

The Impact of Green Entrepreneurship on Economic, Social, and Environmental Development

Cumulative doctoral thesis
submitted to the Europa-Universität Flensburg
in fulfilment of the requirements
for the degree of doctor rerum politicarum (Dr. rer. pol.)

by

Thomas Neumann, M.Eng.

on 29th September 2022 in Flensburg.

Supervisors and
reviewers:

Prof. Dr. Olav Hohmeyer
Prof. Dr. Dirk Ludewig

I ACKNOWLEDGEMENTS

The work for this thesis was carried out in the Department of Energy and Environmental Management at Europa-Universität Flensburg and the Jackstädt-Zentrum Flensburg at the University of Applied Sciences Flensburg. I would like to acknowledge the people who have supported and influenced me throughout my work on this thesis.

First, I would like to thank my supervisors and mentors. Olav Hohmeyer has not only been a supportive and guiding figure for me during my thesis, but he has inspired and shaped me throughout my academic journey so far. Dirk Ludewig introduced me to the field and research community of green entrepreneurship, and he empowered me with the motivation, time, and resources to implement my research ideas.

Second, I want to thank Volker Müller-Benedict for his statistical guidance and Jonathan Mole for his academic writing support and infinite patience.

Third, I would like to thank my colleagues and friends at the University of Applied Science and Europa-Universität Flensburg, the editors and anonymous reviewers of the four papers included in this thesis, and the members of the FGF sustainable entrepreneurship working group. Their valuable comments and voluntary reviews have repeatedly provided me with new perspectives and significantly enhanced the quality of this thesis.

Fourth, I would like to thank the entrepreneurship and open-source communities for their valuable work in collecting data and sharing it with researchers and the public. Thanks go, in particular, to Klaus Fichter and Constanze Trautwein from the Borderstep Institute in Berlin, who welcomed me as a research fellow and entrusted me with datasets (even though these did not make it into the final version of this thesis).

Finally, I wish to thank my parents, my friends, and especially my wonderful wife, who always had faith in me and kept me motivated. You have backed me up and forgiven me for all the hours, days, and weeks I have spent not with you but with my thesis. Thank you!

II ABSTRACT

This thesis contributes to the literature on entrepreneurship and environmental management by examining theoretically and empirically how the impact of green entrepreneurship on economic, social, and environmental development differs from that of conventional entrepreneurship. There is growing interest among practitioners and researchers in (a) the impact of entrepreneurship on the three pillars of sustainable development, and (b) the potential environmental and economic double advantage of green entrepreneurship. However, the econometric analysis of green entrepreneurship performed in this thesis represents the first approach that links these two areas of research.

A three-phase research design was developed and implemented in four qualitative and quantitative papers. In Phase 1, a systematic literature review (Paper I) was conducted to improve knowledge on how entrepreneurship impacts economic, social, and environmental development and what the determinants of this macro-level impact are. In Phase 2, four determinants were selected which are particularly relevant to the relationship between entrepreneurship and sustainable development, namely firm performance, innovativeness, high-growth, and the degree of internationalisation. Data from Flash Eurobarometer (n = 11,039 new firms; Paper II) and Global Entrepreneurship Monitor (n = 9,650 entrepreneurs; Paper III) were then used to empirically investigate how green and conventional entrepreneurship differ regarding these determinants. In Phase 3, the findings of this foundation research were used to hypothesise what impact green entrepreneurship might have on economic, social, and environmental development (Paper IV). An econometric model was subsequently developed and applied to aggregated data from the Global Entrepreneurship Monitor and other international databases (n = 53 countries) to test the developed hypotheses (Paper IV).

The results of this work suggest that green entrepreneurship is positively related to economic and social development but not to environmental development. These results have proven robust for countries at different levels of development, with different measurement approaches, and with time-lags of one, two, and three years. This macro-level economic and societal win-win situation can be partly explained with the micro-level evidence found in Phase 2, which shows that green entrepreneurship is characterised by superior turnover performance and start-up quality.

These micro- and macro-level benefits of green entrepreneurship warrant intensified policy efforts to support green entrepreneurship, and should encourage entrepreneurs, investors, and other stakeholders to engage in green entrepreneurial activities. However, the limitations of the research and the hypotheses raised about the counterintuitive absence of significant differences between the environmental impacts of green and conventional entrepreneurship demand further investigation, once appropriate data becomes available.

CONTENTS

I	ACKNOWLEDGEMENTS	2
II	ABSTRACT	3
III	LIST OF FIGURES	6
IV	LIST OF TABLES	6
1	INTRODUCTION	7
2	RESEARCH DESIGN	11
	2.1 Phase 1 Paper I	13
	2.2 Phase 2 Paper II & III	14
	2.3 Phase 3 Paper IV	18
3	DISCUSSION	20
4	CONCLUSION	23
V	REFERENCES	25

III LIST OF FIGURES

Figure 1 Overview of the three-phase research design and the four papers. 12

IV LIST OF TABLES

Table 1 Overview of selected determinants identified in Phase 1 and their implementation in Phase 2. 15

1 Introduction

Economic policy has historically focused on maximising economic welfare, which has contributed to extensive economic growth and, in many countries, to increasing quality of life (Tietenberg and Lewis 2016). However, concern remains that rapid industrialisation and human development have caused fundamental societal problems, such as excessive population growth, excessive depletion of natural resources, and accelerated climate warming (WCED 1987). To achieve truly sustainable development that “meets the needs of current generations without compromising on the ability of future generations to meet their own needs” (WCED 1987, p. 43), (i) economic, (ii) social, and (iii) environmental development (henceforth: sustainable development) must be addressed simultaneously. Therefore, the United Nations (2015) set 17 Sustainable Development Goals that encompass all three pillars of sustainable development and now form the benchmarks for both policy and economic research.

The role of new firms and entrepreneurs, who create, discover, and exploit entrepreneurial opportunities, in contributing to the three pillars of sustainable development is of remarkable political and academic interest. Innovation and entrepreneurship are covered in four of the United Nations’ Sustainable Development Goals (4, 8, 9, and 17) and several special issues on this topic have recently been published by journals such as *Sustainability*, the *Journal of Business Venturing*, and the *Journal of Cleaner Production*. Entrepreneurship research indicates that entrepreneurs and their new firms are not only crucial for economic development (e.g., Acs et al. 2012; M. Fritsch and Mueller 2007), but are also agents for solving pressing social and environmental challenges (e.g., Dean and McMullen 2007; Hall et al. 2010; Shepherd and Patzelt 2011). However, empirical research does not fully confirm these high political and academic expectations. Indeed, it suggests that entrepreneurship impacts each of the three sustainability pillars differently. There is evidence of a significantly positive impact of entrepreneurship on economic development¹, poverty reduction (Rupasingha and Goetz 2013), and human development (Dhahri and Omri 2018), but also for a negative impact on income equality (Atems and Shand 2018) and environmental development (ben

¹ The extensive research on the impact of entrepreneurship on the economy is described in several literature reviews (e.g., Michael Fritsch 2013; Urbano et al. 2019; van Praag and Versloot 2007).

Youssef et al. 2018; Dhahri and Omri 2018; Gu et al. 2021). A common explanation for the variety in micro-level outcomes and macro-level impacts is the heterogeneity among entrepreneurs and their new firms (Colombelli et al. 2016; Hoogendoorn et al. 2020). In other words, different types of entrepreneurship might affect economic, social, and environmental development differently. This explanation is supported by empirical evidence showing that only a small proportion of new firms induce sustainable development. These new firms with high impact are mostly international (e.g., de Clercq et al. 2008; González-Pernía and Peña-Legazkue 2015; Hessels and van Stel 2011), high-growth (e.g., Acs and Mueller 2007; Stam et al. 2009, 2011), opportunity-driven (Venâncio and Pinto 2020) or innovative (e.g., ben Youssef et al. 2018; Du and O'Connor 2018; Mueller 2007). Shane (2009) recommends that entrepreneurship policies should focus only on those new firms which create the most value for society. Therefore, research is required that investigates the impact of different entrepreneurship types on economic, social, and environmental development, and summarises that knowledge so that policymakers can create policies to promote true sustainable development.

One entrepreneurial type that has recently attracted significant attention among practitioners² and in academia (Anand et al. 2021; Gast et al. 2017; Terán-Yépez et al. 2020) is so-called eco, environmental, or green entrepreneurship. Green entrepreneurs are a part of sustainable entrepreneurs (Shepherd and Patzelt 2011) and distinguish from conventional and social entrepreneurs by a strong environmental orientation (Schaltegger 2002) and a focus on solving environmentally-relevant market failures (Cohen and Winn 2007; Dean and McMullen 2007). Due to this environmental focus, they are expected not only to stimulate the economy but also the environmental pillars of sustainable development (e.g., Cohen and Winn 2007; Shepherd and Patzelt 2011). This hypothesis is supported by recent empirical research showing (a) that green firms younger than ten years perform better than their conventional counterparts (Leoncini et al. 2019; Shrivastava and Tamvada 2019), and (b) that social entrepreneurship positively impacts all three pillars of sustainable development (Méndez-Picazo et al. 2021). However, despite the high interest and expectations in both green entrepreneurship and sustainable development, to the author's knowledge, no qualitative or quantitative investigations have

² Explicitly included in the German coalition agreement for 2021 to 2025.

been carried out into the impact of green entrepreneurship on either economic, social, or environmental development. This thesis aims to fill this research gap³ by investigating the research question:

How does the impact of green entrepreneurship on economic, social, and environmental development differ from the impact of conventional entrepreneurship?

Addressing the gap, this thesis makes four major contributions to entrepreneurship and environmental management literature.

First, it provides an extensive overview of previous research on the relationship between (green) entrepreneurship and sustainable development. It updates previous literature reviews (e.g., Block et al. 2017; Michael Fritsch 2013; Urbano et al. 2019) by incorporating recent research on developing countries, the impact on environmental and social development, and the determinants of this impact.

Second, this thesis answers recent calls (e.g., Anand et al. 2021; Demirel et al. 2019; Gast et al. 2017; Terán-Yépez et al. 2020) for more quantitative research on green entrepreneurship. Previous research was limited by the scarcity of large-scale databases and is thus mostly qualitative (Gast et al. 2017). Moreover, it has mostly focused on the drivers, business practices, challenges, and environmental outcomes of green entrepreneurship (Fichter and Tiemann 2020; Gast et al. 2017; Kirkwood and Walton 2014). This thesis introduces two cross-country databases, which have so far gone largely unnoticed by green entrepreneurship research. The datasets were used to provide empirical evidence for micro-level outcomes and macro-level impacts of green entrepreneurship. The investigation of the economic importance of green entrepreneurship expands the narrow research focus of previous research.

Third, this thesis recognises that entrepreneurship has complex impacts on economic, social, and environmental development, which simultaneously unfold on the micro-, meta-, and macro-level (Johnson and Schaltegger 2020). To ensure that practitioners

³ A lengthy discussion of the theory is omitted here to avoid repetition. The contextualisation of the research question and a detailed discussion of the state of research can be found in the systematic literature review in Paper I and Sections 1 and 2 of Paper IV.

receive information that is truly comprehensive, it is crucial that state-of-the-art econometric research considers not only economic welfare but also the social and environmental impacts of entrepreneurship. Therefore, this thesis goes beyond traditional economic analyses and investigates the impact of entrepreneurship on all three pillars of sustainable development, as defined in the Brundtland Report (WCED 1987).

Fourth, this thesis acknowledges that the occurrence of entrepreneurial types and their nature, outcomes and impacts significantly differ between countries at different levels of development (e.g., Carree et al. 2007; Dhahri and Omri 2018; Fernández-Laviada et al. 2020). While previous (green) entrepreneurship research mainly focused on developed countries (Anand et al. 2021; Sarango-Lalangui et al. 2018), this thesis investigates countries at all levels of development and accounts for potential moderating effects.

2 Research Design

Recent literature reviews show that the research stream on green entrepreneurship is still in its infancy and empirical evidence is scarce (e.g., Anand et al. 2021; Gast et al. 2017; Piwovar-Sulej et al. 2021). Due to this scarcity, the immediate formulation of hypotheses to answer the research question of this thesis would only have been possible to a limited extent. Thus, theoretical and empirical primary research was required first.

For this purpose, a three-phase research design was developed. In Phase 1, empirical entrepreneurship research was reviewed to identify relevant determinants of the impact of entrepreneurship on sustainable development. In Phase 2, these determinants were empirically investigated to determine differences between green and conventional entrepreneurship. Finally, in Phase 3, the results of the conducted primary research were used to develop hypotheses about how the impact of green entrepreneurship on the three pillars of sustainable development might differ from that of conventional entrepreneurship. Finally, these hypotheses were tested through econometric analyses. Statistical analyses in Phases 2 and 3 were performed using IBM SPSS Statistics software (versions 25 to 28). Figure 1 and the following sections provide an overview of the three phases, the four papers arising from the results of the research, and the contributions that the papers make to answering the research question of this thesis. Brief comments provide additional context and information not mentioned in the papers.

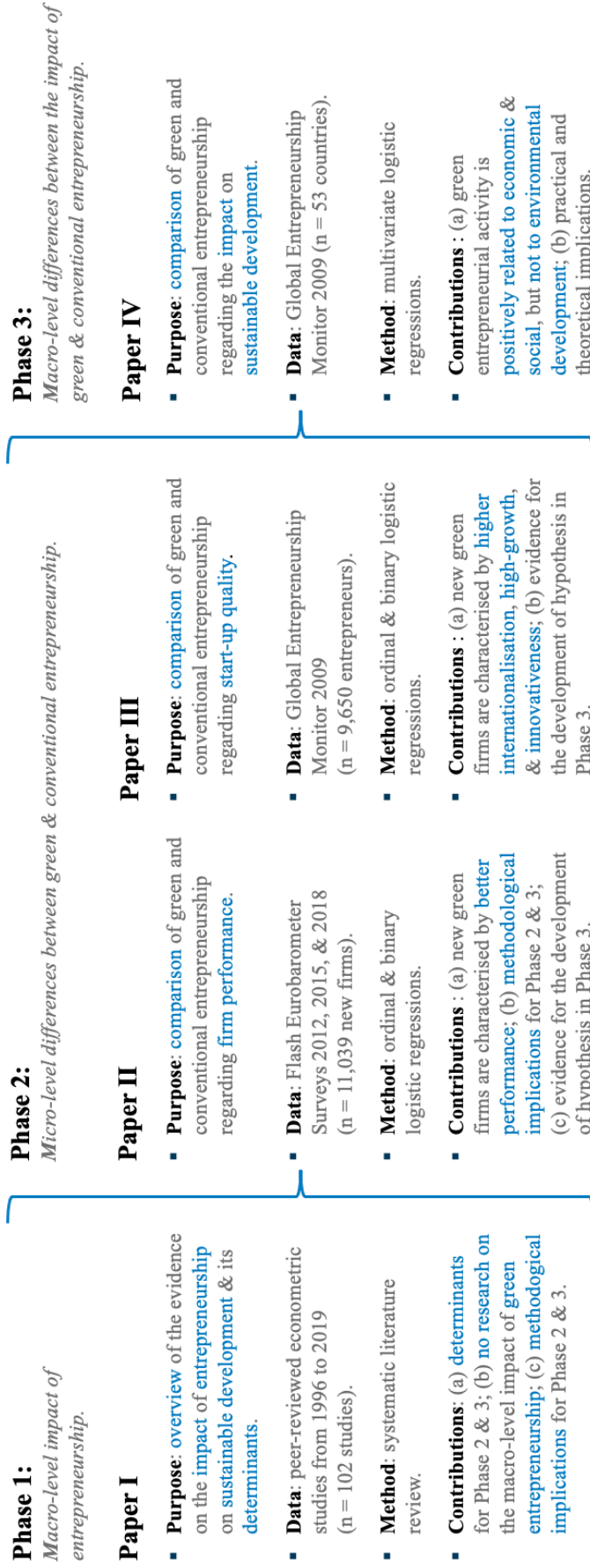


Figure 1 Overview of the three-phase research design and the four papers.

2.1 Phase 1 | Paper I

In Phase 1, empirical evidence for the impact of entrepreneurship on sustainable development was gathered, systematically reviewed, and summarised. The main objective of Phase 1 was to identify and structure the determinants of macro-level impact of entrepreneurship. Phase 1 was culminated in the systematic literature review published in Paper I.

Citation for Paper I: Neumann, T. (2021). The impact of entrepreneurship on economic, social and environmental welfare and its determinants: a systematic review. *Management Review Quarterly* 71, 553-584. <https://doi.org/10.1007/s11301-020-00193-7>.

Comments on Paper I: The term ‘welfare’ used in Paper I originates from Tietenberg and Lewis (2016), who summarised the three pillars of sustainable development in a holistic definition of welfare, which states that a “true measure of development would increase whenever we, as a nation or as a world, were better off and decrease whenever we were worse off” (p. 553). The term welfare can thus be considered to be equivalent to the expression ‘macro-level development’, which is used here and in the subsequent papers. Table 5 from Paper I and the Boolean search string used in the systematic literature review were published as supplementary electronic material.

Contributions of Paper I: Paper I contributes to answering the research question of this thesis with two key findings and four methodological recommendations.

1. Paper I provides an overview of the determinants of the impact of entrepreneurship on sustainable development. This knowledge is required to analyse how green entrepreneurship differs from conventional entrepreneurship regarding these determinants (relevant for Papers II and III) and how these differences might affect the macro-level impact of green entrepreneurship (relevant for Paper IV).
2. Paper I shows that it has not yet been investigated whether the environmental orientation of entrepreneurs is a determinant for sustainable development. This research gap underlines the relevance of the objective of this thesis (relevant for Paper IV).
3. Entrepreneurship research should employ multiple approaches to measure entrepreneurship to increase comparability (relevant for Papers II, III, and IV).

4. Entrepreneurship research should consider that both the macro-level impact of entrepreneurship and its determinants differ between countries at different levels of development (relevant for Papers II, III, and IV).
5. The majority of the research reviewed in Paper I focuses on the macroeconomic impact of entrepreneurship. Econometric entrepreneurship research should consider the impact on all three pillars of sustainable development to provide comprehensive information (relevant for Paper IV).
6. Econometric entrepreneurship research should consider that the macro-level impact of entrepreneurship differs over time and can be structured into a short-term, medium-term, and long-term impact (relevant for Paper IV).

2.2 Phase 2 | Paper II & III

In Phase 2, differences between green and conventional entrepreneurship regarding the determinants identified in Phase 1 were investigated in four steps. First, the relevance of each determinant for the research question of this thesis was evaluated. Second, the literature was carefully screened for existing empirical evidence on how green entrepreneurship differs regarding these determinants. Third, entrepreneurship and green economy databases were examined to assess (a) whether they allow a comparison of green and conventional entrepreneurship and (b) whether they contain data on relevant determinants. Fourth, identified databases meeting these two criteria were used to empirically investigate the relationships between relevant determinants and green and conventional entrepreneurship. The determinants finally selected and investigated in Papers II and III are firm performance, innovativeness, high-growth, and degree of internationalisation. Paper I demonstrates that these four determinants are particularly relevant to the economic pillar of sustainable development. However, the update of the systematic literature review included in Paper IV (see Comments on Paper IV) shows that they also significantly affect the impact of entrepreneurship on social and environmental development. The main elements of the four-step procedure are summarised in Table 1.

Table 1 Overview of selected determinants identified in Phase 1 and their implementation in Phase 2.

Determinants	Previous research on differences between green and conventional entrepreneurship	Comments	Subject of Phase 2
Innovativeness	Hoogendoorn et al. (2020) found that entrepreneurs' environmental orientations are positively related to innovativeness.	The methodological limitations of Hoogendoorn et al. (2020) and the high relevance of innovative entrepreneurship for sustainable development justify further empirical research.	Paper III.
Firm survival	Serio et al. (2020) found that innovative Italian firms survive longer than their conventional counterparts.	The suitability of the data from the German <i>Green Economy Gründungsmonitor</i> , originally from <i>Verband der Vereine Creditreform e. V.</i> , provided to the author by Borderstep GmbH, was investigated in a Master's thesis the author supervised. However, the results show that the data quality is insufficient for scientific evaluation.	Not included.
Firm size	No research yet.	In an earlier version of Paper II, the variation of firm size between green and conventional entrepreneurship was examined. However, the investigation was not included in the final version of the paper in order to maintain a clear research focus, and because firm size is less relevant to academia than turnover development.	Not included.
Degree of internationalisation	Chen et al. (2018) found that entrepreneurs' social orientation is positively related to the degree of internationalisation.	The first empirical evidence for social entrepreneurship and the relevance of the degree of internationalisation for sustainable development justify further empirical research.	Paper III.
Firm performance	Shrivastava and Tamvada (2019) found a positive relationship between different greening strategies of firms and their firm performance. Moreover, they found that this relationship is more pronounced in young firms.	Shrivastava and Tamvada's (2019) lack of focus on new firms younger than ten, five, or three years and further methodological limitations of their study justify further empirical research.	Paper II.
Motivations	No research yet.	In an earlier version of Paper III, the variation of start-up motivation between green and conventional entrepreneurship was examined. However, the investigation was not included in the final version of the paper in order to maintain a clear research focus, and because start-up motivations are less relevant to academia than the determinants finally considered.	Not included.
High-growth	No research yet.	The relevance of high-growth for sustainable development justifies further research.	Paper III.
Qualifications	Hörisch et al. (2017) found that entrepreneurs' environmental orientation is negatively related to their education.	The robust results of Hörisch et al. (2017) are sufficient for this thesis.	Not included.
Gender & age	Hörisch et al. (2017) found that males have lower environmental orientations than females and that entrepreneurs' environmental orientation is positively related to their age.	The robust results of Hörisch et al. (2017) are sufficient for this thesis.	Not included.
Networking	No research yet.	In an earlier version of Paper II, the variations of networking between green and conventional entrepreneurship were examined. However, the investigation was not included in the final version in order to maintain a clear research focus, and because networking is less relevant to academia than turnover development.	Not included.

Note: for other determinants identified in Paper I, neither green entrepreneurship research was found nor was suitable data available for empirical investigations.

Paper II investigated the relationship between different greening strategies and the determinant ‘firm performance’. The paper is based on data from the Flash Eurobarometer Surveys on “Small and Medium-Sized Enterprises, Resource Efficiency and Green Markets” from 2014, 2015, and 2017. The surveys cover data from 36 countries on the greening strategies and firm performance of 11,039 firms younger than eleven years. The methodological recommendations of Paper I (Contributions 3 and 4) were implemented by estimating separate regressions for different entrepreneurial phases and by including country dummies as control variables.

Citation for Paper II: Neumann, T. (2021). Does it pay for new firms to be green? An empirical analysis of when and how different greening strategies affect the performance of new firms. *Journal of Cleaner Production* 317, 128403. <https://doi.org/10.1016/j.jclepro.2021.128403>.

Comments on Paper II: In Paper II, the results of several additional analyses and robustness tests were presented and briefly discussed. The detailed tabular presentations of the results were submitted during the peer-review process. The results for the analysis of four alternative independent variables, representing substantive greening strategies, are mentioned but not described in Paper II. *substGSIa* is an ordinal variable, which represents the share of a new firm’s annual turnover investment in resource efficiency over the past two years. *substGSIIb* is an ordinal variable, which represents the absolute number of resource efficiency actions undertaken by a new firm. *substGSIIa* is an ordinal variable, which represents the share of green products or services in the annual turnover of the latest available fiscal year of a new firm. *substGSIIb* is a binary variable, which indicates whether or not a new firm offers green products or services.

Contributions of Paper II: Paper II contributes to answering the research question of this thesis with one key finding and two methodological recommendations.

1. Paper II shows that new firms benefit from the implementation of substantive greening strategies. This empirical evidence was used to develop hypotheses in Phase 3 (relevant for Paper IV).
2. The impact of greening strategies on firm performance at different entrepreneurial phases underlines the methodological recommendation from Paper I to employ multiple approaches to measure entrepreneurship (relevant for Papers III and IV).

3. Green entrepreneurship research should employ multiple approaches to measure what is ‘green’, as the findings of Paper II reveal that not all greening strategies are positively related to firm performance and that this relationship is not linear but inverted U-shaped (relevant for Papers II, III, and IV).

Paper III investigated the impact of environmental orientation on the three determinants innovativeness, high-growth, and degree of internationalisation. It is based on data from the 2009 Global Entrepreneurship Monitor survey – the only Global Entrepreneurship Monitor survey to date which includes items on green entrepreneurship. It includes data on 9,650 entrepreneurs, who met the research criteria and answered all required questions. The methodological recommendations of Paper I (Contributions 3 and 4) and Paper II (Contributions 2 and 3) were implemented by estimating separate regressions for (a) different entrepreneurial stages, (b) different approaches to measure environmental orientation, and (c) for countries at different levels of development.

Citation for Paper III: Neumann, T. (PREPRINT, submitted April 2022). Are greener start-ups of superior quality? The impact of environmental orientation on innovativeness, high-growth, and internationalisation. Submitted to: *Journal of Innovation and Entrepreneurship*. <https://doi.org/10.21203/rs.3.rs-1557653/v1>.

Comments on Paper III: First, Paper III was submitted after Paper IV, due to the deadline for the call for papers for a special issue in the *Journal of Cleaner Production*. However, the papers were developed simultaneously, and Paper IV is based on the findings of Paper III. Second, for Paper III, several additional analyses and robustness tests were conducted. The detailed tabular presentations of the results were provided to the anonymous reviewers.

Contributions of Paper III: Paper III contributes to answering the research question of this thesis with one key finding and one methodological recommendation.

1. Paper III shows that entrepreneurs’ environmental orientations are positively related to the innovativeness, high-growth, and degree of internationalisation of their new firms. This empirical evidence was used to develop hypotheses in Phase 3 (relevant for Paper IV).

2. Green entrepreneurship research should consider that the impact of entrepreneurs' environmental orientation on high-growth and the degree of internationalisation differs between countries at different levels of development (relevant for Paper IV).

2.3 Phase 3 | Paper IV

The objective of Phase 3 was to develop and test hypotheses directly addressing the research question of this thesis. Phase 3 was culminated in the publication of Paper IV, in which key findings of Phases 1 and 2 were synthesised with other recently published empirical findings into three hypotheses. These hypotheses were tested using merged data from the 2009 Global Entrepreneurship Monitor surveys on 53 countries and other international datasets. To do this, the methodological recommendations in Papers I, II, and III (Section 2.1 and 2.2) were used, to the extent that the available data allowed (see limitations of Paper IV), to create a state-of-the-art econometric research design.

Citation for Paper IV: Neumann, T. (2022). Impact of green entrepreneurship on sustainable development: an ex-post empirical analysis. *Journal of Cleaner Production* 377, 134317. <https://doi.org/10.1016/j.jclepro.2022.134317>.

Comments on Paper IV: At the time of preparing Paper IV, the systemic literature review from Paper I, conducted in May 2019 and updated once in December 2019, was already partially outdated. The theory section of Paper IV therefore includes a brief update summarising the findings of a very recent line of research, which has investigated the impact of entrepreneurship on social and environmental development. Second, for Paper IV, an additional analysis was conducted and briefly discussed. A detailed tabular presentation of the results together with a description of the countries included were provided to the anonymous reviewers.

Contributions of Paper IV: The objective of Paper IV is essentially the objective of this thesis. The paper's findings thus contribute directly to answering the research question of this thesis. The main finding of Paper IV is that a high proportion of green entrepreneurial activity is positively related to economic and social development, but not to environmental development. Paper IV thoroughly discusses this and further findings,

offering potential explanations, political and managerial implications, and recommendations for future research.

3 Discussion

In the three phases of the research for this thesis, the impact of green entrepreneurship on economic, social, and environmental development was compared to the impact of conventional entrepreneurship. Phases 1 and 2 provided the required fundamental theoretical and empirical knowledge, so that in Phase 3, three hypotheses could be developed and empirically tested, namely that green entrepreneurial activity positively impacts (i) economic, (ii) social, and (iii) environmental development. The results of the econometrical analyses confirmed hypotheses (i) and (ii) by showing that higher shares of green entrepreneurial activity are positively related to economic and social development. However, the results did not confirm the anticipated positive impact of green entrepreneurship on environmental development, so hypothesis (iii) was rejected. This counterintuitive finding is remarkable, as empirical evidence confirms a positive relationship between environmental orientation and environmental performance at the micro-level (e.g., Meirun et al. 2020) and the literature on green entrepreneurship provides compelling arguments for a positive relationship at the macro-level. Paper IV provides, among others, the following two explanations for the absence of environmental impacts. First, the economic growth generated by green entrepreneurship might outweigh anticipated environmental benefits. Second, the econometric analysis was hampered by significant data limitations (e.g., small sample size, no panel data), so existing relationships might not have been detected among the strong impacts of other efforts to reduce greenhouse gas emissions. Accordingly, the presented results are likely to underestimate the true environmental relevance of green entrepreneurship. These hypotheses and further findings related to the research question of this thesis were thoroughly discussed in Paper IV. Paper IV also contains a comprehensive discussion of methodological limitations regarding the econometric analysis. Furthermore, the research design of this thesis is not itself free of limitations, providing promising avenues for future research.

First, it needs to be stated that the research approaches in this thesis and the four papers presented within it were conceived and conducted by a single author. However, the research methods were carefully selected, and various robustness tests were implemented to maintain objectivity. Additionally, all four papers have been subjected to

academic peer review, and both the research design and the papers have been discussed frequently at doctoral colloquiums, entrepreneurship conferences, paper development workshops, and with doctoral supervisors. Nevertheless, the chance remains that the research is burdened with subjectivity and selection biases.

Second, Papers II, III, and IV rely on secondary databases, which were originally designed for research on social entrepreneurship (Global Entrepreneurship Monitor) and green small and medium-sized enterprises (Flash Eurobarometer). The construction of variables was thus limited by the availability and suitability of survey items, and (green) entrepreneurship had to be measured differently in the three quantitative papers. For instance, while Paper II investigated firms younger than eleven, six, or four years, Papers III and IV analysed entrepreneurs who either planned to launch a new firm or managed a firm younger than 3.5 years. Additionally, Paper II identified firms as green if they applied certain substantive or symbolic greening strategies, while Papers III and IV used the environmental orientation of firms as a proxy. Although there is evidence that different approaches to measuring what is green are highly correlated (e.g., Meirun et al. 2020), the hypotheses of Paper IV based on Phase 2 need to be treated with caution. The lack of data with comparable items is a common problem in green entrepreneurship research (Gast et al. 2017), and future research should consider the development of standardised measurements, the combination of multiple measurement approaches, and the construction of more advanced multi-item measurements.

Third, the cumulative nature of the present work and the limitations of peer-reviewed journals restricted the choice of research topics and the depth of individual papers. In particular, the word count restrictions of the journals limited the description of how the methodological approach of Paper IV differs from that of Hoogendoorn et al. (2020). Such a description is common for constructive replication research literature. Moreover, the different thematic focuses of the journals required the use of different terminology in the papers (see notes on Paper I in Section 2.1). Finally, publication in academic journals requires clear research foci and motivations, so not all determinants for which suitable data were available could be considered (see Table 1). However, the decision as to which determinants were included was not driven by favourable preliminary results but solely by previous theoretical considerations to avoid possible selection bias. Although this thesis includes two papers examining the differences between green and conventional

entrepreneurship regarding the determinants identified, both the Flash Eurobarometer and Global Entrepreneurship Monitor surveys hold potential for future research and publications.

Fourth, while many studies have investigated the economic impacts of entrepreneurship and the determinants of these impacts, Papers I and IV highlight that there is little econometric research which considers the social and environmental impacts of entrepreneurship. Even less is known about the determinants of these relationships. Consequently, only the hypotheses developed in Paper IV on the economic impacts of entrepreneurship are well-founded. Further foundation research is needed, which considers all three pillars of sustainable development so that it could contribute to understanding the identified differences between green and conventional entrepreneurship at the macro-level.

Fifth, the quantitative nature of Papers II, III, and IV prevents any conclusions from being drawn about the mechanisms underlying the observed differences between green and conventional entrepreneurship. In other words, this thesis only provides limited answers as to why green entrepreneurship is characterised by superior performance, quality, and impacts on economic and social development and why the findings differ between countries at different levels of development. Paper IV raises multiple hypotheses as to why no significant differences were found in the environmental impact of green and conventional entrepreneurship. However, it remains a matter for future research to test these hypotheses and enrich the contextual richness by investigating explanatory micro-, meso-, and macro-level effects. This investigation can be conducted, for example, by employing mediating and moderating models or adopting qualitative approaches.

Sixth, Papers II, III, and IV suffer from the scarcity of large-scale cross-country data to distinguish between green and conventional entrepreneurship. Thus, more green entrepreneurship research, both on the micro- and macro-level, is required to evaluate and expand the presented findings once appropriate data becomes available. Future micro-level research should focus on how green entrepreneurship differs regarding other determinants (e.g., survival rates, firm size, motivations) and why. Future macro-level research on green entrepreneurship should apply more sophisticated econometric research designs to investigate causality (requires panel data), long-term impacts, and interaction effects between the three pillars of sustainable development.

4 Conclusion

Practitioners and researchers show a growing interest in (a) the benefits and harms of entrepreneurship for sustainable development and (b) green entrepreneurship as a potential economic and environmental win-win solution. This thesis is the first to link these two areas of research by asking how the impact of green entrepreneurship on sustainable development differs from that of conventional entrepreneurship. Paper IV provides a comprehensive overview of the implications arising from the answer to the research question. However, the overall consideration of this thesis leads to further practical implications beyond those presented in the individual papers.

The first implication stems from the need for more large-scale databases on green entrepreneurship, as outlined in Section 3 and all four papers. Although the databases used here were suitable for preliminary foundation research, more advanced research will require panel data collected over five, ten, or more years from surveys explicitly designed to explore green entrepreneurship. Policymakers should thus encourage the introduction of new (standardised) survey items⁴ into existing internationally-harmonised entrepreneurship databases, such as the Flash Eurobarometer surveys⁵, the Global Entrepreneurship Monitor⁶, the OECD / Kauffman Entrepreneurship Indicators Program⁷, or the World Bank Global Entrepreneurship Survey⁸.

Further implications result from the fact that no significant relationship was found between green entrepreneurship and environmental development. Entrepreneurs and stakeholders engaged in green entrepreneurship should recognise that not all greening strategies have an equal impact (Paper II), and that micro- (Paper II) and macro-level benefits (Paper IV) may take several years to materialise. Entrepreneurs should therefore focus on minimising the environmental footprint of both their outputs (services and products) and inputs (resources and activities) and ensure that their increasing economic activity does not offset these efforts.

⁴ A proposal for new Global Entrepreneurship Monitor survey items on green and sustainable entrepreneurship can be found in Roomi et al. (2021).

⁵ See <https://www.gesis.org/en/eurobarometer-data-service/survey-series>.

⁶ See <https://www.gemconsortium.org>.

⁷ See <https://www.oecd.org/sdd/business-stats/>.

⁸ See <https://www.worldbank.org/en/programs/entrepreneurship>.

Finally, three more implications of practical importance arise from the findings suggesting that green entrepreneurship is characterised by increased performance (Paper II), superior quality (Paper III), and pronounced economic and social impacts (Paper IV). First, although the mechanisms behind the superior performance and quality of green entrepreneurship are not yet fully understood, the initial positive evidence should encourage entrepreneurs to adopt substantive greening strategies. Second, the economic and social win-win situation increases the attractiveness of green entrepreneurship for private and public investors seeking profit, societal impact, or both. Venture capitalists and public funding institutions could harness the potential of green entrepreneurship, for example, by establishing dedicated green start-up funds and portfolios. Third, the findings highlight that policymakers in countries at all levels of development should recognise green entrepreneurship as a valuable tool for achieving economic and social development – and probably also for environmental development. This importance to sustainable development warrants intensified policy efforts to stimulate green entrepreneurship, by encouraging the creation of green start-ups and supporting existing ones.⁹

Despite the academic and practical value of the findings this thesis yields, it is far from exhaustive. Joint political, managerial, and academic efforts are required to develop a comprehensive understanding of if, how, when, where, and why green entrepreneurship can contribute most to economic, social, and environmental development. This thesis is a first step on this path and a reference point for future research.

⁹ Practical recommendations on how to implement these strategies are discussed in Paper III and IV.

V REFERENCES

- Acs, Z. J., Audretsch, D. B., Braunerhjelm, P., & Carlsson, B. (2012). Growth and entrepreneurship. *Small Business Economics*, 39(2).
<https://doi.org/10.1007/s11187-010-9307-2>
- Acs, Z. J., & Mueller, P. (2007). Employment effects of business dynamics: Mice, Gazelles and Elephants. *Small Business Economics*, 30(1).
<https://doi.org/10.1007/s11187-007-9052-3>
- Anand, A., Argade, P., Barkemeyer, R., & Salignac, F. (2021). Trends and patterns in sustainable entrepreneurship research: A bibliometric review and research agenda. *Journal of Business Venturing*, 36(3).
<https://doi.org/10.1016/j.jbusvent.2021.106092>
- Atems, B., & Shand, G. (2018). An empirical analysis of the relationship between entrepreneurship and income inequality. *Small Business Economics*, 51(4), 905–922. <https://doi.org/10.1007/s11187-017-9984-1>
- ben Youssef, A., Boubaker, S., & Omri, A. (2018). Entrepreneurship and sustainability: The need for innovative and institutional solutions. *Technological Forecasting and Social Change*, 129. <https://doi.org/10.1016/j.techfore.2017.11.003>
- Block, J. H., Fisch, C. O., & van Praag, M. (2017). The Schumpeterian entrepreneur: a review of the empirical evidence on the antecedents, behaviour and consequences of innovative entrepreneurship. *Industry and Innovation*, 24(1).
<https://doi.org/10.1080/13662716.2016.1216397>
- Carree, M., van Stel, A., Thurik, R., & Wennekers, S. (2007). The relationship between economic development and business ownership revisited. *Entrepreneurship & Regional Development*, 19(3), 281–291.
<https://doi.org/10.1080/08985620701296318>
- Chen, J., Puumalainen, K., & Saarenketo, S. (2018). The Internationalisation of Ventures: The Roles of a Nation's Institutions and the Venture's Value Orientation. In *Contemporary Issues in International Business*. Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-70220-9_4

- Cohen, B., & Winn, M. I. (2007). Market imperfections, opportunity and sustainable entrepreneurship. *Journal of Business Venturing*, 22(1).
<https://doi.org/10.1016/j.jbusvent.2004.12.001>
- Colombelli, A., Krafft, J., & Vivarelli, M. (2016). To be born is not enough: the key role of innovative start-ups. *Small Business Economics*, 47(2), 277–291.
<https://doi.org/10.1007/s11187-016-9716-y>
- de Clercq, D., Hessels, J., & van Stel, A. (2008). Knowledge spillovers and new ventures' export orientation. *Small Business Economics*, 31(3).
<https://doi.org/10.1007/s11187-008-9132-z>
- Dean, T. J., & McMullen, J. S. (2007). Toward a theory of sustainable entrepreneurship: Reducing environmental degradation through entrepreneurial action. *Journal of Business Venturing*, 22(1). <https://doi.org/10.1016/j.jbusvent.2005.09.003>
- Demirel, P., Li, Q. C., Rentocchini, F., & Tamvada, J. P. (2019). Born to be green: new insights into the economics and management of green entrepreneurship. *Small Business Economics*, 52(4). <https://doi.org/10.1007/s11187-017-9933-z>
- Dhahri, S., & Omri, A. (2018). Entrepreneurship contribution to the three pillars of sustainable development: What does the evidence really say? *World Development*, 106. <https://doi.org/10.1016/j.worlddev.2018.01.008>
- Du, K., & O'Connor, A. (2018). Entrepreneurship and advancing national level economic efficiency. *Small Business Economics*, 50(1).
<https://doi.org/10.1007/s11187-017-9904-4>
- Fernández-Laviada, A., López-Gutiérrez, C., & San-Martín, P. (2020). The Moderating Effect of Countries' Development on the Characterization of the Social Entrepreneur: An Empirical Analysis with GEM Data. *Voluntas*, 31(3), 563–580.
<https://doi.org/10.1007/s11266-020-00216-7>
- Fichter, K., & Tiemann, I. (2020). Impacts of promoting sustainable entrepreneurship in generic business plan competitions. *Journal of Cleaner Production*, 267, 122076.
<https://doi.org/10.1016/j.jclepro.2020.122076>

- Fritsch, M., & Mueller, P. (2007). The effect of new business formation on regional development over time: the case of Germany. *Small Business Economics*, 30(1). <https://doi.org/10.1007/s11187-007-9067-9>
- Fritsch, Michael. (2013). New Business Formation and Regional Development: A Survey and Assessment of the Evidence. *Foundations and Trends in Entrepreneurship*, 9(3), 249–364. <https://doi.org/10.1561/03000000043>
- Gast, J., Gundolf, K., & Cesinger, B. (2017). Doing business in a green way: A systematic review of the ecological sustainability entrepreneurship literature and future research directions. *Journal of Cleaner Production*, 147. <https://doi.org/10.1016/j.jclepro.2017.01.065>
- González-Pernía, J. L., & Peña-Legazkue, I. (2015). Export-oriented entrepreneurship and regional economic growth. *Small Business Economics*, 45(3). <https://doi.org/10.1007/s11187-015-9657-x>
- Gu, W., Wang, J., Hua, X., & Liu, Z. (2021). Entrepreneurship and high-quality economic development: based on the triple bottom line of sustainable development. *International Entrepreneurship and Management Journal*, 17(1), 1–27. <https://doi.org/10.1007/s11365-020-00684-9>
- Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing*, 25(5). <https://doi.org/10.1016/j.jbusvent.2010.01.002>
- Hessels, J., & van Stel, A. (2011). Entrepreneurship, export orientation, and economic growth. *Small Business Economics*, 37(2). <https://doi.org/10.1007/s11187-009-9233-3>
- Hoogendoorn, B., van der Zwan, P., & Thurik, R. (2020). Goal heterogeneity at start-up: are greener start-ups more innovative? *Research Policy*, 49(10). <https://doi.org/10.1016/j.respol.2020.104061>
- Hörisch, J., Kollat, J., & Brieger, S. A. (2017). What influences environmental entrepreneurship? A multilevel analysis of the determinants of entrepreneurs' environmental orientation. *Small Business Economics*, 48(1). <https://doi.org/10.1007/s11187-016-9765-2>

- Johnson, M. P., & Schaltegger, S. (2020). Entrepreneurship for Sustainable Development: A Review and Multilevel Causal Mechanism Framework. *Entrepreneurship Theory and Practice*, 44(6).
<https://doi.org/10.1177/1042258719885368>
- Kirkwood, J., & Walton, S. (2014). How green is green? Ecopreneurs balancing environmental concerns and business goals. *Australasian Journal of Environmental Management*, 21(1).
<https://doi.org/10.1080/14486563.2014.880384>
- Leoncini, R., Marzucchi, A., Montresor, S., Rentocchini, F., & Rizzo, U. (2019). ‘Better late than never’: the interplay between green technology and age for firm growth. *Small Business Economics*, 52(4). <https://doi.org/10.1007/s11187-017-9939-6>
- Meirun, T., Makhoulfi, L., & Ghazali Hassan, M. (2020). Environmental Outcomes of Green Entrepreneurship Harmonization. *Sustainability*, 12(24).
<https://doi.org/10.3390/su122410615>
- Méndez-Picazo, M.-T., Galindo-Martín, M.-A., & Castaño-Martínez, M.-S. (2021). Effects of sociocultural and economic factors on social entrepreneurship and sustainable development. *Journal of Innovation & Knowledge*, 6(2).
<https://doi.org/10.1016/j.jik.2020.06.001>
- Mueller, P. (2007). Exploiting Entrepreneurial Opportunities: The Impact of Entrepreneurship on Growth. *Small Business Economics*, 28(4).
<https://doi.org/10.1007/s11187-006-9035-9>
- Piwowar-Sulej, K., Krzywonos, M., & Kwil, I. (2021, May 1). Environmental entrepreneurship – Bibliometric and content analysis of the subject literature based on H-Core. *Journal of Cleaner Production*. Elsevier Ltd.
<https://doi.org/10.1016/j.jclepro.2021.126277>
- Rupasingha, A., & Goetz, S. J. (2013). Self-employment and local economic performance: Evidence from US counties. *Papers in Regional Science*, 92(1), 141–161. <https://doi.org/10.1111/j.1435-5957.2011.00396.x>

- Sarango-Lalangui, P., Santos, J., & Hormiga, E. (2018). The Development of Sustainable Entrepreneurship Research Field. *Sustainability*, *10*(6), 2005. <https://doi.org/10.3390/su10062005>
- Schaltegger, S. (2002). A Framework for Ecopreneurship. *Greener Management International*, *2002*(38). <https://doi.org/10.9774/GLEAF.3062.2002.su.00006>
- Serio, R. G., Dickson, M. M., Giuliani, D., & Espa, G. (2020). Green Production as a Factor of Survival for Innovative Startups: Evidence from Italy. *Sustainability*, *12*(22), 9464. <https://doi.org/10.3390/su12229464>
- Shane, S. (2009). Why encouraging more people to become entrepreneurs is bad public policy. *Small Business Economics*, *33*(2). <https://doi.org/10.1007/s11187-009-9215-5>
- Shepherd, D. A., & Patzelt, H. (2011). The New Field of Sustainable Entrepreneurship: Studying Entrepreneurial Action Linking “What is to be Sustained” with “What is to be Developed.” *Entrepreneurship Theory and Practice*, *35*(1), 137–163. <https://doi.org/10.1111/j.1540-6520.2010.00426.x>
- Shrivastava, M., & Tamvada, J. P. (2019). Which green matters for whom? Greening and firm performance across age and size distribution of firms. *Small Business Economics*, *52*(4). <https://doi.org/10.1007/s11187-017-9942-y>
- Stam, E., Hartog, C., van Stel, A., & Thurik, R. (2011). Ambitious Entrepreneurship, High-Growth Firms, and Macroeconomic Growth. In *The Dynamics of Entrepreneurship: Evidence from Global Entrepreneurship Monitor Data*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199580866.003.0011>
- Stam, E., Suddle, K., Hessels, J., & Stel, A. van. (2009). High-Growth Entrepreneurs, Public Policies, and Economic Growth. In *Public Policies for Fostering Entrepreneurship*. New York, NY: Springer US. https://doi.org/10.1007/978-1-4419-0249-8_5
- Terán-Yépez, E., Marín-Carrillo, G. M., Casado-Belmonte, M. del P., & Capobianco-Uriarte, M. de las M. (2020). Sustainable entrepreneurship: Review of its evolution and new trends. *Journal of Cleaner Production*, *252*. <https://doi.org/10.1016/j.jclepro.2019.119742>

- Tietenberg, T. H., & Lewis, Lynne. (2016). *Environmental & natural resource economics* (10th ed.). Boston: Pearson.
- United Nations. (2015). *Transforming our World: the 2030 Agenda for Sustainable Development*. eSocialSciences.
<https://EconPapers.repec.org/RePEc:ess:wpaper:id:7559>
- Urbano, D., Aparicio, S., & Audretsch, D. (2019). Twenty-five years of research on institutions, entrepreneurship, and economic growth: what has been learned? *Small Business Economics*, 53(1), 21–49. <https://doi.org/10.1007/s11187-018-0038-0>
- van Praag, C. M., & Versloot, P. H. (2007). What is the value of entrepreneurship? A review of recent research. *Small Business Economics*, 29(4).
<https://doi.org/10.1007/s11187-007-9074-x>
- Venâncio, A., & Pinto, I. (2020). Type of Entrepreneurial Activity and Sustainable Development Goals. *Sustainability*, 12(22), 9368.
<https://doi.org/10.3390/su12229368>
- World Commission on Environment and Development. (1987). *Our common future (The Brundtland Report)*. New York: Oxford University Press.