.

Conversely, label 2 (scorecard) does not indicate any significant parameters for socks. This could potentially be attributed to the nature of socks as relatively small and mundane fashion items, where respondents may not be highly engaged with ESG outcomes. However, for other products, specifically for those where label 1 displays minimal or no significance, label 2 elicits a significant, yet relatively weak, inclination towards superior environmental and, in the case of suits, even social performance.

The most pronounced efficacy is attained by label 3 (scorecard and impact). Across all products, at least one ESG parameter, and in the case of t-shirts and suits even all three, exhibit significance. Consistently, this label reflects a considerably stronger preference for a favorable ESG performance compared to all other labels. It is noteworthy that label 3 displays the ESG impact compared to an average product. In the context of the social and governance dimensions, a positive preference denotes a preference for superior performance. Conversely, in the case of the environmental dimension, a negative preference indicates a disutility toward heightened resource consumption, consequently also expressing a preference for enhanced environmental performance. Similar to labels 1 and 2, label 4 (traffic light) exhibits only a limited number of significant parameters. In comparison to label 3, these significant parameters indicate a lower preference for better ESG performance.

Returning to the concept of WTP, as computed in a manner analogous to that of experiment 1 and presented in Table 4.6, it becomes evident that consumers exhibit a willingness to allocate financial resources for the attributes from which they derive utility. This willingness aligns with an incremental pattern corresponding to the average prices, ascending from the lower-priced socks to the higher-priced suits. Nonetheless, it's worth noting that the magnitude of this WTP alternates when compared to the experiment lacking sustainable characteristics.

**Table 4.6** Experiment results - Clothing articles with sustainable characteristics

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP	
Socks	ASC "left choice"		0.108	0.110	0.986		
	ASC "right choice"		-	-	-		
	ASC "no choice"		-3.175***	0.324	-9.802		
Price	$\mu$		-0.219***	0.026	-8.588		
	$\sigma$		0.211***	0.031	-6.832		
Material	Conventional cotton	Base level					
		Organic cotton	$\mu$	-	-	-	-
			$\sigma$	-	-	-	-
	Wool	$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
	Recycled materials	$\mu$	-0.567**	0.271	-2.092	-2.59	
		$\sigma$	2.760***	0.626	4.408		
	Polyester	$\mu$	-0.859***	0.197	-4.366	-3.92	
		$\sigma$	-	-	-	-	
	Country of manufacturing	China	Base level				
			Europe	$\mu$	0.801***	0.184	4.347
				$\sigma$	-	-	-
Bangladesh		$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
Vietnam		$\mu$	0.175	0.219	0.800	-	
		$\sigma$	1.639***	0.448	3.656		
Germany		$\mu$	0.950***	0.208	4.559	4.34	
		$\sigma$	0.878**	0.428	-2.050		
Quality		Low	Base level				
			Medium	$\mu$	-	-	-
				$\sigma$	-	-	-
	High	$\mu$	0.619***	0.175	3.539	2.83	
		$\sigma$	1.461***	0.355	4.114		
	Label 1 - Environmental	Label general	Base level				
CO2			$\mu$	-0.450***	0.137	-3.272	-2.05
			$\sigma$	-	-	-	-
Water consumption		$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
Waste production		$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
Energy consumption		$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
Label 1 - Social		Workforce score	$\mu$	-	-	-	-
			$\sigma$	-	-	-	-
Label 1 - Governance		Human rights score	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
Label 1 - Governance	Management score	$\mu$	-0.509	0.485	-1.049	-	
		$\sigma$	2.525***	0.814	-3.102		
Label 2	CSR strategy score	$\mu$	0.911*	0.478	1.905	4.16	
		$\sigma$	-	-	-	-	
Label 3	Environment	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
	Social	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
	Governance	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
Label 4 - Environment	Environment	$\mu$	-1.131***	0.266	-4.255	-5.16	
		$\sigma$	-	-	-	-	
	Social	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
	Governance	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
Label 4 - Social	Red	Base level					
		Yellow	$\mu$	-0.661**	0.320	-2.064	-3.02
			$\sigma$	-	-	-	-
	Green	$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
	Label 4 - Social	Red	Base level				
Yellow			$\mu$	-0.417	0.296	-1.407	-
			$\sigma$	1.910***	0.799	2.389	
Green		$\mu$	-	-	-	-	-
		$\sigma$	-	-	-	-	-
Label 4 - Social		Red	Base level				

Continued on next page

Table 4.6 – continued from previous page

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP		
	Governance	Yellow	$\mu$	-	-	-		
			$\sigma$	-	-	-		
	Green	$\mu$	0.312	0.340	0.917	-		
		$\sigma$	1.705***	0.708	-2.407	-		
		<hr/>						
		<hr/>						
T-Shirt	ASC "left choice"		0.169*	0.086	1.953			
	ASC "right choice"		-	-	-			
	ASC "no choice"		-1.237***	0.230	-5.369			
	Price		-0.039***	0.004	-9.327			
	Material	Conventional cotton	Base level					
			Organic cotton	$\mu$	-	-	-	-
		Wool	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
			Recycled materials	$\mu$	0.130	0.145	0.892	-
				$\sigma$	1.162***	0.415	2.798	-
		Polyester	$\mu$	-0.827***	0.182	-4.532	-21.21	
			$\sigma$	1.028***	0.407	2.528	-	
		Country of manufacturing	China	Base level				
				Europe	$\mu$	0.710***	0.176	4.044
			Bangladesh	$\mu$	0.332**	0.168	1.976	8.51
				$\sigma$	-	-	-	-
	Vietnam		$\mu$	0.279	0.179	1.557	-	
			$\sigma$	0.847**	0.428	1.976	-	
	Germany		$\mu$	0.656***	0.172	3.823	16.82	
			$\sigma$	-	-	-	-	
	Quality		Low	Base level				
				Medium	$\mu$	0.665***	0.150	4.425
			High	$\mu$	0.825***	0.147	5.614	21.15
				$\sigma$	-	-	-	-
	Label 1 - Environmental	Label general	Base level					
			CO2	$\mu$	-	-	-	-
		Water consumption	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
			Waste production	$\mu$	-	-	-	-
				$\sigma$	-	-	-	-
		Energy consumption	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
		Label 1 - Social	Workforce score	$\mu$	-	-	-	-
			Human rights score	$\mu$	-	-	-	-
		Label 1 - Governance	Management score	$\mu$	-	-	-	-
			CSR strategy score	$\mu$	-	-	-	-
	Label 2	Environment	$\mu$	0.104***	0.021	4.879	2.67	
			$\sigma$	-	-	-	-	
		Social	$\mu$	-	-	-	-	
			$\sigma$	-	-	-	-	
Label 3	Environment	$\mu$	-0.759***	0.318	-2.390	-19.46		
		$\sigma$	2.351***	0.741	3.171	-		
	Social	$\mu$	1.196***	0.408	2.934	30.67		
		$\sigma$	-	-	-	-		
Label 4 - Environment	Governance	$\mu$	1.195***	0.411	2.910	30.64		
		$\sigma$	-	-	-	-		
	Red	Base level						
		Yellow	$\mu$	-	-	-	-	
Label 4 - Social	Green	$\mu$	-	-	-	-		
		$\sigma$	-	-	-	-		
	Red	Base level						
		Yellow	$\mu$	-	-	-	-	

Continued on next page

Table 4.6 – continued from previous page

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP	
		$\sigma$	-	-	-	-	
	Green	$\mu$	-	-	-	-	
		$\sigma$	-	-	-	-	
	Label 4 - Governance	Red	Base level	-	-	-	
		Yellow	$\mu$	-	-	-	
		$\sigma$	-	-	-	-	
		Green	$\mu$	0.594***	0.218	2.722	15.23
		$\sigma$	-	-	-	-	
Pants	ASC "left choice"		0.069	0.126	0.548		
	ASC "right choice"		-	-	-		
	ASC "no choice"		-2.047***	0.469	-4.365		
	Price	$\mu$	-0.026***	0.006	-4.276		
		$\sigma$	0.034***	0.008	-4.352		
	Material	Conventional cotton	Base level	-	-	-	
		Organic cotton	$\mu$	-	-	-	
		$\sigma$	-	-	-	-	
		Wool	$\mu$	-0.501*	0.280	-1.793	-19.27
		$\sigma$	1.386**	0.686	-2.019		
		Recycled materials	$\mu$	-0.495*	0.258	-1.920	-19.04
		$\sigma$	-	-	-	-	
		Polyester	$\mu$	-1.241***	0.469	-2.646	-47.73
		$\sigma$	3.582***	1.307	-2.740		
	Country of manufacturing	China	Base level	-	-	-	
		Europe	$\mu$	0.742***	0.310	2.396	28.54
		$\sigma$	1.577**	0.700	-2.254		
		Bangladesh	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Vietnam	$\mu$	0.084	0.278	0.302	-
		$\sigma$	1.643*	0.908	1.809		
		Germany	$\mu$	1.151***	0.330	3.486	44.27
		$\sigma$	2.120***	0.870	-2.438		
	Quality	Low	Base level	-	-	-	
		Medium	$\mu$	0.707***	0.245	2.884	27.19
		$\sigma$	-	-	-	-	
		High	$\mu$	1.284***	0.362	3.542	49.38
		$\sigma$	2.549***	1.096	2.327		
	Label 1	Label general	Base level	-	-	-	
	Label 1 - Environmental	CO2	$\mu$	0.008	0.010	0.813	-
		$\sigma$	0.035**	0.016	-2.159		
		Water consumption	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Waste production	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Energy consumption	$\mu$	-0.005**	0.003	-1.968	-0.19
		$\sigma$	-	-	-	-	
	Label 1 - Social	Workforce score	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Human rights score	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
	Label 1 - Governance	Management score	$\mu$	1.590**	0.734	2.164	61.15
		$\sigma$	-	-	-	-	
		CSR strategy score	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
	Label 2	Environment	$\mu$	0.123***	0.049	2.507	4.73
		$\sigma$	-	-	-	-	
		Social	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Governance	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
	Label 3	Environment	$\mu$	-1.741***	0.703	-2.477	-66.96
		$\sigma$	4.690***	1.676	-2.798		
		Social	$\mu$	-	-	-	-
		$\sigma$	-	-	-	-	
		Governance	$\mu$	2.596***	0.945	2.746	99.85
		$\sigma$	3.752**	1.826	2.055		
	Label 4 - Environment	Red	Base level	-	-	-	
		Yellow	$\mu$	-	-	-	
		$\sigma$	-	-	-	-	

Continued on next page



Table 4.6 – continued from previous page

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP
		Green	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 4 - Social	Red	Base level	-	-	-
		Yellow	$\mu$	-	-	-
			$\sigma$	-	-	-
		Green	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 4 - Governance	Red	Base level	-	-	-
		Yellow	$\mu$	-	-	-
			$\sigma$	-	-	-
		Green	$\mu$	0.687**	0.333	2.062
			$\sigma$	-	-	26.42
Suits	ASC "left choice"			-0.024	0.100	-0.238
	ASC "right choice"			-	-	-
	ASC "no choice"			-1.445***	0.255	-5.671
	Price		$\mu$	-0.005***	0.001	-7.745
			$\sigma$	0.005***	0.001	-6.515
	Material	Conventional cotton	Base level	-	-	-
		Organic cotton	$\mu$	0.590***	0.201	2.934
			$\sigma$	1.920***	0.610	3.146
		Wool	$\mu$	-	-	-
			$\sigma$	-	-	-
		Recycled materials	$\mu$	-	-	-
			$\sigma$	-	-	-
		Polyester	$\mu$	-0.538***	0.163	-3.295
			$\sigma$	-	-	-107.60
	Country of manufacturing	China	Base level	-	-	-
		Europe	$\mu$	0.758***	0.200	3.789
			$\sigma$	-	-	151.60
		Bangladesh	$\mu$	-	-	-
			$\sigma$	-	-	-
		Vietnam	$\mu$	-0.149	0.194	-0.770
			$\sigma$	1.674***	0.419	-3.995
		Germany	$\mu$	0.726***	0.178	4.074
			$\sigma$	-	-	145.20
	Quality	Low	Base level	-	-	-
		Medium	$\mu$	0.641***	0.155	4.126
			$\sigma$	-	-	128.20
		High	$\mu$	0.790***	0.165	4.775
			$\sigma$	0.992***	0.424	-2.342
	Label 1	Label general	Base level	-	-	-
	Label 1 - Environmental	CO2	$\mu$	-	-	-
			$\sigma$	-	-	-
		Water consumption	$\mu$	-	-	-
			$\sigma$	-	-	-
		Waste production	$\mu$	< 0.001**	< 0.001	2.021
			$\sigma$	-	-	0.00
		Energy consumption	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 1 - Social	Workforce score	$\mu$	-	-	-
			$\sigma$	-	-	-
		Human rights score	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 1 - Governance	Management score	$\mu$	-	-	-
			$\sigma$	-	-	-
		CSR strategy score	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 2	Environment	$\mu$	0.060*	0.033	1.799
			$\sigma$	-	-	12.00
		Social	$\mu$	0.068*	0.039	1.761
			$\sigma$	0.266***	0.069	3.836
		Governance	$\mu$	-	-	-
			$\sigma$	-	-	-
	Label 3	Environment	$\mu$	-0.590*	0.310	-1.901
			$\sigma$	-	-	-118.00
		Social	$\mu$	1.262***	0.520	2.429
			$\sigma$	2.992***	1.265	2.365
		Governance	$\mu$	0.875*	0.460	1.902
						175.00

Continued on next page

Table 4.6 – continued from previous page

Product	Parameter		Estimated value	Rob. std. error	Rob. t-test	WTP	
Label 4 - Environment	Red		Base level	-	-	-	
		Yellow	$\mu$	-	-	-	
	Green		$\sigma$	-	-	-	
			$\mu$	-	-	-	
	Label 4 - Social	Red		Base level	-	-	-
			Yellow	$\mu$	-	-	-
Green			$\sigma$	-	-	-	
			$\mu$	-	-	-	
Label 4 - Governance	Red		Base level	-	-	-	
		Yellow	$\mu$	-	-	-	
	Green		$\sigma$	-	-	-	
			$\mu$	-	-	-	

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

As in experiment 1, various significant standard deviation parameters continue to be evident, signifying considerable preference heterogeneity with respect to many attributes in the experiment across the sample. The exhibited variation in preference structures could potentially be explained by respondent-specific characteristics such as sociodemographic and attitudinal traits. Once more, these interdependencies were investigated by examining relevant factors collected to describe the sample, with a particular focus on variables including age, income, shopping frequency, stated average prices per clothing article, and gender. Results show that for the cheaper products, variations around the mean can be partly explained through age, shopping frequency, and stated average prices per clothing article in the case of socks and age, shopping frequency, and gender in the case of t-shirts. For the more expensive products, less can be explained through the analyzed factors. For pants, shopping frequency is still one explanation. Yet only variations in the preference for price can be explained through age, stated average prices per clothing article, and gender. For suits, only sporadic dependencies can be determined. However, it's noteworthy that outcomes vary across different product categories. Detailed results for this analysis can be found in the appendix 6.2.4.

## 4.6 Discussion and conclusion

This study investigates consumer preferences concerning both general and sustainable attributes of products, as well as the efficacy of various sustainable label designs in convey-

ing this information. The initial research question (*How does ESG information presented via different label designs affect consumer choices in the apparel industry?*) is addressed through the application of choice experiments.

The findings clearly demonstrate that consumers are inclined to pay extra for certain criteria but not all of them. Surprisingly, with the exception of suits, the participants in the study did not exhibit a willingness to pay premiums for organic cotton, which contradicts previous research suggesting that consumers are willing to pay more for products made from organic materials (e.g., Hustvedt and Bernard, 2008; Casadesus-Masanell et al., 2009; Ha-Brookshire and Norum, 2011). This inconsistency in results could be attributed to a potential lack of comprehension among study participants regarding the environmental qualities of organic cotton (e.g., reduced water and energy consumption), which could be a consequence of the deliberate omission of supplementary information regarding the materials, including their advantages, during the course of the study. As a result, it can be concluded that it is necessary to provide fashion customers with enhanced information regarding the sustainable characteristics and advantages of materials to potentially facilitate their willingness to make purchases at elevated prices.

In contrast, concurrence with prior research was affirmed with respect to the country of manufacturing (e.g., Hustvedt and Bernard, 2008; Ha-Brookshire and Norum, 2011). To elucidate, the study's participants exhibited an average WTP of approximately 50% of the respective product's average price when those products were manufactured in Europe or Germany, which corresponds to the geographical region of residence for the study participants. Customers are, therefore, willing to pay premiums for products sourced from regions characterized by shorter transport routes and those where improved working conditions are generally presumed.

Furthermore, high quality also demonstrates an increased WTP, reaching up to almost 90 percent of the respective product's average price. This implies that, even in the absence of explicit labels, there is observable evidence suggesting a consumer preference for more sustainable products. The findings indicate that existing consumer preferences align harmoniously with sustainability objectives, encompassing aspects such as reduced

transportation of products or higher quality with higher lifespans. If these preferences can be integrated into the manufacturing process, fashion producers may anticipate heightened demand for products, provided this is achieved in a cost-effective manner that does not exceed the increased WTP.

This result does not change remarkably after the incorporation of sustainability criteria. Most general attributes (e.g., quality, country of manufacturing) have maintained their importance and significance despite the presence of ESG information. This suggests that study participants seek to optimize all parameters that can directly (such as ESG criteria) and indirectly (such as quality) impact sustainability performance. Consequently, any activities related to ESG considerations should be seen as complementary rather than substitutive to the inherent product characteristics. Nevertheless, there is no consistent trend in the strength of preferences for the general attributes.

Moreover, the introduction of sustainability criteria has unveiled a notably high WTP for enhanced sustainability performance for all products. This willingness, however, is heavily contingent on the method of information presentation, i.e., the choice of label. Notably, the label featuring a scorecard and impact factor exhibits the highest relevance in utility, signifying its effectiveness, which is also in alignment with the stated usefulness of labels as discussed in section 4.4.4. This finding corroborates previous research, emphasizing the potential of labels to boost WTP for sustainable products (Žurga and Tavčer, 2014; Engle et al., 2018). Additionally, this study extends prior research in other industries concerning label design by demonstrating that, in the fashion industry as well, labels incorporating a combination of verbal and visual components prove most effective (Tang et al., 2004; Bastounis et al., 2021).

As the remaining labels exhibit a limited number of significant parameters, it can be inferred that they do not exhibit the same level of effectiveness as the scorecard and impact label. An interesting observation arises when examining the text-only label. While two parameters significantly and considerably show an increased WTP for socks, fewer or even no parameters do this for other products. This phenomenon may indicate a potential fatigue effect: The sock experiment was the first conducted, during which participants

invested considerable time in scrutinizing the text-only label, which presents unprocessed information requiring cognitive processing. However, as the experiments progressed, participant fatigue may have set in, or the depth of information on that type of label may have been overwhelming, reducing their willingness to thoroughly examine the label and leading them to opt for labels with processed information.

When analyzing the WTP elicited by the most efficacious label (scorecard and impact) for sustainability performance, it becomes evident that at least one of the ESG dimensions holds significant relevance across all product categories. However, only for t-shirts and suits, all three ESG parameters are significant. Consequently, prior studies can only be partially substantiated, as they have posited a higher WTP for superior social performance, which is not true for socks and pants (Dickson, 2001; Hustvedt and Bernard, 2010; Nakano, 2019). However, unlike prior studies, the experiment in this study involves a more realistic scenario where respondents are presented with all three ESG criteria. This means that, in some instances, a poor social outcome may need to be traded against a good environmental outcome. Moreover, the experiment's complexity might also contribute to the partial relevance of social performance. In summary, hypothesis 1 (*higher sustainable performance results in a higher WTP*) and sub-hypothesis 1a (*higher environmental performance results in a higher WTP*) can completely be confirmed, while sub-hypotheses 1b (*higher social performance results in a higher WTP*) and 1c (*higher governance performance results in a higher WTP*) attain partial validation.

Additionally, this study extends research by encompassing not only specific sustainability criteria but also a comprehensive array of pertinent sustainability criteria, summarized by the ESG dimension. These show, depending on the type of label and the product, an increased WTP of partly more than 200% to the average price of the respective products when optimizing the entire ESG spectrum. The significant WTP underscores the participants' overarching emphasis on embracing sustainability comprehensively rather than solely focusing on specific sustainability criteria. Thereby, the cost of the clothing articles appears to have no impact on the proclivity for sustainability, which becomes clear when comparing the relative WTP across the products: While socks and pants, which

encompass the least expensive and second most expensive options, show a considerably heightened relative preference for environmental performance (the only sustainability performance significant for all the products), the reverse can be observed for t-shirts and suits, the second least expensive and most expensive clothing articles. Consequently, there is no discernible trend aligning with the price of the products.

To elucidate the findings once more in a transparent manner, Table 4.7 displays the prices of diverse clothing articles with varying attributes. The leftmost column presents the base prices of products alongside their corresponding base attribute levels. The second column features products with general attributes deemed sustainable (such as organic cotton, local production, and high quality) without displaying ESG information. The third column showcases the same products but includes ESG information. Finally, the last column presents these products with the highest achievable sustainability performance.

**Table 4.7** Presentation of various product prices based on their characteristics

Product	Product price (in €) based on product characteristics and base price			
Organic cotton	✗	✓	✓	✓
Produced in Germany	✗	✓	✓	✓
Highest quality	✗	✓	✓	✓
ESG label (scorecard and impact)	✗	✗	✓	✓
Highest ESG performance	✗	✗	✗	✓
Socks	3	11	10	15
T-Shirt	10	51	48	129
Pants	25	123	119	285
Suit	120	617	541	1,087

The results obtained from the experiment conducted with a large number of participants enhance the current body of literature in the realm of fashion purchase decision-making within the context of sustainability. This study stands as the pioneering effort to comprehensively incorporate ESG information, encompassing practically pertinent methods for its presentation, such as ESG traffic lights and scorecards. Consequently, it yields theoretical perspectives on the importance of consumer preferences in the context of apparel shopping and the effectiveness of particular label designs.

The analyses also yield evident managerial insights and provide clear guidance for corporate managers planning either to improve the ESG performance of their products or to revise their current approaches. Primarily, it is apparent that customers demonstrate

a willingness to pay substantial premiums for enhanced sustainability performance. Managers can thus be assured that the increased expenditures associated with improving sustainability performance can be offset. Additionally, they can communicate this enhanced sustainability performance to customers through effective labels. However, caution must be exercised to ensure that these labels do not become overly complex, as customers may progressively perceive them as demanding and complicated, as is the case with text-only labels. Instead, labels should be designed to be readily comprehensible while still offering the requisite depth of information, such as exemplified by the scorecard and impact label.

## 4.7 Limitations and future research

In spite of its comprehensive design and meaningful outcomes, this study exhibits three notable limitations. Firstly, as this study marks the pioneering endeavor in the scholarly discourse to adopt a holistic perspective on the significance of sustainability criteria and the manner in which the comprehensive communication of ESG information influences the decisions made by fashion consumers, the study's design is exhaustive. Survey participants were tasked with evaluating a multitude of information content variations, some of which were highly detailed, across four distinct product categories. The complexity of the experiment may have imposed a cognitive burden on respondents, potentially leading them to employ decision heuristics. This might account for peculiar patterns observed in the signs and significances of parameters, especially concerning ESG measures. For instance, this could explain the preference for the yellow environmental traffic light in the case of socks or instances where the number of significant ESG label parameters appears limited. In light of the valuable insights garnered from this research, future studies could address this issue by concentrating on the most important parameters and the most effective label, i.e., the scorecard and impact label.

Secondly, despite the considerable size of the participant pool, each respondent was tasked with completing only two choice tasks for each product category and information type (e.g., two tasks for socks without sustainable information and two for socks with sustainable information). While this design does not compromise the validity of

the results at the aggregate level, it might present limitations when scrutinized from a within-respondent perspective. In future research, informed by the insights gained from this study, it could be beneficial to refine the study's focus. Rather than conducting experiments across a broad spectrum, participants could be directed to undertake a reduced number of distinct experiments in selected or even single product categories and thus be able to complete a larger number of choice tasks per product.

Moreover, there are additional research prospects that can be explored through the analysis of real-world data. Despite the advancements in choice experiments over traditional questionnaire-based methods and the implementation of measures to mitigate hypothetical bias in this study, this bias endures. Gathering and analyzing field data holds the potential to surmount this challenge, potentially yielding results of even greater robustness. However, such field data would require a fashion maker or retailer to opt into such a real-world trial of labeling. Furthermore, it is necessary that consumers trust the company assessing the ESG information or the issuer of the associated label so that they actually use the information. Consequently, an additional compelling research inquiry emerges, focusing on the criteria that must be satisfied to gain consumer trust.



## 5 | Conclusion

### 5.1 Summary of the research findings

In recent years, there has been a noticeable increase in awareness of sustainability, both within corporate entities and among end-consumers. As a result, companies have initiated the integration of ESG criteria into their strategic frameworks. However, there remain substantial areas of development, particularly within the domain of supply chains, which have a substantial influence on a company's economic success, competitiveness, and customer satisfaction (Ahmad and Mondal, 2016). Consequently, it is imperative to gain insights into the means by which sustainability can be enhanced within supply chains and to delineate the specific ESG criteria that should be incorporated or refined to facilitate this advancement.

This dissertation examines the role of sustainability and the incorporation of ESG criteria within the context of supply chains. Specifically, this overarching inquiry is explored through three distinct essays, each posing unique research questions and employing different research methodologies: a multiple-case study, a quantitative analysis utilizing the fuzzy analytical hierarchy process, and an experimental approach involving choice experiments.

While the first two essays focus on the perspective of a buying firm when choosing a supplier, the third essay adopts an end-customer viewpoint. The overall conclusions indicate that ESG considerations play a significant role across the entire supply chain, gaining significance for all participants within it. The specific key takeaways from each essay will be succinctly summarized and discussed in the following.

In Essay I (cf. Chapter 2), the research addresses the role of governance criteria in the

context of sustainable supplier selection. Employing a multiple-case study approach, an increasing relevance of these criteria throughout each stage of the supplier selection process is observed. Furthermore, the study identifies eleven essential criteria for the initial *registration* phase and five criteria for the subsequent *selection* phase of suppliers. The study's results suggest that the heightened relevance of these criteria can be ascribed to the introduction of the German Supply Chain Act and the escalating demand for such criteria from diverse stakeholders, encompassing customers, investors, and the younger generation. These findings contribute to the existing body of literature on sustainable supplier selection and corporate governance (e.g., Zhang et al., 2013; Zimmer et al., 2016; Ben-Amar et al., 2017; Khan et al., 2018; Jain and Singh, 2020). They offer specific and implementable governance criteria for the sustainable supplier selection process, concurrently illuminating the evolving influence of governance factors. Additionally, the research imparts practical insights that can be leveraged by both buying firms and suppliers, providing them with guidance for the formulation of actionable strategies aimed at enhancing their ESG performance.

The research is subject to certain limitations. Owing to the chosen research design, the number of cases subjected to analysis is constrained, resulting in limitations associated with industry specificity, geographic variation, and cultural context. Consequently, there may be constraints on the generalizability of the findings to other companies. Additionally, in light of the relatively substantial size of the companies under examination, the question arises whether the results are applicable to smaller enterprises with more limited operational capabilities. Improving the generalizability of findings across various companies could be attained through the execution of quantitative studies tailored to each industry and accounting for diverse company sizes. Furthermore, it should be noted that the findings exclusively represent the standpoint of buying companies, neglecting the perspective of the suppliers involved.

In Essay II (cf. Chapter 3), an investigation was carried out to assess the significance of economic and ESG criteria within the realm of sustainable supplier selection. Following the identification of twenty-four distinct pivotal criteria, the fuzzy analytical

hierarchy process was employed to ascertain the weights assigned to these criteria. The findings revealed that, on average, economic criteria accounted for 51% of the weighting, environmental criteria for 22%, social criteria for 16%, and governance criteria for 11%. Furthermore, through an analysis of 17 diverse industries, it was demonstrated that although the criteria were ranked consistently across most industries, the specific weightings assigned to them exhibited substantial variations, underscoring the distinct characteristics associated with each industry. The results extend existing literature in the field of sustainable supplier selection (e.g., Weber et al., 1991; Ho et al., 2010; Zimmer et al., 2016; Rashidi and Cullinane, 2019). They provide theoretical insights into the importance of selection criteria across all pertinent dimensions, and, in a practical sense, they provide guidance on establishing a comprehensive supplier selection framework through a methodical, objective, and data-driven approach.

Essay II also presents certain scientific limitations. Firstly, the study exclusively employs a single evaluation method, namely FAHP. Furthermore, it presupposes that the criteria remain consistent across all industries to enable cross-industry comparisons. In practice, these criteria, particularly the less significant ones, may exhibit slight variations. Enhancing the robustness of the findings could be achieved by conducting individual studies for each industry and performing a comprehensive analysis using multiple methodologies. Furthermore, it's important to note that the study's constraints related to geography and time must be considered when extending the applicability of these results to other scenarios.

In Essay III (cf. Chapter 4), an analysis of consumer preferences for sustainable product attributes within the apparel industry was conducted. By employing choice experiments, specifically the MMNL model, the study revealed that consumers are willing to pay premiums for product attributes that directly and indirectly improve the sustainability of a product. The latter includes factors such as superior product quality and local manufacturing facilities with shorter transportation distances in comparison to China, such as Germany and Europe, for which consumers exhibited a willingness to pay premiums partly exceeding 50% of the average product price. When contemplating attributes

that exert a direct influence on sustainability, as conveyed by ESG criteria, the WTP demonstrates a noteworthy increase, at times surpassing 200%, for improvements of the entire ESG metrics when they are showcased through a scorecard and an impact label that incorporates textual and visual elements. The study extends existing research in the field of fashion purchase decision-making in the context of sustainability (e.g., Hustvedt and Bernard, 2008; Casadesus-Masanell et al., 2009; Ma et al., 2017; Williams and Hodges, 2022). It signifies a pioneering endeavor aimed at fully integrating ESG criteria into the decision-making processes of fashion consumers while also providing valuable insights into the efficacy of different label designs. Furthermore, it offers practical implications that provide clear guidance for corporate managers seeking to improve the ESG performance of their products or reassess their current strategies.

Essay III, however, also does exhibit three primary limitations. To begin, given the innovative nature of Essay III, the study possesses a comprehensive and thorough design that might impose a cognitive burden on participants, potentially leading them to employ decision heuristics. Second, the within-respondent perspective might be limited, as participants only engaged in two choice tasks for each product category and information type.

Both limitations could be addressed in future investigations by leveraging the study's outcomes to simplify the design, thereby concentrating on the most crucial parameters, assigning study participants with less intricate tasks, and increasing the number of choice tasks each participant must perform per scenario. Such an approach would not only enhance the robustness of the findings but also generate additional insights. Lastly, while choice experiments are a valuable method when real-world data is unavailable, future studies should endeavor to collect real-world data to enhance the robustness of the findings.

## 5.2 Avenues for further research

The findings across all three essays extend the existing literature while also revealing limitations that can provide guidance for future research endeavors. Firstly, it is noteworthy

that all three essays center on Germany, a sustainability pioneer. However, concentrating solely on enhancing sustainability within Germany may not suffice in addressing global-scale sustainability challenges. Hence, promising avenues for further research involve the examination of other regions and countries, investigating potential similarities and differences, and crafting region-specific sustainability roadmaps. Specifically, an analysis of countries characterized by lower incomes and diminished sustainability performance is essential to discern which aspects of the identified findings should be extrapolated to these nations and to identify strategies that can address and mitigate the remaining disparities.

Furthermore, the temporal scope of the three essays is somewhat constrained, with each study collecting data within a relatively short time frame. Given the extended nature of the sustainability journey, a more comprehensive analysis of changes in supply chain sustainability over time is recommended. This would permit the observation of long-term alterations in supplier selection, such as those influenced by the German Supply Chain Act, and changes in end-customer awareness regarding sustainability. This approach would help identify potential gaps in sustainable behavior, evaluate the effectiveness of specific measures (e.g., the German Supply Chain Act), and formulate corresponding countermeasures. In particular, insights into the effectiveness of the German Supply Chain Act could provide valuable guidance on the implementation of effective sustainability measures for other countries.

Besides, there are additional prospects for research in examining methods to gather and provide essential data to companies and customers. Presently, there is a lack of consistent standards, and ESG data frequently falls short in terms of availability and transparency to the requisite degree. Nevertheless, this condition constitutes a fundamental requirement for executing the strategies identified in all three essays across the entire supply chain. Furthermore, it would engender a shared comprehension of the concept of sustainability and, potentially, foster a greater inclination to engage in and support sustainable actions and consumption.

From a company perspective, the avenues for further research aligning with Essays I and II can be consolidated, given that both essays delve into sustainable supplier selec-

tion. Firstly, the primary focus is on larger companies. Investigating smaller firms offers the potential to draw valuable conclusions since the resources and legal obligations for integrating ESG criteria may significantly differ between firms of various sizes. These findings could contribute to understanding what measures are necessary to enable smaller companies to act more sustainably and integrate ESG considerations into their supplier selection processes. Secondly, the current focus is exclusively on the perspective of buying firms. Incorporating the perspective of suppliers could provide valuable insights into common perspectives, as well as contrasting viewpoints. The latter is crucial for understanding the reasons behind the potential ineffectiveness of certain mechanisms and for developing corresponding countermeasures.

The future research directions pertaining to Essay III should be treated as distinct from those related to Essays I and II due to its focus on the end-consumer viewpoint rather than that of a purchasing firm. The scope of Essay III is confined to the fashion industry. Nonetheless, enhancing sustainability performance within the fashion industry alone does not provide a holistic perspective. It is advisable to apply the insights derived from this study to other domains, developing strategies and measures to comprehensively enhance sustainability performance. Examining solely the end-customer perspective reveals numerous facets, including consumption, nutrition, or mobility. It is imperative to comprehend the pertinent criteria within these domains and the elements for which end-consumers are willing to allocate financial resources, with the ultimate goal of fostering enhanced long-term sustainability performance.

### 5.3 Concluding remarks

The outcomes of this dissertation yield substantive contributions to the body of literature concerning ESG integration across supply chains, spanning from supplier selection to the ultimate end-customers. These contributions aim to enhance sustainability, which, as emphasized in the introductory statement, stands as *one of the greatest challenges of our time*.

When considering the future, it becomes evident that despite the potential challenges

ahead, tangible progress is observable. For instance, corporations are unequivocally implementing measures to enhance their sustainability performance within the supply chain, driven in part by legal mandates. Additionally, end-consumers have not only acknowledged the paramount significance of sustainability but are also demonstrating their dedication by being willing to allocate additional financial resources to advance this pivotal objective. The convergence of heightened awareness among companies, evolving regulatory mandates, and consumer demand suggests that ESG considerations will likely assume greater importance in the future, exerting an influence on the corporate landscape.

The shift towards sustainable practices is a significant and complex process, but pursuing these objectives is crucial for the betterment of future generations. It is a collective responsibility to drive and support these changes and contribute to a more sustainable and ethical global supply chain. While there exist individuals expressing exceedingly critical viewpoints that portend a bleak future, a more sanguine and hopeful outlook materializes upon closer examination of the present dynamics and the eagerness of individuals to actively participate in enhancing overall sustainability performance. If collective efforts are directed toward the aspiration of a more sustainable future, there is a promising probability that this objective will come true.

## 6 | Appendix

### 6.1 Appendix to Essay II

#### 6.1.1 Identification and summary of relevant criteria

**Table 6.1** Criteria identification

Criteria	Identified sub-criteria	Zimmer et al. (2016)	Rashidi et al. (2020)			
		Sub-criteria	#	Sub-criteria	#	
Economic	Quality	Quality	48	Quality	41	
					Service	7
					Service quality	7
	Flexibility	Flexibility	45	-		
	Price (incl. cost)	Price	43	Price	17	
		Cost	36	Cost	23	
	Delivery performance	Logistic cost	27	Transportation cost	4	
		Reverse logistics	25	Delivery	29	
				Loyalty	4	
	Lead time	Lead time	39	Lead time	11	
				Flexibility	11	
	Relationship	Relationship	32	-		
	Technical/ technological Capability	Technical Capability	32	Technology capability	13	
				R&D	8	
Technical capability				5		
Innovation				4		
Design capability				4		
Environment	Environmental management system	Environmental management system	67	Environmental management system	16	
		Controlling of ecological impacts	35			

*Continued on next page*



Table 6.1 – continued from previous page

Criteria	Identified	Zimmer et al. (2016)	Rashidi et al. (2020)		
	sub-criteria	Sub-criteria	#	Sub-criteria	#
Environment	Resource consumption (incl. energy and water)	Resource consumption	51	Resource consumption	6
		Energy consumption	32	Energy consumption	9
		Waste water	34	Waste water	4
	Eco-design	Eco-design	47	Eco-design	10
				Eco-design cost	4
	Recycling and reuse	Recycling	44	Recycling	12
		Reuse	28	Reuse	6
	Air emission	Air emission	27	Air emissions	6
				Pollution control	11
				Pollution production	5
Environmental code of conduct	Environmental code of conduct	23			
Social	Health and safety	Health and safety	14	Work safety & labor health	30
		Safety practices	6		
		Annual number of accidents	3		
	Working conditions	-		Employment practices	9
				Flexible working arrangements	5
				Child labor	4
				Interest and rights of employees	4
	Staff training	Staff training	21	-	
	Stakeholder management	Involvement of stakeholders	22	Information disclosure	6
		Stakeholder relations	11	Local communities influence	5
The rights of stakeholders		8	Contractual stakeholder influence	4	
Social responsibility	Social management commitment	17	Social responsibility	7	
	Donations for sustainable projects	9			
Social code of conduct	Social code of conduct	10			

# = Number of articles that use sub-criteria

## 6.1.2 Detailed analysis per industry

**Table 6.2** Sub-criteria weights and ranks by industry

Criteria	#	Auto & P. (n=28)			Chemicals (n=9)			Consulting (n=22)			Consumer prod. (n=20)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	18%	1		15%	1		15%	1		18%	1	
	1.2	8%	3		7%	4		6%	4		8%	3	
	1.3	12%	2		10%	2		10%	2		10%	2	
	1.4	7%	4	11%	6%	5	12%	7%	3	9%	8%	4	10%
	1.5	4%	7		4%	8		4%	8		4%	9	
	1.6	3%	13		3%	14		3%	12		3%	13	
	1.7	3%	11		4%	10		3%	15		3%	15	
Environmental	2.1	6%	5		8%	3		5%	6		5%	7	
	2.2	4%	9		5%	7		5%	7		5%	5	
	2.3	3%	14	6%	3%	13	8%	3%	13	6%	3%	12	4%
	2.4	3%	12		4%	12		3%	14		3%	11	
	2.5	2%	15		4%	9		3%	17		3%	14	
	2.6	2%	19		2%	21		2%	23		2%	18	
Social	3.1	5%	6		4%	11		6%	5		5%	6	
	3.2	4%	8		5%	6		4%	9		4%	8	
	3.3	2%	16	9%	2%	18	5%	2%	18	6%	2%	16	6%
	3.4	1%	21		2%	20		2%	22		2%	20	
	3.5	1%	23		2%	16		2%	21		1%	23	
	3.6	1%	24		1%	23		1%	24		1%	22	
Governance	4.1	4%	10		2%	19		4%	10		3%	10	
	4.2	2%	18		1%	24		2%	20		2%	19	
	4.3	2%	17	5%	3%	15	2%	4%	11	4%	2%	17	1%
	4.4	1%	20		2%	17		3%	16		2%	21	
	4.5	1%	22		2%	22		2%	19		1%	24	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	Energy (n=8)			Food & bever. (n=10)			Health care (n=23)			Industrials (n=19)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	16%	1		15%	1		17%	1		15%	1	
	1.2	9%	3		8%	2		6%	5		7%	3	
	1.3	14%	2		8%	3		11%	2		8%	2	
	1.4	6%	4	12%	6%	5	6%	7%	3	13%	6%	4	11%
	1.5	5%	6		3%	13		4%	9		4%	9	
	1.6	4%	9		3%	11		3%	14		4%	10	
	1.7	3%	14		2%	18		3%	15		3%	17	
Environmental	2.1	6%	5		5%	8		7%	4		3%	14	
	2.2	5%	7		8%	4		5%	6		5%	6	
	2.3	4%	8	8%	4%	9	4%	4%	11	4%	3%	12	6%
	2.4	3%	12		5%	6		4%	10		4%	11	
	2.5	3%	11		3%	12		3%	13		3%	18	
	2.6	2%	16		2%	17		2%	17		2%	23	
Social	3.1	4%	10		5%	7		5%	7		6%	5	
	3.2	3%	13		4%	10		5%	8		5%	8	
	3.3	2%	17	10%	2%	19	4%	2%	16	5%	3%	16	6%
	3.4	1%	21		1%	22		1%	21		2%	24	
	3.5	1%	18		1%	24		1%	22		2%	20	
	3.6	1%	24		1%	23		1%	23		2%	22	
Governance	4.1	3%	15		3%	16		3%	12		5%	7	
	4.2	1%	19		1%	21		2%	19		2%	21	
	4.3	1%	20	4%	3%	14	4%	2%	18	6%	3%	13	2%
	4.4	1%	23		3%	15		1%	20		3%	15	
	4.5	1%	22		2%	20		1%	24		3%	19	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	Insurance (n=5)			Machinery (n=12)			Real estate (n=18)			Retail (n=9)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	11%	1		19%	1		15%	1		18%	1	
	1.2	5%	8		10%	2		6%	4		4%	9	
	1.3	10%	2		9%	3		8%	2		9%	2	
	1.4	7%	4	8%	8%	4	11%	7%	3	9%	8%	3	5%
	1.5	4%	9		4%	6		5%	8		5%	7	
	1.6	2%	24		3%	14		4%	9		3%	14	
	1.7	3%	11		2%	17		3%	14		2%	15	
Environmental	2.1	7%	3		4%	9		5%	6		4%	8	
	2.2	6%	5		4%	7		5%	7		6%	4	
	2.3	3%	16	5%	3%	11	6%	4%	12	6%	4%	12	7%
	2.4	6%	6		4%	8		3%	13		6%	5	
	2.5	4%	10		2%	16		3%	16		4%	11	
	2.6	3%	14		1%	23		2%	17		2%	17	
Social	3.1	5%	7		3%	10		6%	5		5%	6	
	3.2	3%	15		3%	12		4%	10		4%	10	
	3.3	2%	20	5%	3%	15	7%	2%	18	4%	1%	23	3%
	3.4	2%	22		2%	20		2%	24		2%	21	
	3.5	3%	13		2%	22		2%	23		2%	16	
	3.6	2%	21		1%	24		2%	21		2%	18	
Governance	4.1	2%	19		4%	5		4%	11		1%	22	
	4.2	2%	23		2%	18		2%	19		1%	24	
	4.3	3%	17	9%	3%	13	6%	3%	15	2%	3%	13	6%
	4.4	3%	12		2%	19		2%	20		2%	19	
	4.5	2%	18		2%	21		2%	22		2%	20	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	Software (n=8)			Tech. hardware (n=6)			Textile (n=5)			TMT (n=4)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	16%	1		15%	1		11%	2		12%	2	
	1.2	5%	7		11%	3		3%	16		3%	18	
	1.3	9%	2		14%	2		5%	7		8%	3	
	1.4	7%	4	7%	8%	4	10%	6%	4	6%	3%	12	14%
	1.5	3%	10		5%	6		3%	14		3%	11	
	1.6	4%	9		2%	14		2%	18		4%	10	
	1.7	3%	15		6%	5		2%	22		2%	24	
Environmental	2.1	3%	11		5%	7		4%	10		3%	17	
	2.2	5%	6		4%	9		5%	6		4%	5	
	2.3	3%	14	7%	4%	8	6%	2%	19	4%	2%	23	2%
	2.4	4%	8		3%	11		5%	8		3%	19	
	2.5	3%	12		2%	15		3%	12		3%	13	
	2.6	2%	24		2%	16		3%	17		3%	15	
Social	3.1	8%	3		3%	10		10%	3		4%	8	
	3.2	6%	5		2%	13		11%	1		4%	6	
	3.3	3%	13	5%	2%	17	3%	3%	11	15%	2%	22	4%
	3.4	2%	20		1%	21		3%	13		3%	21	
	3.5	2%	18		2%	20		4%	9		3%	16	
	3.6	2%	23		2%	18		5%	5		3%	14	
Governance	4.1	2%	16		3%	12		3%	15		13%	1	
	4.2	2%	21		1%	24		2%	24		3%	20	
	4.3	2%	22	3%	2%	19	3%	2%	21	5%	4%	9	0%
	4.4	2%	19		1%	22		2%	23		4%	7	
	4.5	2%	17		1%	23		2%	20		4%	4	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	Transportation (n=5)			Other (n=19)		
		GW	GR	CR	GW	GR	CR
Economic	1.1	19%	1		13%	1	
	1.2	7%	3		6%	3	
	1.3	9%	2		9%	2	
	1.4	5%	6	10%	5%	7	8%
	1.5	4%	8		4%	10	
	1.6	3%	13		3%	13	
	1.7	4%	9		3%	16	
Environmental	2.1	7%	4		6%	5	
	2.2	4%	10		6%	6	
	2.3	3%	14	5%	3%	17	4%
	2.4	3%	15		4%	11	
	2.5	2%	17		4%	12	
	2.6	2%	18		2%	23	
Social	3.1	6%	5		6%	4	
	3.2	4%	7		5%	8	
	3.3	3%	12	7%	3%	14	5%
	3.4	2%	19		2%	20	
	3.5	2%	22		2%	19	
	3.6	2%	20		1%	24	
Governance	4.1	3%	11		4%	9	
	4.2	2%	21		2%	22	
	4.3	3%	16	5%	3%	15	3%
	4.4	1%	23		3%	18	
	4.5	1%	24		2%	21	

# = Label of sub-criteria; n = number of experts surveyed

### 6.1.3 Detailed analysis per type of purchasing

**Table 6.13** Sub-criteria weights and ranks by type of purchasing

Criteria	#	Direct (n=143)			Indirect (n=48)			Other (n=39)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	17%	1		16%	1		16%	1	
	1.2	7%	3		7%	3		8%	3	
	1.3	11%	2		9%	2		8%	2	
	1.4	7%	4	10%	7%	4	8%	7%	4	7%
	1.5	4%	9		4%	10		5%	5	
	1.6	3%	13		4%	11		3%	12	
	1.7	3%	15		3%	15		3%	13	
Environmental	2.1	6%	5		5%	7		4%	7	
	2.2	5%	7		6%	5		4%	8	
	2.3	3%	12	5%	3%	12	5%	3%	11	4%
	2.4	4%	10		4%	9		3%	14	
	2.5	3%	14		3%	14		3%	15	
	2.6	2%	18		2%	19		2%	21	
Social	3.1	5%	6		5%	6		5%	6	
	3.2	4%	8		5%	8		4%	10	
	3.3	2%	17	6%	3%	16	5%	2%	16	3%
	3.4	2%	22		2%	21		2%	20	
	3.5	2%	21		2%	18		2%	23	
	3.6	1%	24		2%	24		2%	24	
Governance	4.1	3%	11		3%	13		4%	9	
	4.2	2%	20		2%	22		2%	18	
	4.3	2%	16	3%	2%	17	2%	2%	17	3%
	4.4	2%	19		2%	20		2%	19	
	4.5	1%	23		2%	23		2%	22	

# = Label of sub-criteria; n = number of experts surveyed

### 6.1.4 Detailed analysis by demographic factors

**Table 6.14** Sub-criteria weights and ranks by gender

Criteria	#	Male (n=166)			Female (n=59)			Other (n=5)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	17%	1		15%	1		15%	1	
	1.2	7%	3		7%	3		7%	4	
	1.3	10%	2		9%	2		7%	3	
	1.4	7%	4	9%	7%	4	8%	4%	13	11%
	1.5	4%	8		4%	9		2%	18	
	1.6	3%	13		3%	13		4%	12	
	1.7	3%	15		4%	11		3%	16	
Environmental	2.1	5%	5		6%	5		6%	5	
	2.2	5%	7		5%	6		5%	6	
	2.3	3%	12	5%	3%	15	5%	4%	10	9%
	2.4	4%	10		4%	10		3%	14	
	2.5	3%	14		3%	14		2%	19	
	2.6	2%	19		2%	18		3%	17	
Social	3.1	5%	6		5%	7		7%	2	
	3.2	4%	9		5%	8		3%	15	
	3.3	2%	17	5%	2%	17	5%	2%	22	6%
	3.4	2%	22		2%	22		1%	24	
	3.5	2%	21		2%	24		2%	21	
	3.6	1%	24		2%	23		1%	23	
Governance	4.1	3%	11		4%	12		4%	9	
	4.2	2%	20		2%	20		2%	20	
	4.3	2%	16	3%	2%	16	3%	5%	7	6%
	4.4	2%	18		2%	19		4%	8	
	4.5	1%	23		2%	21		4%	11	

# = Label of sub-criteria; n = number of experts surveyed



**Table 6.15** Sub-criteria weights and ranks by age

Criteria	#	≤ 30 (n=51)			≤ 40 (n=69)			≤ 50 (n=47)			≤ 60 (n=7)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	17%	1		16%	1		16%	1		15%	1	
	1.2	7%	4		8%	3		6%	5		5%	6	
	1.3	10%	2		10%	2		10%	2		11%	2	
	1.4	8%	3	9%	6%	4	10%	6%	4	11%	7%	3	10%
	1.5	4%	8		4%	9		4%	9		5%	7	
	1.6	3%	12		3%	13		3%	13		3%	11	
	1.7	3%	15		3%	14		3%	15		5%	5	
Environmental	2.1	5%	6		6%	5		7%	3		4%	9	
	2.2	5%	7		5%	6		5%	6		3%	15	
	2.3	3%	13		4%	11		3%	14		1%	24	
	2.4	4%	10	6%	4%	10	7%	4%	10	4%	2%	19	4%
	2.5	3%	14		3%	15		3%	12		2%	21	
	2.6	2%	18		2%	20		2%	17		2%	23	
Social	3.1	5%	5		5%	7		5%	7		6%	4	
	3.2	4%	9		4%	8		4%	8		4%	8	
	3.3	2%	17		2%	16		2%	18		3%	16	
	3.4	1%	23	5%	2%	19	7%	2%	22	5%	3%	13	4%
	3.5	1%	22		2%	22		2%	21		3%	18	
	3.6	1%	24		1%	24		2%	23		3%	12	
Governance	4.1	4%	11		4%	12		4%	11		3%	17	
	4.2	2%	20		2%	21		2%	20		2%	20	
	4.3	3%	16	3%	2%	17	4%	2%	16	2%	4%	10	3%
	4.4	2%	19		2%	18		2%	19		3%	14	
	4.5	2%	21		1%	23		2%	24		2%	22	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	> 60 (n=56)		
		GW	GR	CR
Economic	1.1	16%	1	
	1.2	6%	4	
	1.3	11%	2	
	1.4	7%	3	7%
	1.5	5%	7	
	1.6	3%	14	
	1.7	3%	13	
Environmental	2.1	4%	9	
	2.2	5%	6	
	2.3	3%	11	3%
	2.4	4%	10	
	2.5	3%	15	
	2.6	2%	20	
Social	3.1	5%	5	
	3.2	4%	8	
	3.3	3%	16	4%
	3.4	2%	22	
	3.5	2%	21	
	3.6	2%	24	
Governance	4.1	3%	12	
	4.2	2%	23	
	4.3	2%	17	2%
	4.4	2%	18	
	4.5	2%	19	

# = Label of sub-criteria; n = number of experts surveyed

### 6.1.5 Detailed analysis by expert experience

**Table 6.16** Sub-criteria weights and ranks by years of purchasing experience

Criteria	#	$\leq 1$ year (n=18)			$\leq 3$ years (n=20)			$\leq 5$ years (n=31)			$\leq 10$ years (n=41)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	14%	1		18%	1		17%	1		16%	1	
	1.2	5%	5		9%	2		8%	4		7%	4	
	1.3	7%	3		9%	3		10%	2		12%	2	
	1.4	5%	6	7%	7%	4	10%	8%	3	9%	8%	3	9%
	1.5	4%	11		4%	8		4%	8		5%	7	
	1.6	3%	14		3%	13		3%	12		3%	12	
	1.7	3%	19		3%	15		3%	14		3%	14	
Environmental	2.1	5%	8		5%	6		4%	7		6%	5	
	2.2	5%	7		5%	5		6%	5		4%	9	
	2.3	3%	13	9%	4%	10	9%	3%	11	5%	3%	11	5%
	2.4	3%	16		4%	12		4%	10		4%	10	
	2.5	3%	18		3%	14		3%	15		3%	13	
	2.6	1%	24		2%	18		2%	17		2%	16	
Social	3.1	7%	2		4%	7		5%	6		5%	6	
	3.2	5%	9		4%	9		4%	9		4%	8	
	3.3	3%	17	3%	2%	16	6%	2%	18	6%	2%	18	6%
	3.4	2%	21		2%	19		1%	24		2%	22	
	3.5	2%	22		1%	22		1%	21		2%	20	
	3.6	2%	23		1%	24		1%	23		2%	23	
Governance	4.1	7%	4		4%	11		3%	13		3%	15	
	4.2	3%	15		2%	20		2%	20		1%	24	
	4.3	4%	10	2%	2%	17	3%	2%	16	4%	2%	17	3%
	4.4	3%	12		1%	21		2%	19		2%	21	
	4.5	2%	20		1%	23		1%	22		2%	19	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	> 10 years (n=120)		
		GW	GR	CR
Economic	1.1	16%	1	
	1.2	7%	3	
	1.3	10%	2	
	1.4	7%	4	10%
	1.5	4%	9	
	1.6	3%	12	
	1.7	3%	15	
Environmental	2.1	5%	5	
	2.2	5%	7	
	2.3	3%	13	4%
	2.4	4%	10	
	2.5	3%	14	
	2.6	2%	19	
Social	3.1	5%	6	
	3.2	4%	8	
	3.3	3%	16	5%
	3.4	2%	22	
	3.5	2%	21	
	3.6	1%	24	
Governance	4.1	3%	11	
	4.2	2%	20	
	4.3	2%	17	3%
	4.4	2%	18	
	4.5	2%	23	

# = Label of sub-criteria; n = number of experts surveyed

**Table 6.17** Sub-criteria weights and ranks by years of company tenure

Criteria	#	≤ 1 year (n=7)			≤ 3 years (n=68)			≤ 5 years (n=46)			≤ 10 years (n=38)		
		GW	GR	CR	GW	GR	CR	GW	GR	CR	GW	GR	CR
Economic	1.1	12%	1		17%	1		17%	1		18%	1	
	1.2	4%	8		6%	4		7%	3		7%	3	
	1.3	8%	2		12%	2		9%	2		10%	2	
	1.4	6%	4	8%	7%	3	8%	6%	4	9%	7%	4	12%
	1.5	4%	12		4%	8		4%	11		4%	9	
	1.6	2%	18		3%	13		3%	13		3%	12	
	1.7	5%	6		3%	15		3%	14		3%	14	
Environmental	2.1	5%	7		5%	5		6%	5		5%	7	
	2.2	7%	3		5%	6		5%	7		5%	6	
	2.3	4%	13	4%	3%	12	6%	4%	10	6%	3%	15	5%
	2.4	4%	10		4%	10		3%	12		4%	10	
	2.5	4%	11		3%	14		3%	15		3%	13	
	2.6	2%	19		2%	19		2%	20		2%	19	
Social	3.1	4%	9		5%	7		5%	6		6%	5	
	3.2	5%	5		4%	9		4%	8		4%	8	
	3.3	2%	17	3%	2%	17	5%	2%	16	6%	2%	17	6%
	3.4	2%	22		1%	20		2%	22		2%	22	
	3.5	2%	21		1%	21		2%	23		2%	21	
	3.6	2%	23		1%	24		1%	24		1%	24	
Governance	4.1	4%	14		3%	11		4%	9		3%	11	
	4.2	2%	24		1%	22		2%	18		2%	20	
	4.3	3%	15	4%	2%	16	2%	2%	17	5%	2%	16	3%
	4.4	3%	16		2%	18		2%	19		2%	18	
	4.5	2%	20		1%	23		2%	21		2%	23	

# = Label of sub-criteria; n = number of experts surveyed

Criteria	#	> 10 years (n=55)			n/a (n=16)		
		GW	GR	CR	GW	GR	CR
Economic	1.1	15%	1		16%	1	
	1.2	7%	3		9%	3	
	1.3	9%	2		9%	2	
	1.4	7%	4	10%	8%	4	8%
	1.5	4%	8		5%	6	
	1.6	3%	12		3%	13	
	1.7	3%	15		3%	14	
Environmental	2.1	6%	5		4%	10	
	2.2	5%	6		4%	8	
	2.3	3%	11	4%	4%	9	5%
	2.4	4%	10		3%	12	
	2.5	3%	14		2%	16	
	2.6	2%	18		2%	22	
Social	3.1	5%	7		6%	5	
	3.2	4%	9		4%	7	
	3.3	2%	17	6%	3%	15	4%
	3.4	2%	22		2%	18	
	3.5	2%	21		2%	20	
	3.6	2%	23		2%	21	
Governance	4.1	3%	13		3%	11	
	4.2	2%	20		2%	17	
	4.3	3%	16	2%	2%	19	4%
	4.4	2%	19		2%	23	
	4.5	2%	24		1%	24	

# = Label of sub-criteria; n = number of experts surveyed

## 6.2 Appendix to Essay III

### 6.2.1 Sustainable attributes

**Table 6.19** Sustainable attributes and levels for the choice experiment

ESG dimension	Attribute	Clothing	Level									
			1	2	3	4	5	6	7	8	9	10
Environment	CO <sub>2</sub> (kg)	Socks	3.5	3.1	2.7	2.4	2	1.6	1.2	0.8	0.5	0.1
		T-Shirt	35	31	27	24	20	16	12	8	5	1
		Pants	57	51	45	39	33	27	21	15	9	3
		Suit	181	162	142	122	103	83	63	43	24	4
	Water consumption (l)	Socks	345	307	269	231	193	155	117	79	41	3
		T-Shirt	3,450	3,090	2,730	2,369	2,009	1,649	1,289	928	568	208
		Pants	12,650	11,329	10,008	8,688	7,367	6,046	4,725	3,404	2,083	763
		Suit	18,605	16,662	14,720	12,777	10,835	8,892	6,949	5,007	3,064	1,122
	Energy consumption (MJ)	Socks	18	16	14	12	11	9	7	5	4	2
		T-Shirt	191	172	153	134	115	96	77	58	39	19
		Pants	777	700	622	545	467	390	312	234	157	79
		Suit	2,650	2,396	2,141	1,887	1,633	1,378	1,124	870	615	361
	Waste production (g)	Socks	6.4	6.1	5.9	5.6	5.4	5.1	4.8	4.6	4.3	4.1
		T-Shirt	64	61	59	56	54	51	48	46	43	41
		Pants	255	245	235	224	214	204	194	184	173	163
		Suit	383	367	352	337	321	306	291	275	260	245
Social	Workforce score	All	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	Human rights score	All	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Governance	Management score	All	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	CSR strategy score	All	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

## 6.2.2 Descriptive results

**Table 6.20** Influence of gender on timing of last purchase

Product	Gender	Within last month	Within last three months	Within last year	More than year ago	Never	Total	
Socks (Sig. (2-tailed): 0.634)	Female	Count	101	120	68	39	6	334
		% within Gender	30%	36%	20%	12%	2%	100%
	Male	Count	115	142	97	41	4	399
		% within Gender	29%	36%	24%	10%	1%	100%
	Total	Count	216	262	165	80	10	733
	% within Gender	29%	36%	23%	11%	1%	100%	
T-shirts (Sig. (2-tailed): 0.013)	Female	Count	148	119	40	24	3	334
		% within Gender	44%	36%	12%	7%	1%	100%
	Male	Count	140	139	83	33	4	399
		% within Gender	35%	35%	21%	8%	1%	100%
	Total	Count	288	258	123	57	7	733
	% within Gender	39%	35%	17%	8%	1%	100%	
Pants (Sig. (2-tailed): <0.001)	Female	Count	119	117	67	27	4	334
		% within Gender	36%	35%	20%	8%	1%	100%
	Male	Count	95	113	131	58	2	399
		% within Gender	24%	28%	33%	15%	1%	100%
	Total	Count	214	230	198	85	6	733
	% within Gender	29%	31%	27%	12%	1%	100%	
Suit (Sig. (2-tailed): <0.001)	Female	Count	15	30	66	117	106	334
		% within Gender	4%	9%	20%	35%	32%	100%
	Male	Count	16	35	65	213	70	399
		% within Gender	4%	9%	16%	53%	18%	100%
	Total	Count	31	65	131	330	176	733
	% within Gender	4%	9%	18%	45%	24%	100%	



**Table 6.21** Influence of age on timing of last purchase

Product	Last purchase (weeks)	N	Average age		
			1	2	3
Socks (Sig. (2-tailed): < 0.001)	Within last month	216	46		
	Within last three months	262	47		
	Within last year	165	51	51	
	Never	10	51	51	
	More than a year ago	80		58	
T-shirt (Sig. (2-tailed): < 0.001)	Within last month	288	46		
	Within last three months	258	48	48	
	Within last year	123	53	53	
	More than a year ago	57		59	59
	Never	7			66
Pants (Sig. (2-tailed): < 0.001)	Within last month	214	44		
	Within last three months	230	48	48	
	Within last year	198	50	50	
	More than a year ago	85		59	59
	Never	6			66
Suit (Sig. (2-tailed): < 0.001)	Within last month	31	35		
	Within last three months	65	36	36	
	Within last year	131		42	
	Never	176			53
	More than a year ago	330			53

**Table 6.22** Influence of income on timing of last purchase

Product	Last purchase (weeks)	N	Average income	
			1	2
Socks (Sig. (2-tailed): 0.093)	Within last month	208	3416	
	Within last three months	254	3278	
	More than a year ago	155	2994	2994
	Within last year	74	2986	2986
	Never	9		1722
T-shirt (Sig. (2-tailed): 0.002)	Within last month	278	3509	
	Within last three months	248	3220	3220
	Within last year	115	2878	2878
	More than a year ago	52	2442	2442
	Never	7		1643
Pants (Sig. (2-tailed): 0.089)	Within last month	207	3408	
	Within last three months	216	3331	3331
	More than a year ago	81	3111	3111
	Within last year	190	2929	2929
	Never	6		1667
Suit (Sig. (2-tailed): < 0.001)	Within last month	31		4371
	Within last three months	62		3718
	More than a year ago	313		3419
	Within last year	129		3415
	Never	165	2224	

**Table 6.23** Correlation between age and income to shopping frequency

	Age	Income
Correlation coefficient	0.400 ***	-0.151 ***
Sig. (2-tailed)	< 0.001	< 0.001
N	733	700

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.24** Correlation between age and stated average prices per clothing article

	Socks	T-shirt	Pants	Suits
Correlation coefficient	-0.234 ***	-0.188 ***	0.103 ***	0.179 ***
Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001
N	728	725	723	729

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

Note: Not all participants stated average prices per clothing article; unrealistic high values excluded

**Table 6.25** Influence of gender on stated average prices per clothing article

	Socks		T-shirt		Pants		Suit	
	N	Mean	N	Mean	N	Mean	N	Mean
Female	332	5.99**	331	20.34	330	46.78***	333	99.23***
Male	396	7.03**	394	21.89	393	63.16***	396	194.84***
Sig. (2-tailed)		0.031		0.252		< 0.001		< 0.001

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

Note: Not all participants stated average prices per clothing article; unrealistic high values excluded

**Table 6.26** Influence of gender on person shopping

Gender (Sig. (2-tailed):< 0.001)		Myself	Other	Parents	Partner	Total
Female	Count	324	2	4	4	334
	% within Gender	97%	1%	1%	1%	100%
Male	Count	357	1	4	37	399
	% within Gender	89%	0%	1%	9%	100%
Total	Count	681	3	8	41	733
	% within Gender	93%	0%	1%	6%	100%

**Table 6.27** Correlation between age and factors of TPB

		Factor				
		Attitude	Subjective norm	PBC	Intention	Behavior
Age	Correlation coef.	-0.0135	-0.186***	-0.0072	-0.0689*	-0.095**
	Sig. (2-tailed)	0.715	< 0.001	0.845	0.062	0.010
	N	733	733	733	733	733
Income	Correlation coef.	0.0737*	0.0667*	-0.0388	0.0656*	0.1000***
	Sig. (2-tailed)	0.051	0.078	0.306	0.083	0.008
	N	700	700	700	700	700

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.28** Influence of age on label usefulness

Label usefulness (Sig. (2-tailed): < 0.001)	N	Average age		
		1	2	3
Traffic light	124	46		
Scorecard + impact	358	48		
Scorecard	134	49	49	
No label	92		56	56
Text-only	25			57

**Table 6.29** Influence of factors of TPB on label usefulness

Factor	Label type	N	Average factor score	
			1	2
Attitude (Sig. (2-tailed): < 0.001)	Text-only	25	0.292	
	Scorecard + impact	358	0.213	
	Scorecard	134	0.149	
	Traffic light	124	0.070	
	No label	92		-1.221
Subjective norm (Sig. (2-tailed): < 0.001)	Traffic light	124	0.177	
	Scorecard + impact	358	0.147	
	Scorecard	134	0.043	
	Text-only	25	-0.019	
	No label	92		-0.870
PBC (Sig. (2-tailed): < 0.001)	Text-only	25	0.241	
	Scorecard	134	0.148	
	Traffic light	124	0.088	
	Scorecard + impact	358	0.054	
	No label	92		-0.610
Intention (Sig. (2-tailed): < 0.001)	Text-only	25	0.173	
	Scorecard + impact	358	0.172	
	Traffic light	124	0.146	
	Scorecard	134	0.104	
	No label	92		-1.063
Behavior (Sig. (2-tailed): < 0.001)	Scorecard + impact	358	0.166	
	Text-only	25	0.147	
	Scorecard	134	0.108	
	Traffic light	124	0.056	
	No label	92		-0.918

### 6.2.3 Complementary analysis for choice experiments without sustainable information

**Table 6.30** Correlation between selected sample factors and significant parameters of socks choice experiment without sustainable information

Parameter		Price $\mu$	Willingness-to-pay			
			Recycled materials	CoM Germany	Medium quality	High quality
Age	Correlation coef.	-0.134***	-0.012	-0.058	-0.034	-0.069
	Sig. (2-tailed)	< 0.001	0.752	0.116	0.359	0.061
Income	Correlation coef.	-0.033	-0.006	-0.030	-0.055	-0.039
	Sig. (2-tailed)	0.385	0.878	0.430	0.144	0.360
Shopping frequency	Correlation coef.	-0.204***	0.008	-0.083**	-0.041	-0.054
	Sig. (2-tailed)	< 0.001	0.823	0.025	0.272	0.148
Stated price socks	Correlation coef.	-0.279***	-0.107***	0.152***	0.125***	0.115***
	Sig. (2-tailed)	< 0.001	0.004	< 0.001	0.001	0.002
Gender	Corr. female	-0.269**	-2.595	7.969	3.703	6.250*
	Corr. male	-0.241**	-1.595	5.411	2.773	3.420*
	Sig. (2-tailed)	0.006	0.123	0.156	0.407	0.065

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.31** Correlation between selected sample factors and significant parameters of t-shirt choice experiment without sustainable information

Parameter		Price $\mu$	Willingness-to-pay			
			CoM Europe	CoM Germany	Medium quality	High quality
Age	Correlation coef.	0.181***	0.181***	0.181***	0.181***	0.181*
	Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Income	Correlation coef.	0.009	0.007	0.007	0.007	0.007
	Sig. (2-tailed)	0.821	0.855	0.855	0.855	0.855
Shopping frequency	Correlation coef.	-0.212***	-0.207***	-0.207***	-0.207***	-0.207***
	Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Stated price t-shirt	Correlation coef.	0.220***	0.219***	0.219***	0.219***	0.219***
	Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Gender	Corr. female	-0.051	17.117	21.537	14.122	23.748
	Corr. male	-0.048	17.534	22.062	14.467	24.327
	Sig. (2-tailed)	0.111	0.888	0.888	0.888	0.888

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.32** Correlation between selected sample factors and significant parameters of pants choice experiment without sustainable information

Parameter		Price $\mu$	Willingness-to-pay			
			Wool	Polyester	CoM Bangladesh	Medium quality
Age	Correlation coef.	-0.130***	0.131***	0.086**	-0.105***	-0.099***
	Sig. (2-tailed)	< 0.001	< 0.001	0.020	0.004	0.007
Income	Correlation coef.	0.010	0.001	-0.017	-0.037	-0.052
	Sig. (2-tailed)	0.797	0.983	0.662	0.330	0.163
Shopping frequency	Correlation coef.	-0.161***	0.142***	0.065***	0.001	-0.085**
	Sig. (2-tailed)	< 0.001	< 0.001	0.0079	0.969	0.021
Stated price pants	Correlation coef.	0.160***	-0.133***	-0.189***	0.002	0.066*
	Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	0.949	0.076
Gender	Corr. female	-0.027**	-15.599	-45.103	2.296	41.462
	Corr. male	-0.025**	-21.663	-62.988	-0.192	55.792
	Sig. (2-tailed)	0.026	0.131	0.135	0.431	0.148

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.33** Correlation between selected sample factors and significant parameters of suits choice experiment without sustainable information

Parameter		Price $\mu$	Willingness-to-pay				
			Recycled materials	Europe	Vietnam	Med. qual.	High qual.
Age	Correlation coef.	-0.139***	0.050	-0.030	-0.042	-0.051	-0.071*
	Sig. (2-tailed)	< 0.001	0.179	0.412	0.259	0.164	0.054
Income	Correlation coef.	0.022	-0.011	0.110***	0.014	0.052	0.088**
	Sig. (2-tailed)	0.566	0.765	0.004	0.717	0.173	0.020
Shopping frequency	Correlation coef.	-0.231***	-0.056	-0.096***	-0.086**	-0.118***	-0.119***
	Sig. (2-tailed)	< 0.001	0.132	0.009	0.020	0.001	0.001
Stated price suit	Correlation coef.	0.104***	-0.038	0.106***	-0.047	0.088**	0.141***
	Sig. (2-tailed)	0.005	0.300	0.004	0.204	0.017	< 0.001
Gender	Corr. female	-0.007***	7.740	499.377	-69.618	293.746	459.451
	Corr. male	-0.007***	2.728	226.912	38.158	215.693	270.465
	Sig. (2-tailed)	0.009	0.955	0.114	0.192	0.566	0.309

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

## 6.2.4 Complementary analysis for choice experiments with sustainable information

**Table 6.34** Correlation between selected sample factors and significant parameters of socks choice experiment with sustainable information

Parameter		Price $\mu$	Willingness-to-pay		
			Recycled materials	CoM Germany	High quality
Age	Correlation coef.	-0.132***	-0.010	-0.066*	-0.044
	Sig. (2-tailed)	< 0.001	0.786	0.076	0.236
Income	Correlation coef.	-0.024	< 0.001	-0.060	-0.061
	Sig. (2-tailed)	0.528	0.998	0.110	0.109
Shopping frequency	Correlation coef.	-0.186***	-0.021	-0.122***	-0.097***
	Sig. (2-tailed)	< 0.001	0.565	0.001	0.008
Stated price socks	Correlation coef.	0.212***	0.010	0.160***	0.090*
	Sig. (2-tailed)	< 0.001	0.779	< 0.001	0.015
Gender	Corr. female	-0.224	-5.561	3.578	6.870
	Corr. male	-0.214	9.395	8.359	-3.942
	Sig. (2-tailed)	0.279	0.326	0.733	0.236

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.35** Correlation between selected sample factors and significant parameters of t-shirt choice experiment with sustainable information

Parameter		Price $\mu$	Willingness-to-pay		
			Polyester	Medium quality	L3 - Environment
Age	Correlation coef.	-0.175***	0.112***	-0.147***	0.080*
	Sig. (2-tailed)	< 0.001	0.002	< 0.001	0.031
Income	Correlation coef.	-0.005	-0.044	-0.038	-0.025
	Sig. (2-tailed)	0.900	0.247	0.313	0.513
Shopping frequency	Correlation coef.	-0.210***	0.124***	-0.150***	0.114***
	Sig. (2-tailed)	< 0.001	0.001	< 0.001	0.002
Stated price t-shirt	Correlation coef.	0.157***	-0.092*	0.105***	-0.123***
	Sig. (2-tailed)	< 0.001	0.0130	0.005	0.001
Gender	Corr. female	-0.040*	-22.251	19.489	-17.693
	Corr. male	-0.038*	-29.865	25.562	-27.566
	Sig. (2-tailed)	0.084	0.240	0.162	0.389

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.36** Correlation between selected sample factors and significant parameters of pants choice experiment with sustainable information

Parameter		Price $\mu$	Willingness-to-pay		
			Wool	Polyester	CoM Europe
Age	Correlation coef.	-0.068*	0.065*	-0.012	0.029
	Sig. (2-tailed)	0.065	0.078	0.753	0.434
Income	Correlation coef.	-0.038	-0.020	-0.016	-0.030
	Sig. (2-tailed)	0.322	0.602	0.667	0.422
Shopping frequency	Correlation coef.	-0.123***	0.051	-0.073*	0.021
	Sig. (2-tailed)	0.001	0.169	0.048	0.577
Stated price pants	Correlation coef.	0.065*	0.017	-0.034	0.057
	Sig. (2-tailed)	0.079	0.652	0.363	0.123
Gender	Corr. female	-0.027*	44.778	64.063	-110.703
	Corr. male	-0.024*	-29.277	-238.363	41.189
	Sig. (2-tailed)	0.015	0.408	0.184	0.279

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.36 contd.** Correlation between selected sample factors and significant parameters of pants choice experiment with sustainable information

Parameter		Willingness-to-pay			
		CoM Germany	High quality	L3 - Environment	L3 - Governance
Age	Correlation coef.	0.015	-0.011	0.039	-0.024
	Sig. (2-tailed)	0.682	0.768	0.290	0.510
Income	Correlation coef.	-0.006	-0.020	-0.027	0.003
	Sig. (2-tailed)	0.873	0.596	0.474	0.940
Shopping frequency	Correlation coef.	-0.022	-0.034	0.038	-0.075*
	Sig. (2-tailed)	0.544	0.355	0.309	0.043
Stated price pants	Correlation coef.	0.056	0.063*	-0.026	0.077*
	Sig. (2-tailed)	0.135	0.092	0.489	0.038
Gender	Corr. female	-248.377	117.769	363.807	-217.774
	Corr. male	86.168	208.425	-177.007	10.595
	Sig. (2-tailed)	0.106	0.511	0.218	0.649

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

**Table 6.37** Correlation between selected sample factors and significant parameters of suits choice experiment with sustainable information

Parameter		Price $\mu$	Willingness-to-pay			
			Organic cotton	High quality	L2 Social	L3 - Social
Age	Correlation coef.	-0.064*	-0.030	0.005	-0.008	-0.046
	Sig. (2-tailed)	0.084	0.421	0.886	0.834	0.214
Income	Correlation coef.	0.027	-0.043	-0.007	-0.041	-0.042
	Sig. (2-tailed)	0.482	0.253	0.85	0.284	0.269
Shopping frequency	Correlation coef.	-0.128***	-0.023	-0.059	-0.051	-0.034
	Sig. (2-tailed)	0.001	0.532	0.109	0.171	0.363
Stated price suit	Correlation coef.	0.067*	-0.013	0.041	0.010	-0.001
	Sig. (2-tailed)	0.073	0.717	0.272	0.797	0.989
Gender	Corr. female	-0.005	181.983	284.614	23.742	536.022
	Corr. male	-0.004	34.791	176.000	27.11	232.006
	Sig. (2-tailed)	0.119	0.191	0.403	0.817	0.145

Correlation (2-tailed) is significant at the \*0.10 \*\*0.05 \*\*\*0.01 level

## Bibliography

- Ageron, B., Gunasekaran, A., and Spalanzani, A. (2012). Sustainable supply management: An empirical study. *International Journal of Production Economics*, 140(1):168–182.
- Ahmad, M. T. and Mondal, S. (2016). Dynamic supplier selection model under two-echelon supply network. *Expert Systems with Applications*, 65:255–270.
- Aitken, R., Watkins, L., Williams, J., and Kean, A. (2020). The positive role of labelling on consumers' perceived behavioural control and intention to purchase organic food. *Journal of Cleaner Production*, 255:120334.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2):179–211.
- Alinezad, A., Seif, A., and Esfandiari, N. (2013). Supplier evaluation and selection with QFD and FAHP in a pharmaceutical company. *The International Journal of Advanced Manufacturing Technology*, 68(1-4):355–364.
- Alkahtani, M., Al-Ahmari, A., Kaid, H., and Sonboa, M. (2019). Comparison and evaluation of multi-criteria supplier selection approaches: A case study. *Advances in Mechanical Engineering*, 11(2):168781401882292.
- Ampenberger, M. (2010). Unternehmenspolitik in börsennotierten Familienunternehmen: Eine Analyse von Investitions-, Diversifikations- und Kapitalstrukturrentscheidungen. *Entrepreneurial and Financial Studies*.
- Andersen, M. and Skjoett-Larsen, T. (2009). Corporate social responsibility in global supply chains. *Supply Chain Management: An International Journal*, 14(2):75–86.
- Apostolou, B. and Hassell, J. M. (1993). An empirical examination of the sensitivity of the analytic hierarchy process to departures from recommended consistency ratios. *Mathematical and Computer Modelling*, 17(4):163–170.
- Assent (2022). Moving from CSR to ESG. <https://www.assent.com/solutions/esg-supply-chain/esg-vs-csr/>; accessed on October 3rd, 2022.
- Badri Ahmadi, H., Hashemi Petrudi, S. H., and Wang, X. (2017). Integrating sustainability into supplier selection with analytical hierarchy process and improved grey relational analysis: A case of telecom industry. *The International Journal of Advanced Manufacturing Technology*, 90(9-12):2413–2427.
- Bai, C., Kusi-Sarpong, S., Badri Ahmadi, H., and Sarkis, J. (2019). Social sustainable supplier evaluation and selection: A group decision-support approach. *International Journal of Production Research*, 57(22):7046–7067.



- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1):99–120.
- Barney, J., Wright, M., and Ketchen, D. J. (2001). The resource-based view of the firm: Ten years after 1991. *Journal of Management*, 27(6):625–641.
- Bartlett, M. S. (1951). The effect of standardization on a chi-quadrat approximation in factor analysis. *Biometrika*, 38(3/4):337–344.
- Bastounis, A., Buckell, J., Hartmann-Boyce, J., Cook, B., King, S., Potter, C., Bianchi, F., Rayner, M., and Jebb, S. A. (2021). The impact of environmental sustainability labels on willingness-to-pay for foods: A systematic review and meta-analysis of discrete choice experiments. *Nutrients*, 13(8):2677.
- Bayer AG (2019). Supplier code of conduct. <https://www.bayer.com/en/procurement/supplier-code-of-conduct>; accessed on April 14th 2022.
- Bede, B. (2013). Fuzzy analysis: Mathematics of fuzzy sets and fuzzy logic (pp. 137-170). *Springer Berlin Heidelberg*.
- Bellmann, R. E. and Zadeh, L. (1970). Decision-making in a fuzzy environment. *Management Science*, 17(4):209–215.
- Ben-Amar, W., Chang, M., and McIlkenny, P. (2017). Board gender diversity and corporate response to sustainability initiatives: Evidence from the carbon disclosure project. *Journal of Business Ethics*, 142(2):369–383.
- Bernard, J. C., Hustvedt, G., and Carroll, K. A. (2013). What is a label worth? Defining the alternatives to organic for US wool producers. *Journal of Fashion Marketing and Management: An International Journal*, 17(3):266–279.
- Bhutta, K. S. and Huq, F. (2002). Supplier selection problem: A comparison of the total cost of ownership and analytic hierarchy process approaches. *Supply Chain Management: An International Journal*, 7(3):126–135.
- Bliemer, M. C. and Rose, J. M. (2023). Designing and conducting stated choice experiments. In *Handbook of Choice Modelling 2023*. Cheltenham: Edward Elgar Publishing.
- Borriello, A., Massey, G., and Rose, J. M. (2022). Extending the theory of planned behaviour to investigate the issue of microplastics in the marine environment. *Marine Pollution Bulletin*, 179:113689.
- Boufous, S., Hudson, D., and Carpio, C. (2023). Consumer willingness to pay for production attributes of cotton apparel. *Agribusiness*, 39(4):1026–1048.
- Brand, B. M., Rausch, T. M., and Brandel, J. (2022). The importance of sustainability aspects when purchasing online: Comparing generation x and generation z. *Sustainability*, 14(9):5689.
- Brush, S. (2023). Blackrock, state street among money managers closing ESG funds. *Bloomberg*, 20 September 2023.
- Bryant, A. and Charmaz, K. (2007). *The SAGE handbook of grounded theory*. Sage, Los Angeles.

- Capital Group (2022). ESG global study. <https://www.capitalgroup.com/institutional/investments/esg/perspectives/esg-global-study.html>; accessed on September 27th 2023.
- Casadesus-Masanell, R., Crooke, M., Reinhardt, F., and Vasisht, V. (2009). Households' willingness to pay for "green" goods: Evidence from patagonia's introduction of organic cotton sportswear. *Journal of Economics & Management Strategy*, 18(1):203–233.
- Cerri, J., Testa, F., and Rizzi, F. (2018). The more I care, the less I will listen to you: How information, environmental concern and ethical production influence consumers' attitudes and the purchasing of sustainable products. *Journal of Cleaner Production*, 175:343–353.
- Cervellon, M.-C. and Wernerfelt, A.-S. (2012). Knowledge sharing among green fashion communities online. *Journal of Fashion Marketing and Management*, 16(2):176–192.
- Chai, J., Liu, J. N., and Ngai, E. W. (2013). Application of decision-making techniques in supplier selection: A systematic review of literature. *Expert Systems with Applications*, 40(10):3872–3885.
- Chang, D.-Y. (1996). Application of the extent analysis method on fuzzy AHP. *European Journal of Operational Research*, 95(3):649–655.
- Chang, H., Chen, J., Khimich, N. V., and Wu, G.-S. (2015). Implications of customer-supplier relationships on corporate governance. *Available at SSRN 2640674*.
- Chapagain, A. K., Hoekstra, A. Y., Savenije, H., and Gautam, R. (2006). The water footprint of cotton consumption: An assessment of the impact of worldwide consumption of cotton products on the water resources in the cotton producing countries. *Ecological Economics*, 60(1):186–203.
- Che, Z. H. and Chang, Y. F. (2016). Integrated methodology for supplier selection: The case of a sphygmomanometer manufacturer in Taiwan. *Journal of Business Economics and Management*, 17(1):17–34.
- Chekima, B., Syed Khalid Wafa, S. A. W., Igau, O. A., Chekima, S., and Sondoh, S. L. (2016). Examining green consumerism motivational drivers: Does premium price and demographics matter to green purchasing? *Journal of Cleaner Production*, 112:3436–3450.
- Cheraghi, S. H., Dadashzadeh, M., and Subramanian, M. (2004). Critical success factors for supplier selection - an update. *Journal of Applied Business Research*, 20(2).
- Ching, H. Y. (2020). Responsible investment and the disclosure of ESG information in the companies' integrated reports. In Leal Filho, W., Tortato, U., and Frankenberger, F., editors, *Universities and Sustainable Communities: Meeting the Goals of the Agenda 2030*, World Sustainability Series, pages 449–463. Springer International Publishing, Cham.
- Chiou, C. Y., Hsu, C. W., and Hwang, W. Y. (2008). Comparative investigation on green supplier selection of the American, Japanese and Taiwanese electronics industry in China. In *2008 IEEE International Conference on Industrial Engineering and Engineering Management*, pages 1909–1914. IEEE.

- Chodnicka-Jaworska, P. (2021). ESG as a measure of credit ratings. *Risks*, 9(12):226.
- Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, 78(1):98–104.
- Daniel, R. (1961). Management information crisis. *Harvard Business Review*, 39:111–121.
- de Villiers, C., Naiker, V., and van Staden, C. J. (2011). The effect of board characteristics on firm environmental performance. *Journal of Management*, 37(6):1636–1663.
- Deutsche Schutzvereinigung für Wertpapierbesitz e.V. (2022). Studie zur Vergütung der Vorstände in den DAX- und MDAX-Unternehmen im Geschäftsjahr 2021.
- Dhir, A., Sadiq, M., Talwar, S., Sakashita, M., and Kaur, P. (2021). Why do retail consumers buy green apparel? A knowledge-attitude-behaviour-context perspective. *Journal of Retailing and Consumer Services*, 59:102398.
- Dickson, G. W. (1966). An analysis of vendor selection systems and decisions. *Journal of Purchasing*, 2(1):5–17.
- Dickson, M. A. (2001). Utility of no sweat labels for apparel consumers: Profiling label users and predicting their purchases. *The Journal of Consumer Affairs*, 35(1):96–119.
- Diekmann, A. and Preisendörfer, P. (2003). Green and greenback. *Rationality and Society*, 15(4):441–472.
- Dodds, R., Pitts, R. E., and Smith, W. W. (2016). Willingness to pay for environmentally linked clothing at an event: Visibility, environmental certification, and level of environmental concern. *Tourism Recreation Research*, 41(3):283–290.
- Drempetic, S., Klein, C., and Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, 167(2):333–360.
- Eisenhardt, K. M. (1989a). Agency theory: An assessment and review. *Academy of Management Review*, 14(1):57–74.
- Eisenhardt, K. M. (1989b). Building theories from case study research. *Academy of Management Review*, 14(4):532–550.
- Eisenhardt, K. M. (1991). Better stories and better constructs: The case for rigor and comparative logic. *Academy of Management Review*, 16(3):620–327.
- Eisenhardt, K. M. and Graebner, M. E. (2007). Theory building from cases: Opportunities and challenges. *Academy of Management Journal*, 50(1):25–35.
- Elkington, J. (1998). Accounting for the triple bottom line. *Measuring Business Excellence*, 3(2):18–22.
- Ellis, J. L., McCracken, V. A., and Skuza, N. (2012). Insights into willingness to pay for organic cotton apparel. *Journal of Fashion Marketing and Management: An International Journal*, 16(3):290–305.

- Engle, K. J., Nelson, A., Zhao, Z., and Chi, T. (2018). Impact of life cycle assessment (lca) labelling on us consumers' purchase intentions toward sustainable denim jeans. *International Textile and Apparel Association Annual Conference Proceedings*, 75(1).
- European Commission (2019). Special eurobarometer 501: Attitudes of european citizens towards the environment.
- European Commission (2021). Eu sustainable finance: April package. [https://ec.europa.eu/info/sites/default/files/business\\_economy\\_euro/banking\\_and\\_finance/documents/sustainable-finance-communication-factsheet\\_en.pdf](https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-communication-factsheet_en.pdf); accessed on September 27th 2022.
- European Commission (2022a). European climate law. [https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law\\_en](https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law_en); accessed on October 12th 2022.
- European Commission (2022b). Germany in the EU. [https://germany.representation.ec.europa.eu/uber-uns/deutschland-der-eu\\_de](https://germany.representation.ec.europa.eu/uber-uns/deutschland-der-eu_de); accessed on May 5th 2022.
- European Council (2023). Fit for 55. <https://www.consilium.europa.eu/de/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/#package>; accessed on September 30th 2023.
- European Environment Agency (2019). Textiles in Europe's circular economy. <https://www.eea.europa.eu/publications/textiles-in-europes-circular-economy/textiles-in-europe-s-circular-economy>; accessed on May 8th, 2023.
- Everling, O. (2020). *Social Credit Rating. Reputation und Vertrauen beurteilen*. Springer Fachmedien Wiesbaden.
- Fallon, J. (2022). Scaling ESG solutions in fashion report: A pragmatic sustainability playbook. <https://www.accenture.com/content/dam/accenture/final/industry/retail/document/Accenture-2023-Scaling-ESG-Solutions-In-Fashion-Playbook.pdf>; accessed on August 10th 2023.
- Federal Statistical Office of Germany (2022). Micro census: Germany. <https://www-genesis.destatis.de/genesis/online?operation=table&code=12211-0003&bypass=true&levelindex=1&levelid=1687954563939#abreadcrumb>; accessed on August 12th 2023.
- Filippini, M., Kumar, N., and Srinivasan, S. (2020). Nudging the adoption of fuel-efficient vehicles: Evidence from a stated choice experiment in nepal. *Economics Working Paper Series*, 333(20):1–26.
- Fink, L. (2020). Sustainability as blackrock's new standard for investing. <https://www.blackrock.com/us/individual/blackrock-client-letter#:~:text=Because%20sustainable%20investment%20options%20have,our%20new%20standard%20for%20investing>; accessed on June 20th 2022.
- Fishbein, M. and Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Taylor & Francis.
- Freeman, R. E. (1984). *Strategic management: A stakeholder theory*. Pitman, Boston.

- Freeman, R. E. (2010). *Strategic management: A stakeholder approach*. Cambridge University Press, Cambridge and New York and Melbourne and Madrid and Cape Town and Singapore, reissue edition.
- Friede, G., Busch, T., and Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4):210–233.
- Friedman, M. (1970). The social responsibility of business is to increase its profits. *The New York Times Magazine*.
- Galbreath, J. (2013). ESG in focus: The Australian evidence. *Journal of Business Ethics*, 118(3):529–541.
- Genovese, A., Lenny Koh, S. C., Bruno, G., and Esposito, E. (2013). Greener supplier selection: State of the art and some empirical evidence. *International Journal of Production Research*, 51(10):2868–2886.
- German Bundestag (2021). Gesetz über die unternehmerischen Sorgfaltspflichten zur Vermeidung von Menschenrechtsverletzungen in Lieferketten: Lieferkettensorgfaltspflichtengesetz – LkSG. *Bundesanzeiger Verlage*, I(46).
- German Environmental Agency (2023). Treibhausgas-Emissionen in der Europäischen Union. Hauptverursacher. <https://www.umweltbundesamt.de/daten/klima/treibhausgas-emissionen-in-der-europaeischen-union#hauptverursacher>; accessed on September 29th 2023.
- German Federal Ministry for Economic Corporation and Development (2021). Supply chain law FAQs. <https://www.bmz.de/en/development-policy/supply-chains>; accessed on March 10th 2022.
- German Federal Ministry for Economic Corporation and Development (2022). Supply chain law. <https://www.bmz.de/en/development-policy/supply-chains>; accessed on March 10th 2022.
- Gharaei, A., Karimi, M., and Hoseini Shekarabi, S. A. (2019). An integrated multi-product, multi-buyer supply chain under penalty, green, and quality control polices and a vendor managed inventory with consignment stock agreement: The outer approximation with equality relaxation and augmented penalty algorithm. *Applied Mathematical Modelling*, 69:223–254.
- Ghoushchi, J. S., Milan, D. M., and Rezaee, J. M. (2018). Evaluation and selection of sustainable suppliers in supply chain using new GP-DEA model with imprecise data. *Journal of Industrial Engineering International*, 14(3):613–625.
- Gillespie, B. and Rogers, M. M. (2016). Sustainable supply chain management and the end user: Understanding the impact of socially and environmentally responsible firm behaviors on consumers’ brand evaluations and purchase intentions. *Journal of Marketing Channels*, 23(1-2):34–46.
- Gioia, D. A., Corley, K. G., and Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research. *Organizational Research Methods*, 16(1):15–31.

- Glaser, B. G. and Strauss, A. L. (1967). The discovery of grounded theory: Strategies for qualitative research Aldine Publishing Company. *New York*.
- Gleim, M. R., Smith, J. S., Andrews, D., and Cronin, J. J. (2013). Against the green: A multi-method examination of the barriers to green consumption. *Journal of Retailing*, 89(1):44–61.
- Golden, B. L., Wasil, E. A., and Harker, P. T. (1989). The analytic hierarchy process: Applications and studies. 2(1):1–273.
- Govindan, K., Khodaverdi, R., and Jafarian, A. (2013). A fuzzy multi criteria approach for measuring sustainability performance of a supplier based on triple bottom line approach. *Journal of Cleaner Production*, 47:345–354.
- Govindan, K., Rajendran, S., Sarkis, J., and Murugesan, P. (2015). Multi criteria decision making approaches for green supplier evaluation and selection: A literature review. *Journal of Cleaner Production*, 98:66–83.
- Grant, D. B., Trautrim, A., and Wong, C. Y. (2017). *Sustainable logistics and supply chain management: Principles and practices for sustainable operations and management*. KoganPage, London and New York and New Dehli, second edition edition.
- Gupta, A. K. and Gupta, N. (2020). Effect of corporate environmental sustainability on dimensions of firm performance – towards sustainable development: Evidence from india. *Journal of Cleaner Production*, 253:119948.
- Gupta, S., Chatterjee, P., Yazdani, M., and Santibanez Gonzalez, E. D. (2021). A multi-level programming model for green supplier selection. *Management Decision*, 59(10):2496–2527.
- Gupta, S., Soni, U., and Kumar, G. (2019). Green supplier selection using multi-criterion decision making under fuzzy environment: A case study in automotive industry. *Computers & Industrial Engineering*, 136:663–680.
- Gwozd, W. and Müller, T. (2017). An environmental perspective on clothing consumption: Consumer segments and their behavioral patterns. *Sustainability*, 9(5):762.
- Ha-Brookshire, J. E. and Norum, P. S. (2011). Willingness to pay for socially responsible products: Case of cotton apparel. *Journal of Consumer Marketing*, 28(5):344–353.
- Haeri, S. A. S. and Rezaei, J. (2019). A grey-based green supplier selection model for uncertain environments. *Journal of Cleaner Production*, 221:768–784.
- Haghani, M., Bliemer, M. C., Rose, J. M., Oppewal, H., and Lancsar, E. (2021). Hypothetical bias in stated choice experiments: Part II. Conceptualisation of external validity, sources and explanations of bias and effectiveness of mitigation methods. *Journal of Choice Modelling*, 41:100322.
- Haws, K. L., Winterich, K. P., and Naylor, R. W. (2014). Seeing the world through green-tinted glasses: Green consumption values and responses to environmentally friendly products. *Journal of Consumer Psychology*, 24(3):336–354.

- Heider, A. K. (2017). *Unternehmenskultur und Innovationserfolg in Familienunternehmen*. Springer Fachmedien Wiesbaden, Wiesbaden.
- Hensher, D. A. and Greene, W. H. (2003). The mixed logit model: The state of practice. *Transportation*, 30(2):133–176.
- Hensher, D. A., Rose, J. M., and Greene, W. (2015). *Applied choice analysis*. Cambridge books online. Cambridge University Press, Cambridge, second edition edition.
- Hermundsdottir, F. and Aspelund, A. (2022). Competitive sustainable manufacturing - sustainability strategies, environmental and social innovations, and their effects on firm performance. *Journal of Cleaner Production*, 370:133474.
- Hess, S. and Palma, D. (2019). Apollo: A flexible, powerful and customisable freeware package for choice model estimation and application. *Journal of Choice Modelling*, 32:100170.
- Ho, W., Xu, X., and Dey, P. K. (2010). Multi-criteria decision making approaches for supplier evaluation and selection: A literature review. *European Journal of Operational Research*, 202(1):16–24.
- Hsu, C.-C., Kannan, V. R., Keong Leong, G., and Tan, K.-C. (2006). Supplier selection construct: instrument development and validation. *The International Journal of Logistics Management*, 17(2):213–239.
- Huang, S. H. and Keskar, H. (2007). Comprehensive and configurable metrics for supplier selection. *International Journal of Production Economics*, 105(2):510–523.
- Hussain, N., Rigoni, U., and Oriij, R. P. (2018). Corporate governance and sustainability performance: Analysis of triple bottom line performance. *Journal of Business Ethics*, 149(2):411–432.
- Hustvedt, G. and Bernard, J. C. (2008). Consumer willingness to pay for sustainable apparel: the influence of labelling for fibre origin and production methods. *International Journal of Consumer Studies*, 32(5):491–498.
- Hustvedt, G. and Bernard, J. C. (2010). Effects of social responsibility labelling and brand on willingness to pay for apparel. *International Journal of Consumer Studies*, 34(6):619–626.
- Hustvedt, G., Carroll, K. A., and Bernard, J. C. (2013). Consumer ethnocentricity and preferences for wool products by country of origin and manufacture. *International Journal of Consumer Studies*, 37(5):498–506.
- Igarashi, M., de Boer, L., and Fet, A. M. (2013). What is required for greener supplier selection? A literature review and conceptual model development. *Journal of Purchasing and Supply Management*, 19(4):247–263.
- Ihemezie, E. J., Ukwuaba, I. C., and Nnaji, A. P. (2018). Impact of ‘green’ product label standards on consumer behaviour: A systematic review analysis. *International Journal of Academic Research in Business and Social Sciences*, 8(9):666–684.

- Jain, N. and Singh, A. R. (2020). Sustainable supplier selection under must-be criteria through fuzzy inference system. *Journal of Cleaner Production*, 248:119275.
- Jensen, M. and Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3:305–360.
- Johnstone, M.-L. and Tan, L. P. (2015). Exploring the gap between consumers’ green rhetoric and purchasing behaviour. *Journal of Business Ethics*, 132(2):311–328.
- Joshi, Y. and Rahman, Z. (2015). Factors affecting green purchase behaviour and future research directions. *International Strategic Management Review*, 3(1-2):128–143.
- Juras, P. (2007). A risk-based approach to identifying the total cost of outsourcing. *Management Accounting Quarterly*, 9(1):43.
- Kahraman, C., Cebeci, U., and Ulukan, Z. (2003). Multi-criteria supplier selection using fuzzy AHP. *Logistics Information Management*, 16(6):382–394.
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1):31–36.
- Kalish, S. and Nelson, P. (1991). A comparison of ranking, rating and reservation price measurement in conjoint analysis. *Marketing Letters*, 2(4):327–335.
- Kannan, V. R. and Tan, K. C. (2002). Supplier selection and assessment: Their impact on business performance. *The Journal of Supply Chain Management*, 38(4):11–21.
- Kaufmann, A. and Gupta, M. M. (1991). Introduction to fuzzy arithmetic: Theory and applications, 1991. *VanNostrand Reinhold, New York*.
- Khan, H. (2011). A literature review of corporate governance. *2011 International Conference on E-business, Management and Economics*, 25:1–5.
- Khan, M., Serafeim, G., and Yoon, A. (2016). Corporate sustainability: First evidence on materiality. *The Accounting Review*, 91(6):1697–1724.
- Khan, S. A., Kusi-Sarpong, S., Arhin, F. K., and Kusi-Sarpong, H. (2018). Supplier sustainability performance evaluation and selection: A framework and methodology. *Journal of Cleaner Production*, 205:964–979.
- Koh, H.-K., Burnasheva, R., and Suh, Y. G. (2022). Perceived ESG (environmental, social, governance) and consumers’ responses: The mediating role of brand credibility, brand image, and perceived quality. *Sustainability*, 14(8):4515.
- Köksal, D., Strähle, J., and Müller, M. (2018). Social sustainability in apparel supply chains—the role of the sourcing intermediary in a developing country. *Sustainability*, 10(4):1039.
- Köksal, D., Strähle, J., Müller, M., and Freise, M. (2017). Social sustainable supply chain management in the textile and apparel industry—a literature review. *Sustainability*, 9(1):100.
- Koos, S. (2022). The German Supply Chain Due Diligence Act 2021 and its impact on globally operating German companies. In *Proceedings of the 2nd Riau Annual Meeting on Law and Social Sciences (RAMLAS 2021)*, Advances in Social Science, Education and Humanities Research. Atlantis PressParis, France.



- Köster, C. (2023). The changing impact of governance criteria in the supplier selection process [Paper presentation]. Hawai'i Accounting Research Conference, University of Hawai'i at Manoa.
- Koszewska, M. (2021). Clothing labels: Why are they important for sustainable consumer behaviour? *Journal of Consumer Protection and Food Safety*, 16:1–3.
- Kozar, J. M. and Hiller Connell, K. Y. (2013). Socially and environmentally responsible apparel consumption: knowledge, attitudes, and behaviors. *Social Responsibility Journal*, 9(2):315–324.
- Kreipl, C. (2020). *Verantwortungsvolle Unternehmensführung*. Springer Fachmedien Wiesbaden, Wiesbaden.
- Kronthal-Sacco, R. and Whelan, T. (2023). CSB sustainable market share index; NYU Stern - Center for Sustainable Business.
- Krueger, P., Sautner, Z., and Starks, L. T. (2020). The importance of climate risks for institutional investors. *The Review of Financial Studies*, 33(3):1067–1111.
- Kwong, C. K. and Bai, H. (2003). Determining the importance weights for the customer requirements in QFD using a fuzzy AHP with an extent analysis approach. *IIE Transactions*, 35(7):619–626.
- Lafortune, G., Cortés Puch, M., Mosnier, A., Fuller, G., Diaz, M., Riccaboni, A., Kloke-Lesch, A., and Zachariadis, T. (2021). Europe sustainable development report 2021: Transforming the European Union to achieve the sustainable development goals.
- Lee, A. H., Kang, H.-Y., Hsu, C.-F., and Hung, H.-C. (2009). A green supplier selection model for high-tech industry. *Expert Systems with Applications*, 36(4):7917–7927.
- Lee, T.-R., Phuong Nha Le, T., Genovese, A., and Koh, L. S. (2011). Using FAHP to determine the criteria for partner's selection within a green supply chain. *Journal of Manufacturing Technology Management*, 23(1):25–55.
- Li, J., Fang, H., and Song, W. (2019). Sustainable supplier selection based on SSCM practices: A rough cloud topsis approach. *Journal of Cleaner Production*, 222:606–621.
- Li, T.-T., Wang, K., Sueyoshi, T., and Wang, D. D. (2021). ESG: Research progress and future prospects. *Sustainability*, 13(21):11663.
- Lin, R.-J. (2013). Using fuzzy dematel to evaluate the green supply chain management practices. *Journal of Cleaner Production*, 40:32–39.
- Liu, A., Xiao, Y., Lu, H., Tsai, S.-B., and Song, W. (2019). A fuzzy three-stage multi-attribute decision-making approach based on customer needs for sustainable supplier selection. *Journal of Cleaner Production*, 239:118043.
- Ma, Y. J., Gam, H. J., and Banning, J. (2017). Perceived ease of use and usefulness of sustainability labels on apparel products: application of the technology acceptance model. *Fashion and Textiles*, 4:1–20.

- Maloney, J., Lee, M.-Y., Jackson, V., and Miller-Spillman, K. A. (2014). Consumer willingness to purchase organic products: Application of the theory of planned behavior. *Journal of Global Fashion Marketing*, 5(4):308–321.
- Masters, B. and Temple-West, P. (2023). The real impact of the ESG backlash. *Financial Times*, 4 December 2023.
- Matemane, R., Moloi, T., and Adelowotan, M. (2022). Appraising executive compensation ESG-based indicators using analytical hierarchical process and delphi techniques. *Journal of Risk and Financial Management*, 15(10):469.
- McColgan, P. (2001). Agency theory and corporate governance: A review of the literature from a UK perspective. *Department of Accounting & Finance, University of Strathclyde*, 6:0203.
- Meixell, M. J. and Luoma, P. (2015). Stakeholder pressure in sustainable supply chain management. *International Journal of Physical Distribution & Logistics Management*, 45(1/2):69–89.
- Menguc, B. and Ozanne, L. K. (2005). Challenges of the “green imperative”: A natural resource-based approach to the environmental orientation–business performance relationship. *Journal of Business Research*, 58(4):430–438.
- Merkert, R. and Beck, M. J. (2020). Can a strategy of integrated air-bus services create a value proposition for regional aviation management? *Transportation Research Part A: Policy and Practice*, 132:527–539.
- Miles, M. B. and Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Sage.
- Miles, M. B., Huberman, A. M., and Saldaña, J. (2014). *Qualitative data analysis. A methods sourcebook*. Sage.
- Miller, C. C., Cardinal, L. B., and Glick, W. H. (1997). Retrospective reports in organizational research: A reexamination of recent evidence. *Academy of Management Journal*, 40(1):189–204.
- Mittwoch, A.-C. and Bremenkamp, F. L. (2021). Das Lieferkettensorgfaltspflichtengesetz – Ein nachhaltiger Ordnungsrahmen für international tätige Marktakteure? *Kritische Vierteljahresschrift für Gesetzgebung und Rechtswissenschaft*, 104(3):207–236.
- Monks, R. and Minow, N. (2004). *Corporate Governance, (Vol. 3)*. Blackwell Publishing, Malden MA.
- Moon, S.-J., Costello, J. P., and Koo, D.-M. (2017). The impact of consumer confusion from eco-labels on negative wom, distrust, and dissatisfaction. *International Journal of Advertising*, 36(2):246–271.
- Moser, A. K. (2015). Thinking green, buying green? Drivers of pro-environmental purchasing behavior. *Journal of Consumer Marketing*, 32(3):167–175.
- Muller, L., Lacroix, A., and Ruffieux, B. (2019). Environmental labelling and consumption changes: A food choice experiment. *Environmental and Resource Economics*, 73(3):871–897.

- Muresan, I. C., Harun, R., Arion, F. H., Brata, A. M., Chereches, I. A., Chiciudean, G. O., Dumitras, D. E., Oroian, C. F., and Tirpe, O. P. (2021). Consumers' attitude towards sustainable food consumption during the COVID-19 pandemic in Romania. *Agriculture*, 11(11):1050.
- Naciti, V. (2019). Corporate governance and board of directors: The effect of a board composition on firm sustainability performance. *Journal of Cleaner Production*, 237:117727.
- Nakano, M. (2019). Evaluation of corporate social responsibility by consumers: Use of organic material and long working hours of employees. *Sustainability*, 11(19):5219.
- Neumayr, L. and Moosauer, C. (2021). How to induce sales of sustainable and organic food: The case of a traffic light eco-label in online grocery shopping. *Journal of Cleaner Production*, 328:129584.
- Nielsen, I. E., Banaeian, N., Golińska, P., Mobli, H., and Omid, M. (2014). Green supplier selection criteria: From a literature review to a flexible framework for determination of suitable criteria. In *Logistics Operations, Supply Chain Management and Sustainability*, pages 79–99. Springer, Cham.
- Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., and Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, 1(4):189–200.
- Noci, G. (1997). Designing 'green' vendor rating systems for the assessment of a supplier's environmental performance. *European Journal of Purchasing & Supply Chain Management*, 3(2):103–114.
- Patagonia Works (2021). Annual benefit corporation report. <https://www.patagonia.com/on/demandware.static/-/Library-Sites-PatagoniaShared/default/dw18ad9c7c/PDF-US/Patagonia-2021-BCorp-Report-Updated-2-15-22.pdf>; accessed on December 12th 2023.
- Paul, J. and Rana, J. (2012). Consumer behavior and purchase intention for organic food. *Journal of Consumer Marketing*, 29(6):412–422.
- Post, C., Rahman, N., and Rubow, E. (2011). Green governance: Boards of directors' composition and environmental corporate social responsibility. *Business & Society*, 50(1):189–223.
- Proto, M., Malandrino, O., and Supino, S. (2007). Eco-labels: A sustainability performance in benchmarking? *Management of Environmental Quality: An International Journal*, 18(6):669–683.
- Rahman, M. and Haque, M. (2016). Investigation of fabric wastages in knit t-shirt manufacturing industry in Bangladesh. *International Journal of Research in Engineering and Technology*, 5(10):212–215.
- Rashidi, K. and Cullinane, K. (2019). A comparison of fuzzy dea and fuzzy topsis in sustainable supplier selection: Implications for sourcing strategy. *Expert Systems with Applications*, 121:266–281.

- Rashidi, K., Noorizadeh, A., Kannan, D., and Cullinane, K. (2020). Applying the triple bottom line in sustainable supplier selection: A meta-review of the state-of-the-art. *Journal of Cleaner Production*, 269:122001.
- Revelt, D. and Train, K. (1998). Mixed logit with repeated choices: Households' choices of appliance efficiency level. *Review of Economics and Statistics*, 80(4):647–657.
- Ribeiro, S. (2022). *The Role of Sustainable Labels in the Fashion Industry*. PhD thesis, Universidade Católica Portuguesa.
- Rogers, Z. S., Carter, C. R., and Kwan, V. (2019). Making tough choices: A policy capturing approach to evaluating the tradeoffs in sustainable supplier development initiatives. *Journal of Purchasing and Supply Management*, 25(5).
- Rombach, M. (2022). ESG in corporate investment decisions: An experimental study on the investment behavior of decision makers [paper presentation]. 38th eurasian business and economics society (EBES).
- Rose, J. M. and Bliemer, M. (2008). Stated preference experimental design strategies. In Hensher, D.A., Button, K.J., editor, *Handbook of Transport Modelling*. Elsevier, Oxford., pages pp. 51–179. Emerald Group Publishing Limited.
- Saaty, T. L. (1980). The analytic hierarchy process. *McGraw-Hill New York*.
- Saaty, T. L. (1988). How to make a decision: The analytic hierarchy process. Proceedings of the International Symposium on the Analytic Hierarchy Process. Creative Decisions Foundation.
- Saeed, M. and Kersten, W. (2019). Drivers of sustainable supply chain management: Identification and classification. *Sustainability*, 11(4):1137.
- Sandra, N. and Alessandro, P. (2021). Consumers' preferences, attitudes and willingness to pay for bio-textile in wood fibers. *Journal of Retailing and Consumer Services*, 58:102304.
- Saricam, C. and Okur, N. (2019). Analysing the consumer behavior regarding sustainable fashion using theory of planned behavior. In Muthu, S. S., editor, *Consumer Behaviour and Sustainable Fashion Consumption*, Textile Science and Clothing Technology, pages 1–37. Springer Singapore, Singapore.
- Sarkis, J. (2006). *Greening the Supply Chain*. Springer London Limited, London.
- Sarkis, J., Gonzalez-Torre, P., and Adenso-Diaz, B. (2010). Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management*, 28(2):163–176.
- Shen, B., Li, Q., Dong, C., and Perry, P. (2017). Sustainability issues in textile and apparel supply chains. *Sustainability*, 9(9):1592.
- Shen, L., Olfat, L., Govindan, K., Khodaverdi, R., and Diabat, A. (2013). A fuzzy multi criteria approach for evaluating green supplier's performance in green supply chain with linguistic preferences. *Resources, Conservation and Recycling*, 74:170–179.

- Siemens AG (2019). Siemens group code of conduct for suppliers and third party intermediaries. <https://new.siemens.com/global/en/company/about/corporate-functions/supply-chain-management/sustainability-in-the-supply-chain/code-of-conduct.html>; accessed on April 11th 2022.
- Simić, D., Kovačević, I., Svirčević, V., and Simić, S. (2017). 50 years of fuzzy set theory and models for supplier assessment and selection: A literature review. *Journal of Applied Logic*, 24:85–96.
- Simon, H. A. (1972). Theories of bounded rationality, decision and organization. *Decision and Organization*, 1(1):161–176.
- Simon, H. A. (1997). *Models of bounded rationality: Empirically grounded economic reason (Vol. 3)*. MIT Press.
- Siraj, A., Taneja, S., Zhu, Y., Jiang, H., Luthra, S., and Kumar, A. (2022). Hey, did you see that label? It’s sustainable!: Understanding the role of sustainable labelling in shaping sustainable purchase behaviour for sustainable development. *Business Strategy and the Environment*, 31(7):2820–2838.
- Smith, N. C. (2003). Corporate social responsibility: Whether or how? *California Management Review*, 45(4):52–76.
- Sogari, G., Corbo, C., Macconi, M., Menozzi, D., and Mora, C. (2015). Consumer attitude towards sustainable-labelled wine: An exploratory approach. *International Journal of Wine Business Research*, 27(4):312–328.
- Song, W., Xu, Z., and Liu, H.-C. (2017). Developing sustainable supplier selection criteria for solar air-conditioner manufacturer: An integrated approach. *Renewable and Sustainable Energy Reviews*, 79:1461–1471.
- Steg, L. (2015). Environmental psychology and sustainable consumption. In *Handbook of research on sustainable consumption*, pages 70–83. Edward Elgar Publishing, Cheltenham.
- Tang, E., Fryxell, G. E., and Chow, C. S. F. (2004). Visual and verbal communication in the design of eco-label for green consumer products. *Journal of International Consumer Marketing*, 16(4):85–105.
- Teece, D. J., Pisano, G., and Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7):509–533.
- Textile Exchange (2017). Organic cotton market report. <https://textileexchange.org/knowledge-center/reports/2017-organic-cotton-market-report/>; accessed on April 14th 2022.
- Thiruchelvam, S. and Tookey, J. E. (2011). Evolving trends of supplier selection criteria and methods. *International Journal of Automotive and Mechanical Engineering*, 4:437–454.
- Thøgersen, J. (2002). Promoting green consumer behavior with eco-labels. *New tools for environmental protection*, pages 83–104.

- Thøgersen, J. (2005). How may consumer policy empower consumers for sustainable lifestyles? *Journal of Consumer Policy*, 28(2):143–177.
- Thornton, L. M., Autry, C. W., Gligor, D. M., and Brik, A. B. (2013). Does socially responsible supplier selection pay off for customer firms? A cross-cultural comparison. *Journal of Supply Chain Management*, 49(3):66–89.
- Torabzadeh Khorasani, S. (2018). Green supplier evaluation by using the integrated fuzzy ahp model and fuzzy copras. *Process Integration and Optimization for Sustainability*, 2(1):17–25.
- Train, K. (2009). *Discrete choice methods with simulation*. Cambridge University Press, Cambridge and New York and Melbourne and Madrid and Cape Town and Singapore and São Paulo and Delhi and Mexico City, second edition edition.
- Tsay, Y.-Y. (2009). The impacts of economic crisis on green consumption in Taiwan. In *PICMET '09 - 2009 Portland International Conference on Management of Engineering & Technology*, pages 2367–2374. IEEE.
- Tully, S. M. and Winer, R. S. (2014). The role of the beneficiary in willingness to pay for socially responsible products: A meta-analysis. *Journal of Retailing*, 90(2):255–274.
- United Nations (2004). Who cares wins. <https://documents1.worldbank.org/curated/en/280911488968799581/pdf/113237-WP-WhoCaresWins-2004.pdf>; accessed on September 29th 2023.
- United Nations (2006). Principles for responsible investment. <https://press.un.org/en/2006/sg2111.doc.htm>; accessed on September 29th 2023.
- United Nations (2015). Transforming our world: the 2030 agenda for sustainable development - resolution adopted by the general assembly on 25 september 2015 (a/res/70/1).
- United Nations Environment Programme (2022). Fashion’s tiny hidden secret. <https://www.unep.org/news-and-stories/story/fashions-tiny-hidden-secret>; accessed on April 12th 2023.
- Velte, P. (2016). Women on management board and ESG performance. *Journal of Global Responsibility*, 7(1):98–109.
- Vlaeminck, P., Jiang, T., and Vranken, L. (2014). Food labeling and eco-friendly consumption: Experimental evidence from a Belgian supermarket. *Ecological Economics*, 108:180–190.
- Wang, C.-N., van Viet, T. H., Ho, T. P., van Nguyen, T., and Nguyen, V. T. (2020). Multi-criteria decision model for the selection of suppliers in the textile industry. *Symmetry*, 12(6):979.
- Wang, D., TIAN, Y., and HU, Y. (2005). Empirical study of supplier selection practices in supply chain management in manufacturing companies. *International Journal of Innovation and Technology Management*, 2(04):391–409.

- Waste and Resources Action Programme (2017). Valuing out clothes - the cost of UK fashion. [https://wrap.org.uk/sites/default/files/2020-10/WRAP-valuing-our-clothes-the-cost-of-uk-fashion\\\_WRAP.pdf](https://wrap.org.uk/sites/default/files/2020-10/WRAP-valuing-our-clothes-the-cost-of-uk-fashion\_WRAP.pdf); accessed on April 14th 2022.
- Weber, C. A., Current, J. R., and Benton, W. C. (1991). Vendor selection criteria and methods. *European Journal of Operational Research*, 50(1):2–18.
- Weißensteiner, C. (2014). *Reputation als Risikofaktor in technologieorientierten Unternehmen: Status quo-Reputationstreiber-Bewertungsmodell*. Springer Gabler.
- Welch, K. and Yoon, A. (2022). Do high-ability managers choose ESG projects that create shareholder value? Evidence from employee opinions. *Review of Accounting Studies*, pages 1–28.
- Wetzstein, A., Hartmann, E., Benton jr., W. C., and Hohenstein, N.-O. (2016). A systematic assessment of supplier selection literature – state-of-the-art and future scope. *International Journal of Production Economics*, 182:304–323.
- Whipple, J. M. and Roh, J. (2010). Agency theory and quality fade in buyer–supplier relationships. *The International Journal of Logistics Management*, 21(3):338–352.
- White, K., Habib, R., and Hardisty, D. J. (2019). How to shift consumer behaviors to be more sustainable: A literature review and guiding framework. *Journal of Marketing*, 83(3):22–49.
- Wiederhold, M. and Martinez, L. F. (2018). Ethical consumer behaviour in Germany: The attitude-behaviour gap in the green apparel industry. *International Journal of Consumer Studies*, 42(4):419–429.
- Williams, A. and Hodges, N. (2022). Signaling sustainability: Exploring consumer perspectives on communicating apparel sustainability information. *Journal of Sustainable Marketing*, 3(1):26–40.
- Winter, S. and Lasch, R. (2016). Environmental and social criteria in supplier evaluation – lessons from the fashion and apparel industry. *Journal of Cleaner Production*, 139:175–190.
- Xu, L., Kumar, D. T., Shankar, K. M., Kannan, D., and Chen, G. (2013). Analyzing criteria and sub-criteria for the corporate social responsibility-based supplier selection process using AHP. *The International Journal of Advanced Manufacturing Technology*, 68(1-4):907–916.
- Yang, Y. and Nilsson, P. (2023). Volkswagen, BMW and Mercedes hit by Xinjiang forced labour complaint: Carmakers are the target of one the first cases brought under Germany’s new supply chain law. *Financial Times*, 20 June 2023.
- Yawar, S. A. and Seuring, S. (2017). Management of social issues in supply chains: A literature review exploring social issues, actions and performance outcomes. *Journal of Business Ethics*, 141(3):621–643.
- Yin, R. K. (2018). Case study research - design and methods. *Applied Social Research Methods and Series*, 5.

- Zadeh, L. A. (1965). Fuzzy sets. *Information and Control*, 8(3):338–353.
- Zhang, J. Q., Zhu, H., and Ding, H.-b. (2013). Board composition and corporate social responsibility: An empirical investigation in the post sarbanes-oxley era. *Journal of Business Ethics*, 114(3):381–392.
- Zimmer, K., Fröhling, M., and Schultmann, F. (2016). Sustainable supplier management – a review of models supporting sustainable supplier selection, monitoring and development. *International Journal of Production Research*, 54(5):1412–1442.
- Žurga, Z. and Tavčer, P. F. (2014). Apparel purchasing with consideration of eco-labels among slovenian consumers. *Fibres & Textiles in Eastern Europe*, 22(5):20–27.