Sustainability Matters: Analyzing the Transformative Effects of ESG-Criteria on Supplier Selection

Masterarbeit

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vorgelegt von

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List of Content

1. Introduction

1.1 Motivation

In 2015 the Parisian Climate Agreement 195 countries agreed upon the transformation to a more sustainable world economy (bmz, 2023). In the process the three aims to reduce the increase of the global temperature, decrease of emissions and adaption to the climate change, as well as steering of financial investments in line with the climate goals. The European Green Deal is introduced to ensure the necessary actions are taken (bmz, 2023). Living in a global economy long supply chains are common. With introduction of the "Lieferkettensorgfaltspflichtengesetz", which came into power with the begin of 2023 the supply chain became a topic of interest. Furthermore, in Paragraph 6 the law rules that a company has to implement a procurement strategy that ensures the prevention of sustainable risks (LkSG, 2021, para. 6 (3)) is regulated. Furthermore, it is found, that the procurement has a strategic role in generation of a sustainable production and therefore a more sustainable company by its interface function between supply chain and production (inverto, 2023).

1.2 State of Research, Relevance, and Research Question

For a first overview the of the existing research the search string (Environmental, Social, and Governance" OR "ESG") AND ("Supplier Selection") is entered into google scholar. This leads to an output of 93 articles, which focus on financial effects of the ESG-criteria. However, not on the supplier selection process. Hence the to be investigated matter of this thesis has not been much overlooked yet. Though, the sustainable supplier selection criteria have been analyzed so far under the term of "sustainable" or "green" supplier selection. The relevance of the topic is further underlined by the standardization of the ESG-criteria through the Corporate Sustainability Reporting Directive (CRSD) to companies outside the financial sector. Furthermore, the directive will continue to include business of decreasing size till in the year 2026 will be relevant for all enterprises including the small and medium businesses. Taking the given distribution of company sizes in Germany, by 2026 a percentage of greater 93 percent of the German value generation (destatis, 2023) will be affected by ESG-criteria. By undertaking this research, the status quo of the importance of ESG-criteria in the supplier selection process is analyzed. Therefore, the following research questions is theorized:

To what extent do ESG-criteria influence the contemporary supplier selection process, and how well are they incorporated by todays supplier selection criteria?

Thereby, this thesis aims to provide further information on the current or to be expected influence of ESG criteria on the supplier selection process, while examining the extent to which traditional criteria might already capture certain factors.

1.3 Structure of the Thesis

The structure of this thesis continues with three main chapters. In the first chapter, the theoretical background to this work is displayed. Secondly the underlying research design, methodology and methods are presented. In the third chapter, the research is conducted. In this process the research design is adjusted to the objective of this thesis. Afterwards the methodologies introduced in the second chapter are applied. Then the obtained results are discussed as well as limitations and future research derived from the obtained results. Lastly, the obtained findings are formalized, and the necessary pillars are displayed.

2. Theoretical Background

2.1 ESG-Criteria

In the year 1987 sustainable activities were described as (Brundtland, 1987, p. 292):

"Meeting the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs."

In 2019 the ESG Reporting Guide 2.0 describes the Environmental, Social and Governance criteria as a transformation from the vague, philosophical, and aspirational formulations to more precise, technical, and operational terms (NASDAQ, 2019, p. 5). The criteria were intended to serve as guidelines with the purpose of ensuring more sustainable investment decision (The Global Compact, 2004). In 2019 the NASDAQ described ESG as an expending field (NASDAQ, 2019, p. 3). Or on a more general note: The criteria aim to measure the extent to which sustainability is considered by the respective company (Gillan, Koch and Starks, 2021, p. 2).

Furthermore, the interaction of the ESG-criteria is another promising field for future research. In addition, the influence of different laws would provide an existing research opportunity. Regarding this direction expert 6 states as an example. The expert refers to companies being part of the Clean Energy Buyers Association (CEBA) market. These companies commit themselves to the use of green energy (CEBA, 2023). On the one Hand this example would lead to a lower CO^2 footprint of the supplier, on other hand this would results in boarder taxes due to the import (expert 6, C2, appendix 18). This is one example of potentially many where different laws may cause interactions for which the best solution must be found. Furthermore, the measuring format for sustainable and ESG-criteria is a potential future research direction. While the format for economic criteria is well established, no best practice solution for the sustainable criteria has been found (expert 4, expert 1, B7, appendix 18). The digitalization of supplier selection is an additional research direction. While some authors describe the digital buyer supplier connection (Scuotto *et al.*, 2017; Agrawal and Narain, 2018; Burger and Arlinghaus, 2021) it remains on a general supply chain level or theorizes the management of existing supplier relations. However, using digital platform provider to identify the criteria performance of potential suppliers or selecting potential supplier directly on the platform seems to be a rarely analysed topic (B8.3, appendix 18).

With regard to the application example of this work the use of machine learning is rare in the academic literature tackling the issue of supplier evaluation. Cavalcante et al. (2019) in their literature review did not identify articles using machine learning applications for supplier selection. Ali, Nipu and Khan (2023) found very few studies using machine learning in supplier selection. Furthermore, they found, in line with this work, a prominent use of classical MCDM methods. Given the rising complexity of supplier selection (expert 4, B8.1, appendix x) as well as machine learning high capability (Brunton and Kutz, 2022, p. ix) it displays a promising field for future research.

4.6 Phase 4: Formulation of the Learning

4.6.1 Conclusion

The scope of this work was analysis of the transformative effects of ESG-criteria on the supplier selection process. The undergone investigation process is based on the three pillars of criteria identification, criteria evaluation, and supplier selection method.

Therefore, as a first step the relevant supplier selection criteria were identified through a scoping review. The methodology of the literature search followed Webster and Watson

(2002). Furthermore, for the inner structure orientation is taken from the process of Wolfswinkel, Furtmueller and Wilderom (2013). The regulation EU-2020/852 (2020) as well as the directive EU-2022/2464 (2022) are identified as the relevant sources for the ESG-criteria. For the supplier selection criteria, the dimensions economic, environmental, and social are identified. This is in line with the triple-bottom-line approach of Elkington (1999). The ESG-criteria contain the dimensions environmental, social, and governance. The second pillar divides in the supplier selection criteria and ESG-criteria. For the first case the identified supplier selection criteria are mapped against the ESG-criteria, showing that for the social and most of the environmental criteria a good coverage exists in the supplier selection criteria. However, for the environmental criteria factors like biodiversity and ecosystems, water and marine ecosystems miss respective supplier selection criteria. Furthermore, criteria measuring the activities taken to improve sustainability are not covered by literature criteria (appendix 7). To determine the importance of the criteria a survey is conducted. 34 Participants identified the economic dimension as the most important. The least important was the environmental dimension. The remaining social dimension as well as ESG-criteria distributed in the midfield of the obtained ranking. The survey results are evaluated in a focus group discussion.

In the third pillar, the supplier selection pillar, the k-means algorithm proved to be a valuable method for the segmentation of supplier datasets. Providing clusters of suppliers in accordance to their strengths and weaknesses in selection criteria performance. Allowing a more efficient suitable supplier selection. Furthermore, the XGBoost algorithm proved to be a promising tool to further selected the best fitting supplier out of a dataset. Also providing information on the importance of each criterion in the selection process. Furthermore, the results obtained in the XGBoost analysis of the supplier selection in the material selection use case found social and governance criteria as most influential in the decision-making process.

Ultimately the research question is concluded by stating that at the given moment the ESG-criteria as well as their respective supplier selection criteria dimension social and environmental to not have an influential role when selecting a potential supplier on a general note. However, one use case of the conducted application example found social and governance criteria as highly influential in the decision-making process. Underlined by the newly introduced legislation as well as the expansion of the given legislation the importance of these criteria is on the rise. The results obtained in this study disclose various exciting new research directions for the future.