

Sustainable Entrepreneurship:
**Conceptual and empirical contributions to improve the future
sustainability impact of early stage new ventures**

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Article I – Chapter 3

Exploring entrepreneurship related to the Sustainable Development Goals - Mapping new venture activities in Germany with semi-automated content analysis

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Article II – Chapter 4

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Article III – Chapter 5

Evaluating the future sustainability impact potential of new ventures in early phases - a five-dimension approach, suitable for self- and external evaluation

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Preprint

Article IV – Chapter 6

Antecedents for new venture sustainability impact: Combining traditional with impact specific enablers to explain the sustainability value creation of new ventures

Malte Recker, Dr. Ingo Michelfelder

Preprint

This dissertation manuscript and the related research articles have been created between 2017 and 2021, a phase in which sustainable entrepreneurship has become a major research field with growing awareness in multiple disciplines. This PhD thesis was part of a larger research project started and coordinated by Dr. Ingo Michelfelder at Technical University Berlin. Two prominent academic collaboration partners joined the research, bringing in additional expertise and a global network: MIT Sloan School of Management, Cambridge, USA and Harvard Social Innovation and Change Initiative, Cambridge, USA. The research is strongly focusing both on theory and practice, resulting in ongoing exchange and collaboration with various sustainable entrepreneurs, impact oriented new ventures, support systems and change or sustainability initiatives in Germany and around the globe. Hence, a broad audience and different target groups will find helpful insights and takeaways in this dissertation.

Researchers can first of all take advantage of the collection of most recent literature on sustainability impact measurement approaches, impact predictors for new ventures and overall sustainability entrepreneurship definitions and frameworks. Next the dissertation offers newly developed frameworks and approaches to evaluate sustainability impact potentials in early phases, which are ready to use and fully shared in the respective articles. Third, the manuscript contributes to the evolving research on relevant impact opportunities and significant predictors for future sustainability impact of new ventures in early phases.

Entrepreneurs & new ventures (either already focusing on sustainability or willing to increase their impact focus for current or future activities) can benefit from practical guidance on both where to find impact opportunities suitable for entrepreneurial activity based on the UN's Sustainable Development Goals and also on how to increase the impact potential of their new ventures with help of significant impact predictors identified in this research project and a ready to use self-evaluation approach pointing out improvement areas.

Investors aiming to or already investing in impact oriented new ventures can find guidance on how to pragmatically structure and layout the impact measurement from an academic perspective, ensuring applicability and fit for early phases. In addition, the research at hand might provide valuable insights for the assessment and evaluation of potential investment targets by highlighting important preconditions and success factors on the new venture's way to impact.

Support systems, e.g., public or private initiatives and organizations supporting new ventures and entrepreneurs, often experience challenges in selecting the right projects and people to support, in evaluating the impact potential and in tracking success of their support. All of these challenges can be solved by applying the specifically developed evaluation approach for new ventures' impact potential, which is presented in the respective article. In addition, the identified success factors and typical activity fields help to focus support resources on the right cases.

Coaches & consultants in the field of entrepreneurship and impact oriented business models will find a structured and pragmatic guide on how to evaluate sustainability impact already in early phases and what it takes to build in impact in early business models and ideas. Important decision making and focus setting towards sustainability impact creation is often deprioritized against other business or monetary targets, which are discussed more prominently with all stakeholders.

Policy makers in public and private organizations can identify specific opportunities to create an ecosystem in which sustainable entrepreneurs can flourish and execute their business ideas. They also understand which preconditions are required to boost the impact creation and allow entrepreneurship being an effective lever to support the urgently required sustainability transformation.

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List of abbreviations

| | |
|-----------------|--|
| BSC | Balanced Scorecard |
| CBA | Cost Benefit Analysis |
| CDP | Carbon Disclosure Project |
| Cf. | Compare |
| CO ₂ | Carbon dioxide |
| CV | Curriculum Vitae |
| DSM | Deutscher Startup Monitor, German Startup Monitor |
| e.g. | For example |
| e.V. | Eingetragener Verein, registered association |
| EF | Ecological Footprint |
| EIA | Environmental impact assessment |
| et al. | And others |
| EV | Ecosystem Valuation |
| GECES | Groupe d'Experts de la Commission sur l'Entrepreneuriat Social |
| GmbH | Gesellschaft mit beschränkter Haftung, limited liability company |
| GRI | Global Reporting Initiative |
| IR | Integrated Reporting |
| LCA | Life Cycle Assessment |
| NGO | Non-Governmental Organization |
| Ref. | Reference |
| RQ | Research Question |
| SCI/SSCI | (Social) Sciences Citation Index |
| SDG | Sustainable Develop Goal |
| SEND | Social Entrepreneurship Netzwerk Deutschland, - Network Germany |
| SLCA | Social Life Cycle Assessment |
| SR | Sustainability Reporting |
| SROI | The Social Return of Investment |
| SVA | Sustainable Value Added |
| TBL | Triple Bottom Line |
| UG | Unternehmergeellschaft, entrepreneurial company |
| UN | United Nations |
| USA | United States of America |
| WCED | World Commission on Environment and Development |

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1 Executive Summary

Seeing sustainable new ventures as key actors and important change makers towards the sustainable development goals, we need to better understand how to support those new ventures in creating sustainability impact. This is especially important in early phases, because it is when products or services are developed and impactful, sustainable business models are created (Bocken, 2015; Fichter and Tiemann, 2020). Identifying significant impact predictors and antecedents will help to support entrepreneurs even better in contributing to the Sustainable Development Goals (SDGs). It is widely agreed on, that entrepreneurship still is a relevant field of study, with a strong need to better understand (Shane and Venkataraman, 2000). Sustainability and entrepreneurship should be researched jointly to support the inherent impact potential (Shepherd, 2015).

Summarizing the existing body of research and literature, one can state that first, that there is a lack of more objective, data-driven approaches to assess the contribution of entrepreneurs to the SDGs, which is important to better understand the causal relations between entrepreneurial activity and potential sustainability impact. Consequently, **Article I** explores entrepreneurship related to the Sustainable Development Goals by mapping new venture activities in Germany with semi-automated content analysis. By doing this the authors used freely available web-material, using the semiautomated content analysis for a scalable approach to map entrepreneurial activities along the 17 SDGs. The analysis showed that entrepreneurs currently do not address all SDGs. There is strong direct engagement around SDG 9 (industry, innovation & infrastructure), SDG 3 (good health and well-being) and SDG 12 (responsible consumption and production). On the other end of the spectrum we find SDG 1 (no poverty) and SDG 17 (partnership for the goals) with little-observed activity. However, the article highlights the expected contribution potential and guides the research to further investigate on how to support the impact potential of new ventures in details.

Second, the overarching problem is that measuring sustainability impact across the three domains (economic, social and environmental) is extremely challenging, as in some cases it is even hard to judge whether an organizational sustainability impact is positive or negative (Hahn et al., 2014; Jay and Gerard, 2015). Best practices, currently used primarily in mature organizations, such as the Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting, are very valuable, but are criticized for important shortcomings (Milne and Gray, 2013). And the measurement problem becomes even bigger in early stages of new ventures, due to uncertainty, unavailability of data and frequent changes to products, services and business models. However, without measurement, we cannot make informed choices which new ventures have the potential highest sustainability impact. **Article II's** systematic literature review concludes that there is a lack of sustainability measurement tools appropriate for early stages of a new venture. Holistic measurement tools, covering environmental, social and economic value generation, are needed to enable sustainable entrepreneurs to improve their business and impact models maximizing impact along the three dimensions of sustainability. The relative improvement of generated value needs to be taken into account in order to allow a meaningful comparison of different ventures and business models and to significantly reduce the complexity. The article emphasizes, that research shall integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only. This has been the starting point to develop evaluation approaches and to investigate success factors in articles III and IV.

As a third point, practitioners currently founding new ventures or offering support for respective sustainable entrepreneurs, still lack guidance on how to work out the sustainability impact potential. Primarily, missing fully applicable approaches, fitting the special needs for early stage new ventures, are hindering them in decision making and business or impact model adjustments (Bengo et al., 2016; Arena et al., 2015; Dichter et al., 2016; Geissdoerfer et al., 2016; Hansen et al., 2009; Mudaliar et al., 2008; Schaltegger et al., 2016). And most approaches face understandable criticism (Bengo et al., 2016; Hadad and Găucă, 2014; Mulgan, 2010; Nicholls, 2009). Consequently, there has no overarching standard academic approach to forecast, management or measure impact emerged yet, solely standards for some specific contexts can be found (Bengo et al., 2016; Clifford, 2014; Clark and Brennan, 2016; Figge and Hahn, 2004; Hadad and Găucă, 2014; Kroeger and Weber, 2014; Mulgan, 2010; Nicholls, 2009; Weber and Kratzer, 2013; Recker and Michelfelder, 2017; Nicholls et al., 2015). However, there are emerging standards found in non-academic sources, aiming to close the identified gap in practice. E.g., the impact management project provides a common view on impact measurement and management, still not fully covering the forecasting aspect (The Impact Management Project, 2021). Hence, **Article III** aims to develop a suitable approach and builds on emerging standards, using five dimensions of sustainability impact to evaluate the future potential of new ventures in early phases. Essential impact levers (scale, degree of change and duration) are combined with the importance and risk dimensions associated. The piloting of the developed approach shows the good fit to early stage startups in various industries and a high degree of insights and valuable information. In addition, some refinements have been developed and added to the evaluation concept, improving applicability for future utilization and answering feedback from the pilot audience.

A fourth identified gap is the missing prediction of sustainability value based on significant success factors (predictors and antecedents), which are important to support and guide new ventures and support systems effectively. Whereas there are established dependent variables allowing to measure the success for traditional new ventures, there is much more uncertainty how sustainability impact as a dependent variable can be conceptualized and measured (Tuan, 2008). Quantitative variables that are also appropriate for early-stage new ventures are currently not established and not standardized (Horne, 2019; Recker and Michelfelder, 2017 and consequently there is no simple variable available. But research has developed some measurement frameworks to assess the sustainability value creation of new ventures (see e.g., Weber and Kratzer, 2013; Kalleberg and Leicht, 1991), covering different perspectives of impact such as system transformation, geographic expansion, adaptability and tangibility. The lack of quantitative exploration (Weber and Kratzer, 2013) to validate predominantly qualitative research in this field (Mair and Martí, 2006; Short et al., 2009) has been the starting point to test and validate three hypotheses. **Article IV** indicates that generic sustainability impact predictors are less significant to predict new venture sustainability impact creation in early phases. The regression analysis revealed a set of significant predictors, showing balance of generic and impact oriented predictors. Problem exposure, stakeholder contact, market test and intellectual property have been identified as applicable predictors. This finding will support entrepreneurs, support systems and investors in focusing on the right areas to ensure maximized impact potential from the beginning. Reviewing the results from the different regression models applied, the authors can also conclude, that the developed aggregated impact measure has the broadest coverage of significant predictors. The respective subsidiary impact measure variables, also tested, showed relationships to single predictors, but do not add additional predictors to the set. Hence, the used impact potential measures proves applicability and can be used and further refined by future researches.

Summarizing the four articles, the dissertation manuscript offers conceptual contribution by pointing out a way on how to first map entrepreneurial activity to the SGDs and accordingly indicate the potential contribution of sustainable entrepreneurship for defined regions and sets of new ventures. Second, a scoring approach to assess impact potential of single new ventures has been developed and tested, showing great potential in early phases. In addition a qualitative impact measure has been developed and successfully tested. Empirical contributions could be generated by creating insights in large data sets of new ventures. First exploring the opportunity to contribute to the SDGs. And second by studying the significance of generic and specific success factors and predictors, based on new venture data. Various contribution to practice are listed and detailed throughout the manuscript, aiming to support a broad range of practitioners – starting with the entrepreneurs themselves and ending with all supporting stakeholders, e.g., investors, support systems and policy makers.

Future research might investigate in more depth the transfer of micro new venture level impact into systemic level perspectives. Better understanding in impact realization and potential risks and barriers on the different levels will support the contribution and effectiveness of single new ventures towards the bigger goal. Overlooking the entrepreneurial stages, future research can support in continuing empirical research on antecedents and predictors of early stage impact potential as an important research area to support. Newly developed and more and more standardized approaches to measure and evaluate impact creation shall support this activity as well. Both impact category specific or industry specific data sets might additionally improve the insights and allow to better understand cause and effect relationships in this more specific contexts. It is still a long way to completely understand and prove the full potential of sustainable entrepreneurship, however the growing number of researchers and publications in that field create an optimistic outlook for the next years and will most likely generate important insights.

2 Introduction

2.1 Motivation and research gap

Back in 1987, the Brundtland Commission defined sustainability as “development that meets the needs of the present, without compromising the ability of future generations to meet their own needs” (Brundtland Commission, 1987). Over 30 years later and after having agreed on the Sustainable Development Goals (SDGs) (UN General Assembly, 2015) to structure, manage and track the required actions globally, we are still not achieving the required sustainable development and are consequently also not meeting the aimed for SDGs (The Sustainable Development Goals Report 2019, 2019). The majority of researchers jointly agrees on the extensive challenges, we as a global community, are currently facing when trying to rebalance and hence to sustain our human actions with the earth system’s planetary boundaries (Reid et al., 2010; Rockström et al., 2009; Hummels and Argyrou, 2021).

Increasing noticeability of this misconduct and resulting consequences, as for example by significant and reoccurring climate catastrophes, growing social instability and more and more local and global conflicts, etc. happening around the planet, have peaked public awareness. Our society’s willingness to support the sustainable transformation is higher than ever before. Research has proven that the Sustainable Development Goals are possible and necessary to achieve (Griggs et al., 2014) and the number of activities to reach the goals has significantly increased. And still there are many questions and uncertainties around how to reach the development needed.

Businesses (Loorbach and Wijsman, 2013; Sullivan et al., 2018; Figge and Hahn, 2004; Weissbrod and Bocken, 2017; Bocken and Short, 2016) and especially entrepreneurs starting new ventures are seen as the key actors to support this development (Dean and McMullen, 2007; Shepherd and Patzelt, 2011; Cohen and Winn, 2007; Apostolopoulos et al., 2018), together with politicians and policy makers, who are creating and supporting the required system for new ventures to act in.

Various researches constitute the potential contribution of sustainable entrepreneurship towards sustainable development and a future sustainable transformation (Hummels and Argyrou, 2021; Austin et al., 2006; Emerson, 2003; Zahra et al., 2008). Most traditional businesses, corporates and organizations, as well as fast growing new ventures, have often been seen as or even been blamed for negative sustainability contribution (Muñoz and Cohen, 2018; Terán-Yépez et al., 2020). With increasing sustainable entrepreneurship activity the perception changes to a more positive one. More and more examples of growing new ventures demonstrate the ability to improve sustainability and to grow economically at the same time.

Recent sustainable entrepreneurship research has shown that entrepreneurs can in fact contribute to the required transformation towards a more sustainable planet and community (Horne et al., 2020; Dean and McMullen, 2007; Hall et al., 2010; Schaltegger et al., 2016; Shepherd and Patzelt, 2011). Existing research attempts to explain and quantify contributions by focusing on underlying sustainable business models (Lüdeke-Freund, 2020; Lüdeke-Freund et al., 2020; Schaltegger et al., 2016; Bocken et al., 2016; Boons et al., 2013; Hall et al., 2010), impact measurement and assessment approaches (Horne, 2019; Trautwein, 2021) or required support systems and external factors influencing entrepreneurs. A significant increase in the number of published articles on sustainable entrepreneurship indicates the growing importance of this specific research field (Terán-Yépez et al., 2020; Sarango-Lalangui et al., 2018). Various new disciplines, besides the traditional core ones business and management, are now also focusing on entrepreneurship and picked up the topic as key focus area, e.g., social sciences and environmental sciences (Terán-Yépez et al., 2020).

New sustainable business models help to create change by improving shortcomings and fixing system failures, such as externalities (Isaak, 1998; Schaltegger and Wagner, 2011; Schick et al., 2002; Boons et al., 2013; Evans et al., 2017; Schaltegger et al., 2016; Gladwin et al., 1995). Especially new ventures are important actors to innovate and disrupt existing systems with new solutions and more sustainable business models (Schneider and Veugelers, 2010; Hockerts and Wüstenhagen, 2010). Accordingly, sustainable new ventures support not only economic growth but also sustainability impact creation (Gregori et al., 2019; Meek et al., 2010). Initial research has shown that new ventures can contribute to reach the SDGs (Horne et al., 2020). Entrepreneurial activity is the basis for resulting outcomes and impacts to work towards the transformation needed.

Seeing sustainable new ventures as key actors and important change makers, we need to better understand how to support those new ventures in creating sustainability impact. This is especially important in early phases, because it is when products or services are developed and impactful business models are created (Bocken, 2015; Fichter and Tiemann, 2020). Identifying impact predictors and antecedents will help to support entrepreneurs even better in contributing to the SDGs. It is widely agreed on, that entrepreneurship still is a relevant field of study, with a strong need to better understand (Shane and Venkataraman, 2000). Sustainability and entrepreneurship should be researched jointly to support the inherent impact potential (Shepherd, 2015).

2.2 Overview articles, research questions and hypotheses

Summarizing the existing body of research and literature, one can state that first, that there is a lack of more objective, data-driven approaches to assess the contribution of entrepreneurs to the SDGs, which is important to better understand the causal relations between entrepreneurial activity and potential sustainability impact. Hence, mapping the activity of entrepreneurs related to the national SDGs constitutes a research gap, and due to the importance of the SDGs, the mapping is of significant relevance for a wide range of stakeholders, like policymakers, investors or entrepreneurs. **Article I** is answering two respective research questions:

(RQ1) 'How can we map the SDG related activity of entrepreneurs in Germany?'

(RQ2) 'Which SDGs show high entrepreneurial activity in Germany and which SDGs remain unaddressed?'

Second, the overarching problem is that measuring sustainability impact across the three domains (economic, social and environmental) is extremely challenging, as in some cases it is even hard to judge whether an organizational sustainability impact is positive or negative (Hahn et al., 2014; Jay and Gerard, 2015). Best practices currently used primarily in mature organizations such as the Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting are very valuable, but are criticized for important shortcomings (Milne and Gray, 2013). And the measurement problem becomes even bigger in early stages of new ventures, due to uncertainty, unavailability of data and frequent changes to products, services and business models. However, without measurement, we cannot make informed choices which new ventures have the potential highest sustainability impact. Accordingly, **Article II** is providing an overview on existing measurement approaches and the respective suitability to predict, to benchmark and thus to increase the future sustainability value generation of new ventures.

As a third point, practitioners currently founding new ventures or offering support for respective sustainable entrepreneurs however still lack guidance on how to estimate and improve the sustainability impact potential. Primarily, missing fully applicable approaches, fitting the special needs for early stage new ventures, are hindering them in decision making and impact model adjustments (Bengo et al., 2016; Arena et al., 2015; Dichter et al., 2016; Geissdoerfer et al., 2016; Hansen et al., 2009; Mudaliar et al., 2008; Schaltegger et al., 2016). And most approaches face understandable criticism (Bengo et al., 2016; Hadad and Găucă, 2014; Mulgan, 2010; Nicholls, 2009). Consequently, there has no overarching academic standard approach to forecast, management or measure impact emerged, solely standards for some specific context can be found (Bengo et al., 2016; Clifford, 2014; Clark and Brennan, 2016; Figge and Hahn, 2004; Hadad and Găucă, 2014; Kroeger and Weber, 2014; Mulgan, 2010; Nicholls, 2009; Weber and Kratzer, 2013; Recker and Michelfelder, 2017; Nicholls et al., 2015). However, there are emerging standards found in non-academic sources, aiming to close the identified gap. E.g., the impact management project provides a common view on impact measurement, still not fully covering the forecasting aspect (The Impact Management Project, 2021). **Article III** focuses on the two following research questions to close the identified gap:

(RQ1) 'How can a new venture's sustainability impact potential be evaluated in early phases, using an effective but also efficient approach, relying on existing, often limited, information and data?'

(RQ2) 'How applicable is the developed approach and which limitations are observed by first practitioners, testing the approach to evaluate impact potential of new ventures in early phases?'

The fourth article focuses on the currently missing prediction of sustainability value, which is important to support new ventures and support systems. Whereas there are established success variables for traditional new ventures, there is no perfect model yet when it comes to sustainability impact as a success variable (Tuan, 2008). Quantitative impact measurement is currently not established and not standardized (Horne and Michelfelder, 2017; Recker and Michelfelder, 2017) and consequently there is no simple variable available. But research has developed qualitative measurement frameworks to assess the sustainability value creation of new ventures (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) with help of multiple questions, covering different perspectives of impact: system transformation, geographic expansion, adaptability and tangibility. The lack of quantitative exploration (Weber and Kratzer, 2013) to validate predominantly qualitative research in this field (Mair and Martí, 2006; Short et al., 2009) has been the starting point to test and validate three hypotheses in **Article IV**:

Hypothesis 1: 'Traditional new venture success factors are not sufficient to predict sustainability value creation exhaustively and are not universally applicable for impact oriented new ventures.'

Hypothesis 2: 'A balanced set comprising of traditional profit oriented and impact specific antecedents will predict sustainability value more accurately, than any of the two categories of antecedents individually.'

Hypothesis 3a: 'A multi dimension approach to the dependent variable sustainability value can help to assess and compare the sustainability impact creation of a new venture.'

Hypothesis 3b: 'Subsidiary impact variables can help to specify the interrelationship to certain predictors and to better interpret their explanatory power.'

2.3 Definitions

The outlined research focus touches various underlying definitions of sustainability, entrepreneurship, sustainable entrepreneurship and sustainability impact.

2.3.1 Sustainability

Sustainability has been identified as a key future path for entrepreneurship research (Shepherd, 2015) and new ventures as a key for disrupting existing production and consumption systems (Hockerts and Wuestenhagen, 2010). Significant resources are spent by governments, investors and new ventures on sustainable entrepreneurship without having solved the problem of measuring, predicting and increasing respective impact.

The Brundtland Commission first mentioned sustainability in the still used context in 1987, stating the overarching and inherent objective as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987)

An applicable and more detailed definition of sustainability for the context of this research can be derived from sustainable entrepreneurship research:

“Sustainable entrepreneurship is focused on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society.” (Shepherd and Patzelt, 2011, p.142)

The definition captures two important aspects. First, the broadly accepted three sub-domains economic, environmental and social sustainability are mentioned by this definition, emphasizing also non-economic objectives. Second, it states the necessary ability of continuing an activity indefinitely into the future as a characteristic of sustainable entrepreneurship, hence sustainability is future orientated.

2.3.2 Entrepreneurship

Entrepreneurship used to be a research field with little attention and much complaints, before the field gained significant attention in the 1990s (Stevenson, 2000). With help of the growing Silicon Valley activities, Entrepreneurship became visible and proofed its ability to contribute to economic growth and job creation, a much needed impact during those times. Various researches contributed to the field with definitions and frameworks or processes to explain the phenomenon (e.g., Gartner and Shane, 1995). A still lasting definition was developed by Stevenson and Jarillo at that time in 1991:

“Entrepreneurship is the pursuit of opportunity beyond the resources you currently control.” (Stevenson and Jarillo, 1991)

This definition is perfectly in line with later definitions of entrepreneurship (e.g., Shane and Venkataraman, 2000), which are also focusing on the underlying opportunity that is pursued by the entrepreneur. Stevenson highlights the special focus an entrepreneur typically puts on a single opportunity in the beginning, trying to bring required resources into the venture and to grow it accordingly. In contrast to existing large corporates, resources and cash are typically limited, less

controllable and pose a significant challenge on the new venture. The opportunity is characterized as either innovative in its product, service or underlying business model and often related to new customer segments or geographic target markets, if building on existing solutions (Stevenson and Jarillo, 1991).

2.3.3 Sustainable / social entrepreneurship

Sustainable or social entrepreneurship still is an emerging field of study, building on the general research of entrepreneurship and as a consequence, has to handle with varying definitions and frameworks used (Binder and Belz, 2015; Muñoz and Cohen, 2018). Accordingly, academic definitions of sustainable entrepreneurship as a concept have evolved over the last years (Hummels and Argyrou, 2021; Muñoz and Cohen, 2018). Early definitions highlighted the initial commitment of businesses to behave ethically and to contribute to broad improvements (Crals and Vereeck, 2004). Following definitions put more focus on the discovery, evaluation or examination and exploitation of opportunities as an entrepreneurial process to provide change and correct market imperfections in terms of improving sustainability for individuals, specific beneficiary groups or the planet as a whole (Cohen and Winn, 2007; Dean and McMullen, 2007; Katsikis and Kyrgidou, 2007; Patzelt and Shepherd, 2011; Belz and Binder, 2017).

Further definitions embraced sustainable development or transformational action as required key objective of each sustainable entrepreneurship activity and also connected it to the Sustainable Development Goals, agreed on by the United Nations (O'Neill et al., 2006; Hockerts and Wüstenhagen, 2010; Pacheco et al., 2010). The integration of a triple bottom line, meaning to combine environmental, social and economic perspective into a business and impact model is the essential part of the last group of definitions available (Kuckertz and Wagner, 2010; Schaltegger and Wagner, 2011).

2.3.4 Sustainability impact / sustainable value creation

Successful exploitation of above described opportunities results in sustainability value creation, as defined for general sustainable business models (Lüdeke-Freund, 2020; Lüdeke-Freund et al., 2020; Apostolopoulos et al., 2018; Bocken et al., 2013; Shepherd and Patzelt, 2011; Dean and McMullen, 2007; Cohen and Winn, 2007), often also called sustainability impact. New ventures can contribute to impact value creation (Zahra et al., 2009) by helping to overcome environmental and social challenges and by bringing change to stakeholders and beneficiaries. Sustainable entrepreneurs, being the 'agents of change', focus their resources and business models to important social and environmental problems (Santos, 2012) and to fight externalities (Gladwin et al., 1995). Especially new ventures are important actors to innovate and disrupt existing systems with new solutions and models (Schneider and Veugelers, 2010; Hockerts and Wüstenhagen, 2010).

Creating new sustainable business models is a key competency of new ventures and as a result, offers the possibility to overcome existing challenges (Austin et al., 2006; Rao-Nicholson et al., 2017; Scott et al., 2016). In addition it has been observed, that new ventures often develop new markets and industries with new sustainable products to expand impact by scaling up and replicate in new environments (Casasnovas and Bruno, 2013; VanSandt et al., 2009; Fichter and Clausen, 2013).

Extending existing economic value creation concepts, the triple bottom line concept includes social and environmental benefits leading to sustainable value creation (Lüdeke-Freund et al., 2020;

Elkington, 1997). Social (and environmental) value creation is best explained with help of the theory of change concept (Wry and Haugh, 2018). The theory provides valuable insights in how inputs are transformed by activities (e.g., of new ventures) into tangible outputs (products or services). Those outputs create change for respective stakeholders, receiving, benefiting from or experiencing the tangible outputs. The systemic change in the last step is then called impact (Wry and Haugh, 2018). When applying those definitions on new ventures and forecasting of future impact, it is especially important to include and highlight not only newly created value (outcomes), but also destroyed value (negative outcomes) and value that is not captured (missed outcomes) to ensure a consistent and unbiased value balance (Bocken et al., 2013).

2.4 Overarching framework and research approach

The dissertation is structured along two dimensions, first the *level of analysis* and second the typical *new venture phases* along the process (see Figure 1).

Focusing on the micro level, individual new ventures are in main scope for this research. Three of the following articles study specifically measurement approaches, success factors and impact forecasting approaches targeted to be used by single new ventures, instead of being aggregated to larger data sets. Once multiple new ventures are grouped and used as aggregated study object, as for the first article, we define this as meso level of analysis. Here the article focuses on the overall potential effect of entrepreneurial activity in Germany on the SDGs. The third level, societal and systemic macro level of analysis, is not in scope for this research project and dissertation manuscript. Although some articles indirectly touch the overarching level, it is not intended to further study macro effects of sustainable entrepreneurship. The research field of sustainable development is covering those aspects and provides insights on how for example SDGs can be reached and what challenges exist on a societal level.

Second, various phase and stage concepts were developed in the scope of entrepreneurship and sustainable entrepreneurship research (Mamabolo and Myres, 2020). In addition, practitioners and academic researchers differ significantly in the respective naming and structuring of a typical entrepreneurial process. Whereas practitioners often refer to investment stages, researches focus more on the entrepreneurial opportunity development. Using the founding of an new venture as key milestone, practitioners often differentiate between early phases before the founding and later stages for growth and maturity (Kollmann et al., 2021). Similarly, respective financial needs result in pre-seed, seed and series A, B or C investments connected to each phase following this definition. On the other hand, following the opportunity identification, evaluation, exploitation and consecutive business building as a process, research uses a different nomenclature (Mamabolo and Myres, 2020; Shane and Venkataraman, 2000).

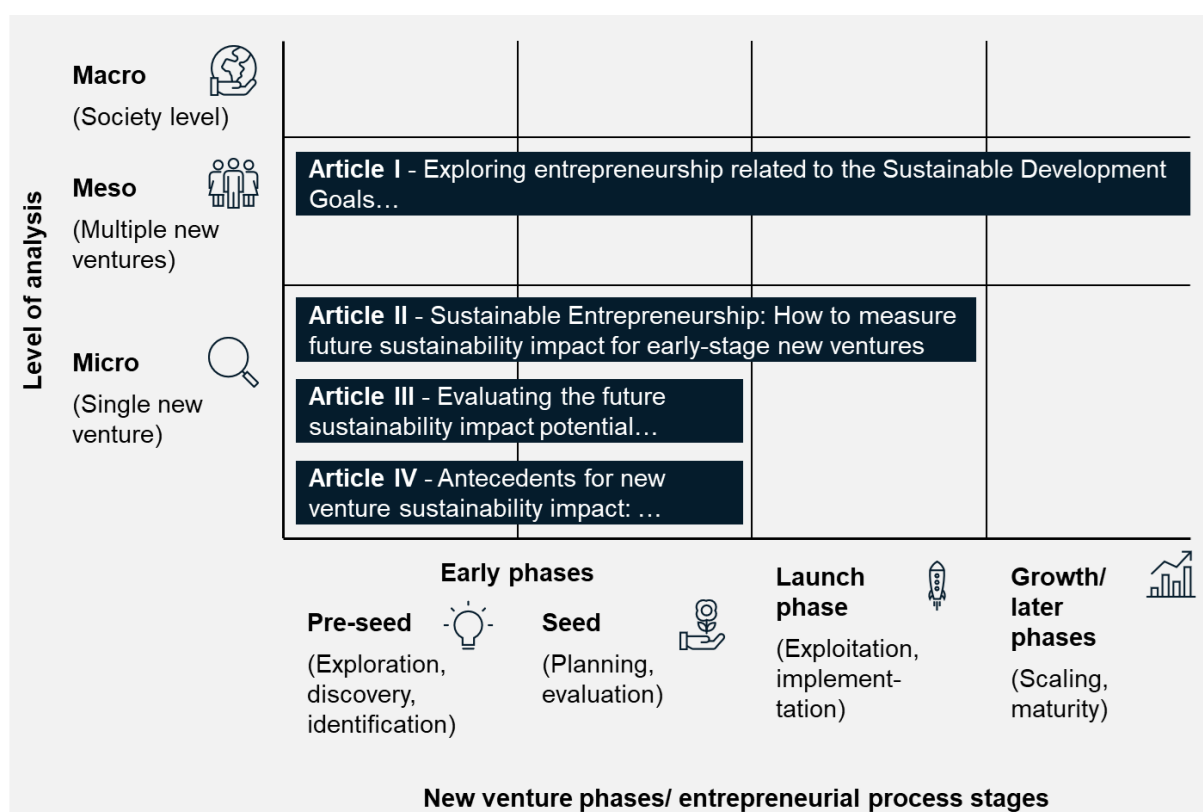


Figure 1 - Overarching framework. Source: Own figure.

Combining the two approaches to define stages and phases, one can differentiate between early phases, the launch phase and later growth phases. With increasing focus on the micro level, the research at hand also focuses especially on early phases of new ventures, when important decision are made influencing both business and impact models. New ventures in later growth phases are defined as out of scope. First, the availability of data and more mature business and impact models allow for application of available impact measurement and management tools, hence the identified gap is not applicable for later phases to the full extent. In addition, the research field of scaling, both the new venture itself and sustainability impact, is based on different theories and frameworks, requiring additional investigation. Traditional entrepreneurship is already offering a full body of literature on the scaling of new ventures.

The overall research approach (see summary of articles and methods in Table 1) is a mixed methods approach, utilizing specific research methods based on the outlined research questions, focus areas and hypotheses for each article. Whenever possible, existing data or collected data was used to complement qualitative and conceptual research, to answer the research questions and validate the hypotheses. Especially for the identified gaps in conceptual frameworks and tools qualitative research methods are applied to contribute to theory.

Introduction

| Article | Research question, hypotheses, focus | Research method | Key findings, contributions |
|--|--|---|--|
| <i>Article I - Exploring entrepreneurship related to the Sustainable Development Goals...</i> | <i>RQ1:</i> How can we map the SDG related activity of entrepreneurs in Germany? <i>RQ2:</i> Which SDGs show high entrepreneurial activity in Germany and which SDGs remain unaddressed? | Semi-automated content analysis and deductive coding Applied, exploratory, quantitative research | <i>RQ1:</i> Based on freely available web-material, the semiautomated content analysis provides a scalable approach to map entrepreneurial activities along the 17 SDGs. <i>RQ2:</i> Entrepreneurs do not address all SDGs. There is strong direct engagement around SDG 9 (industry, innovation & infrastructure), SDG 3 (good health and well-being) and SDG 12 (responsible consumption and production). On the other end of the spectrum, we find SDG 1 (no poverty) and SDG 17 (partnership for the goals) with little-observed activity. |
| <i>Article II - Sustainable Entrepreneurship: How to measure future sustainability impact for early stage new ventures</i> | Overview on existing measurement approaches and the respective suitability to predict, to support and thus to increase the future sustainability value generation of new ventures. | Systematic literature review Theoretical, explanatory, qualitative research | I.) There is a lack of sustainability measurement tools appropriate for early stages of a new venture. II.) Holistic measurement tools, covering environmental, social and economic value generation, are needed. III.) The relative improvement of generated value needs to be taken into account in order to allow a meaningful comparison of different ventures and business models and to significantly reduce the complexity. IV.) Research needs to integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only. |
| <i>Article III - Evaluating the future sustainability impact potential...</i> | <i>RQ 1:</i> How can a new venture's sustainability impact potential be evaluated in early phases, using an effective but also efficient approach, relying on existing, often limited, information and data? <i>RQ2:</i> How applicable is the developed approach and which limitations are observed by first practitioners, testing the approach to evaluate impact potential of new ventures in early phases? | Concept development, piloting and validation Applied, explanatory, qualitative and quantitative research | <i>RQ1:</i> The article demonstrates that a suitable scoring approach has been developed, using five dimensions of sustainability impact to evaluate the future potential of new ventures in early phases. Essential impact levers (scale, degree of change and duration) are combined with the importance and risk dimensions associated. <i>RQ2:</i> The piloting of the developed approach shows the good fit to early stage startups in various industries and a high degree of insights and valuable information. In addition, some refinements have been developed and added to the evaluation concept, improving applicability for future utilization and answering feedback from the pilot audience. |
| <i>Article IV - Antecedents for new venture sustainability impact: ...</i> | <i>Hypothesis 1:</i> Traditional new venture success factors are not sufficient to predict sustainability value creation exhaustively and are not universally applicable for impact oriented new ventures. <i>Hypothesis 2:</i> A balanced set comprising of traditional profit oriented and impact specific antecedents will predict sustainability value more accurately, than any of the two categories of antecedents individually. <i>Hypothesis 3a:</i> A multi dimension approach to the dependent variable sustainability value can help to assess and compare the sustainability impact creation of a new venture. <i>Hypothesis 3b:</i> Subsidiary impact variables can help to specify the interrelationship to certain predictors and to better interpret their explanatory power | Regression analysis, incl. variable and model design Applied, correlational, quantitative research | <i>Hypothesis 1:</i> The results indicate that generic predictors are less significant to predict new venture sustainability impact creation. <i>Hypothesis 2:</i> The set of significant antecedents shows great balance of generic and impact-oriented predictors. Problem exposure, stakeholder contact, market test and intellectual property have been identified as applicable predictors to indicate sustainability impact of new ventures in early phases. <i>Hypotheses 3a&b:</i> Reviewing the results from the different regression models, the authors can conclude that the aggregated measure has the broadest coverage of significant predictors. The respective subsidiary variables show relationships to single predictors, but do not add additional predictors to the set. |

Table 1 - Overview of articles

With help of semi-automated content analysis and deductive coding, a data set of entrepreneurial activity related to the SDGs allows for exploratory research on the potential contribution of sustainable entrepreneurship towards the SDGs in Article I. It is shown, that there clearly is activity related to the development goals which imposed the motivation to further study the impact potential of new ventures. A systematic literature review in Article II answers the question if there are available tools and methods to measure, track and manage sustainability impact potential during early phases. Explanatory and theoretical considerations of required adjustments and complements to existing approaches lead the way towards Article III. Qualitative concept development to design a suitable approach, evaluating future impact potential in early phases, is combined with quantitative research to test and validate the approach on a data set of early stage new ventures. The last article uses quantitative research to study correlations between defined predictors and expected impact of new ventures, measured by an adjusted depended success variable.

3 Article I - Exploring entrepreneurship related to the Sustainable Development Goals - Mapping new venture activities in Germany with semi-automated content analysis

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3.1 Abstract

It is widely agreed that humanity faces major sustainability challenges that require immediate action. The Sustainable Development Goals (SDG) are the most recent political call for action in this direction. In this study, we examine what role entrepreneurship in Germany plays in achieving the German SDGs. Thus, we pick up the discussion on sustainable entrepreneurship as a lever for change and search for empirical evidence that entrepreneurs in Germany identify and develop opportunities along the entire SDG spectrum. For our study, we examined a total of 193 venture competitions in Germany, collected data on a total of 588 rewarded ventures and used a semi-automated content analysis process to allocate those ventures to the main 17 SDGs based on their business activities. With our work offer a scalable and repeatable approach to map SDG related activity of new ventures, and we provide a detailed analysis of Germany's entrepreneurship landscape along the 17 SDGs. We found a very heterogeneous distribution of entrepreneurial activities along the goals, but also significant correlations between multiple goals that are frequently addressed jointly. Contrasting entrepreneurial activity along the SDGs with the national overall SDG performance of Germany we identified multiple SDGs that are rarely addressed by entrepreneurs despite strong needs for improvements. The identified patterns constitute a starting point for additional research on the potential of SDG related entrepreneurship and they direct policy makers and entrepreneurs where they can make the largest contribution to the SDGs.

3.2 Introduction

The 17 Sustainable Development Goals (SDG) that the General Assembly adopted in September 2015 constitute the most widely accepted agenda for sustainable development today (General Assembly, 2015). They build up on the famous call for sustainable development in the Brundtland Report (Brundtland Commission, 1987) and expand the incomplete Millennium Development Goals (MDG) with their narrow focus on poverty reduction (General Assembly, 2015) to create the first global set of goals addressing all three pillars of sustainability. In doing so, the SDGs pick-up the scientific call for global sustainable development goals (Griggs et al., 2013) and help to keep sustainable development a priority on political agendas worldwide. Today they provide the legitimate political framework upon which governments, civil society, and businesses can plan, measure and communicate their contribution to sustainable development.

The SDGs underline the immediate need to change the unsustainable development path that humanity pursues today. Humanity must take the “bold and transformative steps which are urgently needed to shift the world on to a sustainable and resilient path” (General Assembly, 2015). In this transformation, businesses play an important role and particularly entrepreneurs (Apostolopoulos et al., 2018; General Assembly, 2015; Loorbach and Wijsman, 2013; Sullivan et al., 2018; Figge and Hahn, 2004; Hockerts and Wüstenhagen, 2010; Weissbrod and Bocken, 2017; Bocken and Short, 2016). With their ventures, entrepreneurs can create and catalyze the necessary structural changes that incumbents fail to perform for reasons like organizational inertia or the risk to cannibalize or destabilize existing unsustainable business models (Hockerts and Wüstenhagen, 2010; Lüdeke-Freund et al., 2016). Accordingly, it is of special importance to understand whether and in which areas new ventures support the transition towards sustainable development measured along the 17 SDGs (Apostolopoulos et al., 2018). The last years showed increasing numbers of entrepreneurs and new ventures founded in Germany, especially those focusing on environmental and social challenges (SEND and KPMG DSM 2018). To the authors' knowledge, there is limited scientific research that tries to create transparency on entrepreneurship's role towards achieving the SDGs (e.g., Moon, 2018).

Therefore, we developed a structured and scalable approach that allows to map the activities of new ventures in Germany along the 17 SDGs, assuming that there is theoretical potential for each SDG to be addressed by new ventures (Apostolopoulos et al., 2018; Pomare, 2018). We used software supported semi-automated content analysis (Krippendorff, 2012; Weber, 1992; Neuendorf, 2016) to examine a total of 588 ventures that were rewarded in one of 193 venture competitions in Germany in 2017. By doing so, we can draw conclusions on the activity patterns of German entrepreneurs regarding the national SDG targets.

Current SDG performance in Germany indicates some great progress in reducing poverty, improving education and fostering innovation. But on the other hand, major challenges remain towards responsible consumption and production, climate, as well as life below water (Ref. Figure 2), underlining the urgent need for contribution to achieve the SDGs.



Figure 2 - Exemplary SDG dashboard for Germany in the color code of Sachs et al. (2017). Green is used only if all sub-target indicators are achieved, yellow, orange and red indicate the distance to achieving the SDG targets.

Our data reveal a very heterogeneous distribution of entrepreneurial activities along the SDGs as well as a significant correlation between goals that entrepreneurs frequently address together. For the

interpretation of the results, we contrasted the SDG activity of entrepreneurs in Germany with the national overall SDG performance (Sachs et al., 2017). This revealed in which areas entrepreneurship already contributes strongly to sustainable development and in which areas there is a strong need.

Following this introduction, we discuss existing attempts to progress measurement along the SDGs. Then, we outline the methodology we used to map the SDG contribution of German ventures, we present our empirical results, and we discuss the findings and limitations of our approach.

3.3 Theoretical foundation

3.3.1 Measuring country level progress along the SDGs

To date, SDG progress measurement relies on national statistical authorities or independent researchers that so far focus on the national progress along the SDGs (United Nations, 2017; Nilsson et al., 2016; Costanza et al., 2016; Sachs et al., 2017). To our knowledge, the contribution of a specific stakeholder group, like entrepreneurs, to the achievement of the SDGs is not tracked scientifically.

Experiences from the measurement of national SDG progress show that measurement is challenging as there are interaction effects, trade-offs and vaguely defined goals (United Nations, 2017; Nilsson et al., 2016; Costanza et al., 2016; Sachs et al., 2017). Already the official resolution states that there is a gap in data collection and that in some cases there are no clear numerical targets (General Assembly, 2015). These problems explain the challenge to comprehensively and consistently measure progress towards the SDGs. However, measuring progress on the 2030 Agenda is crucial to properly manage the transformation to sustainability. Accordingly, there are numerous attempts to overcome the stated challenges on the national level (United Nations, 2017; Nilsson et al., 2016; Costanza et al., 2016; Sachs et al., 2017). In the context of progress measurement Costanza et al. (2016) explain well that in theory, it is necessary to track progress with an integrated system dynamics model that captures all interdependencies between the goals, but in practice progress is mostly tracked separately for each of the 17 SDGs in a dashboard logic (Costanza et al., 2016). Sachs et al. (2017) provide a good example of such a dashboard. For each SDG the dashboard integrates a wide range of statistical indicators on a national level and communicates the progress performance in a traffic light logic. For instance, Germany's performance for SDG 1 (no poverty) has been rated green as all three indicators for SDG 1 are above a predefined threshold. Used indicators are the poverty headcount ratio at \$1.90/day today and in 2030 as well as the poverty rate after taxes and transfers (Cf. Sachs et al., 2017).

3.3.2 New ventures and their contribution to the SDGs

In the business sphere we could not find similar attempts to track and aggregate progress in a dashboard logic, neither for large corporates nor small and medium-sized enterprises. Existing guidelines as the SDG compass focus on measurement and reporting for large corporates linking SDG progress to sustainability reporting efforts (Global Reporting Initiative et al., 2015). Additionally, there are studies on social/sustainable entrepreneurship that focus on specific sustainability dimensions like the environment (Weiß and Fichter, 2015), studies that are based on self-assessment surveys (SEND and KPMG DSM 2018) and there are studies that combine self-assessment and expert assessments (Engström et al., 2018).

But there is a lack of more objective, data-driven approaches to assess the contribution of entrepreneurs to the SDGs. Hence, mapping the activity of entrepreneurs related to the national SDGs

constitutes a research gap, and due to the importance of the SDGs, the mapping is of significant relevance for a wide range of stakeholders, like policymakers, investors or entrepreneurs.

Assessing the SDG related activity of entrepreneurs is linked to well-known challenges in the field of sustainable impact measurement and entrepreneurship research, most importantly the lack of historical data to be studied and the lack of resources in new ventures to start collecting missing data and reporting them (Clifford, 2014; Dichter et al., 2016; Horne and Michelfelder, 2017; Johnson and Schaltegger, 2016; Recker and Michelfelder, 2017). These challenges make our ambition, to track the country level activity of new ventures related to the national SDGs even more challenging.

Given our choice to focus our analyses on Germany (see choice of empirical setting in the next section), this article addresses the following two research questions:

(RQ1) 'How can we map the SDG related activity of entrepreneurs in Germany?'

(RQ2) 'Which SDGs show high entrepreneurial activity in Germany and which SDGs remain unaddressed?'

3.4 Research design

3.4.1 Empirical setting & data

We decided to focus our analysis on new ventures in Germany. This excludes country level differences, which helped during the assessment of the validity of our methodological approach and limited the scope of ventures to be analyzed to a manageable size. Given relatively good data availability in Germany and Germany's position as leading economy in Europe, we believe to have identified a valuable empirical setting. By focusing on German new ventures solely, we do not neglect the fact that foreign ventures contribute to German SDG performance as well, however studying the potential contribution bottom-up, the sample selection would become infinitely large by including global new ventures active in Germany. The study's sample is based on major venture competitions in Germany, including non-profit and for-profit ventures.

Using existing competition overviews (Bundesministerium für Wirtschaft and Energie, 2017; Für-Gründer.de 2017) we generated a list of 193 venture competitions that were the starting point for the sample. By selecting a German new venture sample, we discard the contribution of non-German ventures to Germany and its national SDG performance indicators. The leading perspective is understanding SDG related activity of German entrepreneurs and comparing it to the national SDG performance, understanding that additional progress is generated by foreign stakeholders.

Out of those competitions, we collected award-winning and distinguished ventures only for categories with a focus on new ventures (independent of topic) and only if their full name was given. Price categories for general innovation were excluded if they did not differentiate between new ventures and incumbent ventures. All competitions and the respective award texts are from 2017. Additional webpage information was downloaded end of 2017 and early 2018. In the sampling process, we had to discard 75 competitions: 32 did not offer an award in 2017, 25 did not focus on ventures, 18 did not provide sufficient information online.

Overall, we created a sample of 588 ventures. The data set of each venture consists of the award text, provided by the award jury, and information found on the venture's webpage (or in some cases Facebook), in either German or English language. The used information contains basically the product

or service description, business model explanation, company visions and missions as well as other explanation relevant to assess the ventures contribution to SDGs found on the landing page and on other pages. The analyzed text varied in its length between 1 and more than 50 pages, containing between 250 and more than 1000 words.

Following our research set-up and focus on Germany, we excluded foreign companies. In addition, we collected venture specific information during the sample creation, allowing us to better describe the sample and analyze the results afterward. This way we collected basic control variables like the founding year, legal entity and postal code where available. Additionally, each venture was allocated to one category out of the International Standard Industrial Classification of All Economic Activities (United Nations Statistics Division, 2018) and categorized as either startup, unclear or non-startup. Here we followed the general notion of startups as young and innovative growth ventures (Brettel et al., 2007; Kollmann and Hensellek, 2017). More specifically, we applied the three criteria of the German startup monitor: startups are (I.) ventures that are younger than ten years, (II.) highly innovative in technology or their business model and (III.) strive for significant growth in employees or revenue. To be considered a startup a venture must fulfill the first criteria and at least one of the other two criteria (Kollmann et al., 2018). The two coders used this categorization to characterize the sample regarding its startup focus and to compare startups and other entrepreneurship forms regarding their potential contribution.

Our mapping of activities collects data based on the inputs, activities, and outputs of businesses and does not try to assess the potential outcomes and impacts as it would be done in a comprehensive impact assessment (Cf. Clifford, 2014). The depth of analysis is thus similar to that of the widely used Global Reporting Initiative (Global Reporting Initiative, 2016). Accordingly, it is important to note that mapping activities to SDGs can only indicate a potential correlation of a business model to the SDGs, but it is no evidence for causation (causation would require a more detailed impact assessment along an input-output-outcome-impact logic for each venture, which is out of scope for our quantitative research approach).

We built our research on data that are most widely available for new ventures, i.e., information from their own websites and those published in venture competitions. These two sources provide numerous information on a venture's business model, its industry sector and meta-information on the venture itself. Moreover, focusing on rewarded ventures provides some quality control in the very dynamic venture environment that allows to filter out immature ideas and ventures. The downside to this approach is a self-selection bias of ventures that participate in competitions. Some ventures might decide against venture competitions for example if they are already very successful. Accordingly, there is a risk that we systematically neglect certain groups of ventures.

Our approach offers a structured and scalable way to map the activities of new ventures in Germany along the 17 SDGs and draw conclusions on the potential contribution of German entrepreneurs to the national SDG targets. We can thus follow the dashboard logic and create an SDG heat map for entrepreneurship in Germany. The mapping helps to understand which SDGs are primarily addressed, which remain unaddressed and it allows to identify patterns of SDGs that are typically addressed in combination.

3.4.2 Method

To answer our research questions, we selected content analysis as an appropriate research method to classify new ventures regarding their potential contribution to SDGs. Other studies with comparable objectives showed that content analysis is an appropriate and insightful method (Barringer et al., 2005; Perry and Bodkin, 2000; Ritala et al., 2018; Roca and Searcy, 2012; Weare and Lin, 2016; Uotila et al., 2009).

Content analysis is defined as a systematic approach to compress a large amount of text and words into predefined content categories based on rules of coding (Krippendorff, 2012; Weber, 1992; Uotila et al., 2009; Neuendorf, 2016). In this study, the approach is used to create SDG categories based on coded keywords and search through venture texts. With the help of modern content analysis and qualitative data analysis software, it is possible to apply this approach to a large amount of texts efficiently. We selected atlas.ti software due to its semi-automated auto-coding function for our study (Atlas.ti, 2018).

Literature differentiates two types of content analysis: first emergent coding also called inductive coding and second, a priori coding or deductive coding (Weber, 1992). The deductive approach is based on a pre-existing coding system with predefined keywords, seen as the more directed approach whereas the inductive approach is based on developing the codes from the data themselves and refining them through the process, being the more conventional approach (Elo and Kyngas, 2008; Hsieh and Shannon, 2005). Since we base our mapping on existing definitions and documentation of the SGD goals, we executed a deductive approach by using predefined keywords, which we used to code the venture texts.

Our content analysis contains four common steps: sampling, defining and piloting the coding scheme, coding and analyzing and reporting (adapted from Neuendorf, 2016).

3.4.3 Defining and piloting the coding scheme

The coding scheme is developed to support the coding process with defined keywords for each SDG based on the official SDG resolution (General Assembly, 2015) (see the full list in the appendix). If a respective keyword is found in the award text or online information, it indicates potential SDG-related activities of a venture.

The objective was first to identify keywords that holistically describe each SDG and its sub-targets based on the available definitions. Second, the selected words had to comprise different aspects, for example, a description of the problem a venture wants to address, details about their approach and information on the aspired effects. Since we included both English and German texts in the sample, the described scheme was developed for both languages with the respective official documents (Die Bundesregierung, 2016; General Assembly, 2015). For the semiautomated coding in atlas.ti we combined the word strings for both languages.

The coding scheme was tested on a sample of ventures. During the test, we identified and resolved problems with regard to wrong matches. For example, the German term “arm” (for poor) generated many wrong matches since it occurs in “warm” and other unrelated words, consequently we restricted matches to the exact word with the help of quotation marks. Nevertheless, some keywords like “jobs” or “career” occurred on nearly every website and not only in the context of SDG 8 (decent work and

economic growth). This confirmed our decision to use semi-automated coding with manual confirmation by two researchers instead of fully automated coding.

The pilot could also invalidate concerns around different wording between the UN descriptions of the SDGs and the venture text material. We observed that both use similar words and a mixture of problem description and solution specification. Accordingly, there was no need to adjust the coding scheme to properly match venture text material to the SDG problem descriptions with the selected keywords.

3.4.4 Coding the text sources

The content analysis methodology is based on the number of occurrences of keywords in the analyzed data and helps to quantify content in terms of predefined search words (Bryman and Bell, 2015). Accordingly, we documented the frequency of Sustainable Development Goal keywords from our coding scheme for each venture.

| | |
|--|--|
| SDG 3: Good health & well-being | Basic research innovation that can be used for medical purposes but have no direct health benefits were excluded from SDG 3 (instead, SDG 9). |
| SDG 4: Quality education | If trainings enable customers to use a project they were excluded. Trainings that enable customers beyond the use of a specific product were included. |
| SDG 7: Affordable & clean energy | We included energy efficiency related ventures with products that reduce energy consumption compared to alternative solutions in the market. |
| SDG 8: Decent work & economic growth | Job creation of new ventures has only been included, if a venture specifically concentrates on the creation or allocation of jobs. Jobs that result primarily from educational activities were not considered for SDG 8. |
| SDG 9: Industry, innovation & infrastructure | The SDG definition is very broad which makes a clear differentiation challenging. We focused on the enabling aspects of new ventures - i.e. innovations that have a high chance to improve the productivity of other industries or provide significant benefits compared to previous solutions. Infrastructure innovation that affect an industry were included, infrastructure innovation that focus on urban/ personal mobility were included in SDG 11. |
| SDG 10: Reduced inequalities | We excluded ventures that simply aim for markets in a developing country without specifically targeting the eradication of inequalities. |
| SDG 11: Sustainable cities & communities | For SDG 11 transport related activities were only included when they affect urban communities or human settlements. |
| SDG 16: Peace, justice & strong institutions | Aspects concerning inclusion from SDG 5 and SDG 10 were not included. Security related business models were only included if they create more transparency and/or accountability on a broader societal level. |
| SDG 17: Partnership for the goals | Aspects of fair trade were only included when they are part of broader cooperation with developing countries, not when organizations only purchase fair trade products (this was integrated in SDG 12). |

Table 2 - Overview of SDG specific coding rules that were necessary for a consistent coding process.

We decided to perform semi-automated content analysis, combining the advantage of an automated scan of all documents uploaded to atlats.ti with the opportunity to verify the search results, reducing random and wrong context matches (e.g., random keywords in the CVs of employees or event notes). The auto coding function was set-up with the following characteristics – ignore cases, strategy: expression, context: word, selected confirm matches, expand to: exact match. The match review was based on general and SDG specific conditions. Additionally, we defined specific coding rules for some SDGs since those can generate wrong matches based on wording and context (see Table 2).

3.5 Analyses & results

After coding the documents, we exported the results in a code-summary table and cleaned the data in preparation for further analysis. The final data set contained the number of matches per SDG for each venture of the sample across all available documents.

Following the research questions, we applied descriptive statistics (Table 3) to get a first overview of general distribution and characteristics of the results. A correlation matrix was additionally used to better understand interdependencies between SDGs and general patterns.

| | All ventures (no threshold, all SDG matches) | | | | | | Ventures (count threshold >0) | | | Ventures (count threshold >1) | | |
|--|---|---------------|------|------|---------------|--------------------|------------------------------------|---------------|-----|------------------------------------|---------------|-----|
| Ventures in sample | 588 100% | | | | | | -177 | 411 | 70% | -59 | 352 | 60% |
| Total SDG matches | Total 6159 | | | | | | Total | 798 | | Total | 602 | |
| SDG | Sum of SDG matches | % of total | Min. | Max. | Standard d | Sample Variance | Count of SDG matches (>0) | % of total | | Count of SDG matches (>1) | % of total | |
| SDG 1: No poverty | 11 | 0% | 0 | 3 | 0,19 | 0,04 | 7 | 1% | | 3 | 0% | |
| SDG 2: Zero hunger | 481 | 8% | 0 | 56 | 4,24 | 18 | 52 | 7% | | 40 | 7% | |
| SDG 3: Good health & well-being | 1092 | 18% | 0 | 70 | 6,36 | 40,5 | 133 | 17% | | 97 | 16% | |
| SDG 4: Quality education | 833 | 14% | 0 | 53 | 5,83 | 34 | 86 | 11% | | 63 | 10% | |
| SDG 5: Gender equality | 80 | 1% | 0 | 25 | 1,39 | 1,92 | 12 | 2% | | 9 | 1% | |
| SDG 6: Clean water & sanitation | 95 | 2% | 0 | 56 | 2,49 | 6,22 | 11 | 1% | | 7 | 1% | |
| SDG 7: Affordable & clean energy | 632 | 10% | 0 | 75 | 5,93 | 35,2 | 51 | 6% | | 42 | 7% | |
| SDG 8: Decent work & economic growth | 107 | 2% | 0 | 22 | 1,75 | 3,06 | 17 | 2% | | 9 | 1% | |
| SDG 9: Industry, innovation & infrastructure | 1085 | 18% | 0 | 40 | 4,77 | 22,8 | 160 | 20% | | 130 | 22% | |
| SDG 10: Reduced inequalities | 409 | 7% | 0 | 64 | 4,12 | 17 | 49 | 6% | | 38 | 6% | |
| SDG 11: Sustainable cities & communities | 483 | 8% | 0 | 52 | 4,17 | 17,4 | 58 | 7% | | 49 | 8% | |
| SDG 12: Responsible consumption & production | 594 | 10% | 0 | 36 | 3,44 | 11,9 | 111 | 14% | | 82 | 14% | |
| SDG 13: Climate action | 72 | 1% | 0 | 13 | 0,87 | 0,75 | 26 | 3% | | 14 | 2% | |
| SDG 14: Life below water | 24 | 0% | 0 | 11 | 0,61 | 0,37 | 3 | 0% | | 3 | 0% | |
| SDG 15: Life on land | 14 | 0% | 0 | 6 | 0,3 | 0,09 | 6 | 1% | | 3 | 0% | |
| SDG 16: Peace, justice & strong institutions | 139 | 2% | 0 | 57 | 2,77 | 7,68 | 12 | 2% | | 11 | 2% | |
| SDG 17: Partnerships for the Goals | 8 | 0% | 0 | 4 | 0,2 | 0,04 | 4 | 1% | | 2 | 0% | |

Table 3 - Descriptive statistical overview of the total and two reduced samples based on quality thresholds for SDG matches.

The final discussion of results was done with the help of a matrix that plots entrepreneurial activity against the national SDG performance. Additionally, we prepared a dashboard (adapted from Sachs et al., 2017) to indicate main areas of entrepreneurial activity and interdependencies between SDGs.

Our final sample is based on data from 588 new ventures and a total of 1315 individual data sources (556 award descriptions and 759 websites) with a minimum of two data sources per venture.

Following our before stated definition of startup (Cf. Brettel et al., 2007; Kollmann and Hensellek, 2017) 74% of the ventures could be classified as startups, less than 5% were clearly no startups, and the remainder is unclear due to limited information. 34% of the ventures were active in manufacturing, 21% in information and communication and 10% in professional, scientific and technical activities. The remaining third spread over 13 other categories of the International Standard Industrial Classification of All Economic Activities (United Nations Statistics Division, 2018). For 70% of the sample, we had information about their legal entity that show that more than 60% are registered as a GmbH (limited liability companies), nearly 10% as UG (usually smaller limited liability company), around 8% as a private person and about 5% as e.V. (associations). Only 40% of the ventures provided information about their founding year. Among those ventures 41% were founded in 2017, 20% in 2016, 16% in 2015. Less than 24% were 3 years or older. We also collected geographic information for 80% of the sample and these data show that 50% of the ventures come from only three federal states Bavaria (17%), Berlin (17%) and North Rhine-Westphalia (16%). Baden-Württemberg (9%) and Hesse (8%) also have a meaningful number of awarded ventures. The remaining 33% spread over the remaining 11 federal states.

In our sample of 588 ventures, the frequency for the different SDG keywords varied strongly between ventures and across the different goals from 0 to a maximum of 75 SDG matches for a single venture (Table 3 summarizes the sample statistics). The strong variation results in the high standard deviations and sample variance especially, for the most frequent SDGs 3, 4 and 9 (each with more than 10% of matches). To some extent, the maxima can be attributed to ventures with a strong marketing focus, comprehensive text material on their website and ventures that won multiple awards. Additionally, differences between SDGs result from an unequal distribution/availability of suitable keywords per SDG. For example, we found a wide range of keywords for SDG 3, while there is only a limited number of suitable keywords for SDG 1 (no poverty). Also, some SDGs have keywords that need additional contextual information and interpretation, for example, SDG 17 (partnership for the goals) (Cf. appendix).

To avoid biased results due to variance we assessed only whether a venture is active in an SDG or not. The absolute number of keyword matches per SDG per venture was not used as the available text material per venture varied strongly, and the absolute frequency of keywords is not a reliable indicator to differentiate between levels of SDG activity. Additionally, we took out all ventures with less than two matches per SDG. This threshold reduced the risk of miss-allocation to an SDG due to individual remarks on a website or award text. This means we only examined ventures with at least two keyword matches from one data source or two matches from different data sources per SDG. Using these quality criteria, we discarded 236 ventures (40% of our sample) coming to a sample of 352 ventures with at least one valid SDG match for detailed analysis.

Out of the discarded 236, 177 ventures had no match, and 59 ventures had only SDG matches below the threshold. A review of the 177 ventures without any matches showed two principal reasons, either a venture had no clear activity related to an SDG or there was hardly any written material for our analysis. A more detailed analysis of the split between the two groups would require manual coding of each website for the 177 ventures and is therefore out of scope for this paper on semi-automated coding. We definitely expect that some of the 177 ventures are active in an SDG domain.

In the remaining sample of 352 ventures, we found a very heterogeneous distribution. Based on our search string SDG 1 (no poverty), 5 (gender equality), 6 (clean water and sanitation), 8 (decent work and economic growth), 14 (life below water), 15 (life on land) and 17 (partnership for the goals) had less than 10 ventures with a SDG match while there was a clear concentration on SDG 3 (good health and well-being), 4 (quality education), 9 (industry, innovation and infrastructure) and 12 (responsible consumption and production) out of which each contributed more than 10% to the total matches.

Of the 352 ventures above the threshold, 198 ventures (56%) had only one SDG match, 96 ventures (27%) had two SDG matches, 33 ventures (9%) had three matches, 18 ventures (5%) had four SDG matches and some isolated cases had even more SDG matches (the maximum was one case with 8 SDG matches). To better understand the patterns behind ventures that are active in multiple SDGs we examined the correlation between different goals. As we translated the absolute frequency of matches per SDG into a binary system (which only indicates SDG activity or non-activity) a suitable test statistic for nominal data had to be used. We used Chi2 test (Kaplan, 2004) that allowed us to analyze the relationship between individual pairs of SDGs. Therefore, we first analyzed the pairs and then aggregated the results for the 136 pairs into a correlation matrix. For easier interpretation, we translated the Chi2 values into corrected contingency coefficient ranging between 0 (low relationship) and 1 (strong relationship). By doing so, we could identify 40 significant correlations between SDGs (29 with $p < 0.01$ and an additional 11 with $p < 0.05$).

| Matrix: Corrected contingency coefficients | | | | | | | | | | | | | | | | | |
|--|-------------------|--------------------|---------------------------------|--------------------------|------------------------|---------------------------------|----------------------------------|--------------------------------------|--|------------------------------|--|--|------------------------|--------------------------|----------------------|--|------------------------------------|
| | SDG 1: No poverty | SDG 2: Zero hunger | SDG 3: Good health & well-being | SDG 4: Quality education | SDG 5: Gender equality | SDG 6: Clean water & sanitation | SDG 7: Affordable & clean energy | SDG 8: Decent work & economic growth | SDG 9: Industry, innovation & infrastructure | SDG 10: Reduced inequalities | SDG 11: Sustainable cities & communities | SDG 12: Responsible consumption & product. | SDG 13: Climate action | SDG 14: Life below water | SDG 15: Life on land | SDG 16: Peace, justice & strong institutions | SDG 17: Partnerships for the Goals |
| SDG 1 | / | 0,36** | 0,04 | 0,18** | 0,26** | 0,01 | 0,03 | 0,26** | 0,02 | 0,03 | 0,03 | 0,25** | 0,02 | 0,01 | 0,01 | 0,01 | 0,01 |
| SDG 2 | | / | 0,23** | 0,05 | 0,03 | 0,13* | 0,00 | 0,03 | 0,15* | 0,11 | 0,02 | 0,45** | 0,12* | 0,11 | 0,36** | 0,06 | 0,02 |
| SDG 3 | | | / | 0,00 | 0,08 | 0,17** | 0,03 | 0,08 | 0,07 | 0,02 | 0,01 | 0,00 | 0,02 | 0,05 | 0,04 | 0,09 | 0,07 |
| SDG 4 | | | | / | 0,25** | 0,09 | 0,08 | 0,25** | 0,14* | 0,55** | 0,07 | 0,03 | 0,07 | 0,04 | 0,07 | 0,10 | 0,03 |
| SDG 5 | | | | | / | 0,02 | 0,05 | 0,14* | 0,05 | 0,34** | 0,01 | 0,04 | 0,03 | 0,01 | 0,01 | 0,03 | 0,01 |
| SDG 6 | | | | | | / | 0,13* | 0,02 | 0,09 | 0,04 | 0,03 | 0,19** | 0,03 | 0,01 | 0,01 | 0,02 | 0,36** |
| SDG 7 | | | | | | | / | 0,05 | 0,23** | 0,11 | 0,24** | 0,31** | 0,35** | 0,03 | 0,10 | 0,06 | 0,14* |
| SDG 8 | | | | | | | | / | 0,00 | 0,34** | 0,06 | 0,02 | 0,03 | 0,01 | 0,01 | 0,03 | 0,01 |
| SDG 9 | | | | | | | | | / | 0,19** | 0,14* | 0,12* | 0,22** | 0,02 | 0,06 | 0,06 | 0,05 |
| SDG 10 | | | | | | | | | | / | 0,13* | 0,04 | 0,06 | 0,03 | 0,03 | 0,16** | 0,02 |
| SDG 11 | | | | | | | | | | | / | 0,17** | 0,16** | 0,03 | 0,09 | 0,13* | 0,03 |
| SDG 12 | | | | | | | | | | | | / | 0,35** | 0,05 | 0,25** | 0,02 | 0,20** |
| SDG 13 | | | | | | | | | | | | | / | 0,02 | 0,02 | 0,03 | 0,01 |
| SDG 14 | | | | | | | | | | | | | | / | 0,44** | 0,01 | 0,01 |
| SDG 15 | | | | | | | | | | | | | | | / | 0,01 | 0,01 |
| SDG 16 | | | | | | | | | | | | | | | | / | 0,01 |
| SDG 17 | | | | | | | | | | | | | | | | | / |

** Significance level $p < 0.01$; * Significance level $p < 0.05$

Table 4 - Correlation matrix with corrected contingency coefficients for the reduced sample (threshold >1). Chi2 test statistics between SDG pairs ($n=558$; $df= 1$).

For example, the strongest correlation could be observed between SDG 4 (quality education) and SDG 10 (reduced inequalities) with 0.55 ($p < 0.01$). In our sample, this result can be explained with various initiatives that provide training/enabement for refugees to facilitate integration into Germany. Another strong relationship could be observed between SDG 2 (zero hunger) and SDG 12 (responsible

consumption and production) with 0.45 ($p < 0.01$) that can be linked to various ventures that sell organic and/or healthy food. The correlation is based on our search string with keyword matches like food, farm*, fish* for nutrition (SDG 2) and sustainable, local, etc. for sustainable/ conscious consumption (SDG 12). Table 4 provides an overview of all 40 identified correlations.

The results of our sample create some transparency about the SDG domains that German ventures are directly involved in and we can observe some patterns between SDGs. However, due to the earlier mentioned interdependencies, trade-offs and vaguely defined goals (United Nations, 2017; Nilsson et al., 2016; Costanza et al., 2016; Sachs et al., 2017) it is important to analyze the observed results more into detail to avoid premature conclusions.

3.6 Discussion

In the following section, we review our approach and discuss our results with regard to our two research questions. In addition to this, we explore the potential role of entrepreneurship for sustainable development to support future research and policymakers.

RQ1: How can we map the SDG related activity of entrepreneurs in Germany?

Response: Based on freely available web-material, the semiautomated content analysis provides a scalable approach to map entrepreneurial activities along the 17 SDGs.

Compared to interview, expert and survey-based data collection, the selected approach does not rely on response rates and an individual's willingness to answer, in order to obtain a larger sample size (Albino et al., 2009). In addition, using a predefined coding scheme on existing information for new ventures, either created by the venture itself (primary data) or by third-parties (secondary data), reduces the subjective influence compared to above mentioned approaches, although there is a possible remaining bias inherent with semi-automated approach. In addition, it allows to create a larger and more diverse sample, and in combination with filter criteria (e.g., only ventures that were rewarded in a venture competition), it is possible to exclude immature ideas and ventures.

Therefore, this option is more suitable to identify patterns of SDG related entrepreneurship on a large scale (e.g., for Germany). Natural downsides are the level of detail per venture, which is generally lower than in interviews, expert assessments or surveys, as well as a potential self-selection bias of ventures that take part in competitions. Scaling the approach to different geographical regions is possible but requires adjusting the coding scheme to specific cultural and language contexts.

The scalable approach creates a large set of data, and it is important to understand the inherent limitations of these data. As mentioned in the methodology section we analyzed the data with a semi-automated content analysis using search strings of keywords in atlas.ti. This means atlas.ti scanned source documents automatically for relevant German and English keywords and the authors collectively reviewed the allocations to discount false matches. The central element of this approach is the selection of suitable keywords for each of the 17 SDG. As we discussed before the goals contain numerous interdependencies, trade-offs and they are vaguely defined goals (United Nations, 2017; Nilsson et al., 2016; Costanza et al., 2016; Sachs et al., 2017). This complicates a highly selective coding for related SDGs like SDG 5 (gender equality) and SDG 10 (reduced inequalities), and it makes it impossible to code highly selective search strings for each of the 169 sub-targets that make up the 17 SDGs. Accordingly, when our search string classifies a venture as a contributor to a certain SDG, it is likely that only certain sub-targets of an SDG are actually addressed. Transferring this thought to our

entire sample we expect that certain sub-targets in each SDG remain unaddressed even though the SDG itself is addressed. The specific pattern of addressed sub-targets should reflect the specific development needs of Germany with its specific social, economic and ecological conditions. For instance, in Germany, the eradication of hunger (SDG 2 - zero hunger) is not a major concern whereas obesity and malnutrition are serious problems mentioned (Sachs et al., 2017). Accordingly, we must interpret the observed patterns for the 17 SDGs in combination with background knowledge on Germany to draw valid conclusions with our methodology on a more detailed level.

RQ2: Which SDGs show high entrepreneurial activity in Germany and which SDGs remain unaddressed?

Response: Entrepreneurs do not address all SDGs. There is strong direct engagement around SDG 9 (industry, innovation & infrastructure), SDG 3 (good health and well-being) and SDG 12 (responsible consumption and production). On the other end of the spectrum we find SDG 1 (no poverty) and SDG 17 (partnership for the goals) with little-observed activity.

In order to discuss entrepreneurial contributions to SDGs in more depth, we relate the found activity to the national context, specifically the national German SDG performance (Cf. Figure 3). In our research, we follow the assumption that venture activity in an SDG is an indicator for future progress towards achieving the SDG. This assumption is not blind to the fact that many ventures in our sample might not be game changers with regard to sustainable development and some might actually create negative effects - considering, for example, the discussions about the rebound effect (Figge and Hahn, 2004; Bocken and Short, 2016). However, the absence of entrepreneurial activity in an SDG domain shows clearly that entrepreneurs do not find suitable opportunities to directly affect an SDG, regardless of the specific impact. In absence of active entrepreneurs in an SDG domain, we cannot expect many innovative solutions from the private sector for sustainable development - something that the 2030 agenda calls for (General Assembly, 2015). Therefore, we consider the frequency of entrepreneurial activity in an SDG domain a prerequisite for progress and a valid, but not an exhaustive indicator. It is not an exhaustive indicator because it requires interpretation concerning the specific national conditions and the various interdependencies between the goals.

Patterns of national SDG performance & entrepreneurial activity: Applying this thought we contrast our results for entrepreneurship in Germany with the national SDG dashboard (Figure 3), which aggregates the national SDG performance by aggregating available indicators (Cf. Sachs et al., 2017). The findings of this comparison are best illustrated in a matrix with, first entrepreneurial activity and second national SDG performance (Figure 4). The matrix supports the synthesis and development of patterns and targeted policy recommendations (see Figure 5).

The simplified matrix shows four patterns of SDGs (Figure 4). We have two categories where national performance and entrepreneurial activity are consistent (i.e., both dimensions are high or low). In the top right corner, we find those SDGs with consistent high national SDG performance and high entrepreneurial activity for SDGs 3, 4, 9, 10 and 11 - pattern “maintain”. In the low left corner SDGs with low national SDG performance and low entrepreneurial activities for SDGs 5, 13, 14, 15, 16, 17 - pattern “boost”. If both indicators show high performance, the correlation suggests that entrepreneurs are active in relevant SDG domains, while weak performance in both indicators suggests low societal SDG performance and no relevant entrepreneurial activities.

The remaining two quadrants indicate contradictory results, where national SDG performance and entrepreneurial activity do not go in the same direction. In the top left corner we have high SDG

performance in Germany but low entrepreneurial activity for SDGs 1, 6 and 8 - pattern “encourage”). In the low right quadrant, we have low national SDG performance and high entrepreneurial activity for SDGs 2, 7 and 12- pattern “scale”.



Figure 3 - Comparison of national SDG performance (color coding based on Sachs et al., 2017) and entrepreneurial SDG activity in Germany (color code based on difference to mean e.i.e. Green >71; Yellow 70-36; orange 36-18; red <18).

Interdependencies: The observed patterns represent the direct entrepreneurial activities, but they neglect indirect effects, or broader contributions to several SDGs (Littlewood and Holt, 2018). If we take the eradication of poverty (SDG 1) as an example, we have an SDG with low entrepreneurial activity, but high national performance. The underlying reason for this contradiction can be found in the applied macro-economic indicators that capture progress on a national level for SDG 1. Progress is measured with indicators like the poverty headcount ratio or the population with an income below 50% of the median disposable income (Sachs et al., 2017). New ventures cannot directly address such indicators. However, ventures can indirectly fight the causes of poverty like a lack of education (SDG 4) or weak economies (SDG 9). Accordingly, we can assume that entrepreneurs primarily contribute indirectly to SDG 1 via other SDGs like SDG 4 and 9. Generalizing this thought, we assume that there are SDGs where there are little opportunities for entrepreneurs to contribute directly.

Considering the wide range of potential business models (Pacheco et al., 2010) it is certainly possible to find entrepreneurial examples for all SDGs. However, our analysis reveals that entrepreneurs rarely address certain SDGs although national performance generates a visible need (pattern “boost”). Explaining this pattern, we offer three principal reasons: (1) many SDGs are addressed indirectly and (2) some SDGs are not suitable and/or attractive to be addressed by entrepreneurs. Moreover, we find SDGs with strong entrepreneurial activity, but low national performance (pattern “scale”), which we attribute to (3) missing scale of entrepreneurial activities and/or ineffective entrepreneurial activities that lead to low impact.

(1) In some SDGs progress in one SDG is tied to progress in another SDG. SDG 13 (climate action) (Pattern “boost”) is arguably one of the best examples for strong interdependency with other SDGs.

The key indicator of progress is CO2 emissions. This means progress is linked to all energy consuming elements of society in our fossil fuel dependent societies. Accordingly, progress requires countless actions across the entire spectrum of SDGs. For instance, progress needs a wide range of technological innovation (SDG 9) -most importantly new sources of energy (SDG 10), we have to change the way we produce food (SDG 2) and we have to change the way we live and consume (SDG 11 and 12) and to enable all those things we need suitable education (SDG 4). We conclude that especially SDG 1 (no poverty), 8 (decent work and economic growth), 13 (climate action), 14 (life below water) and 15 (life on land) depend strongly on progress on other SDGs, but we must emphasize that more detailed assessments of interactions are necessary to draw reliable conclusions (Nilsson et al. 2016).

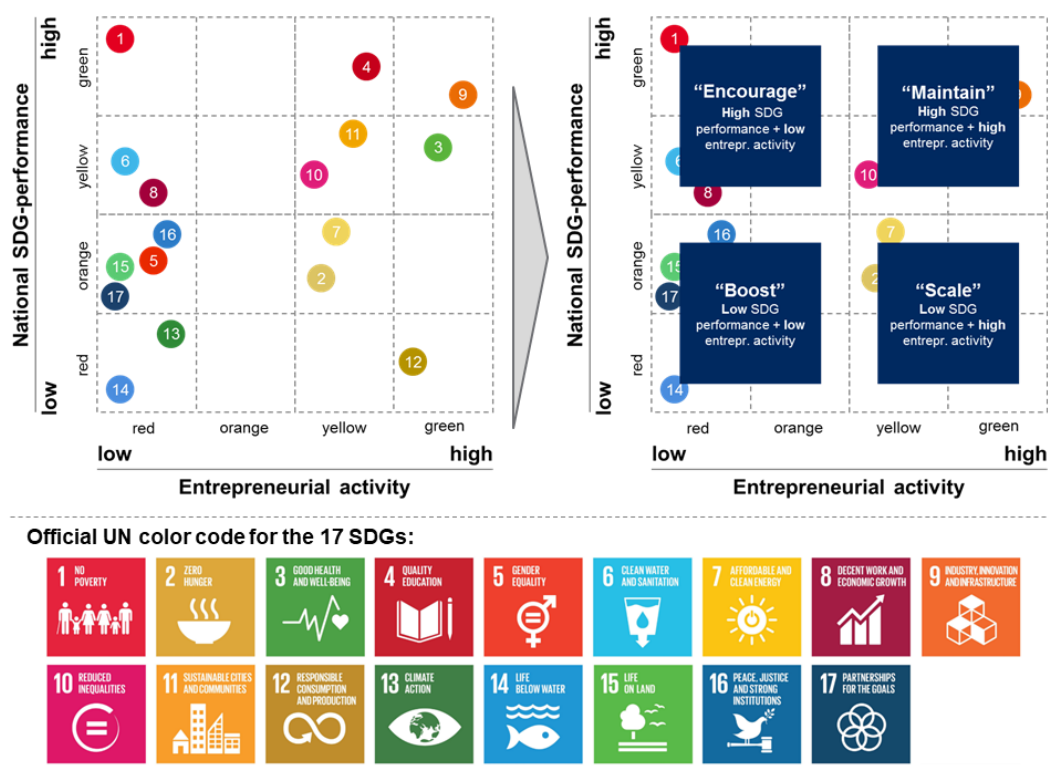


Figure 4 - Matrix: Plotting SDGs according to national SDG performance and mapped entrepreneurial activity (national performance scores were distributed within their color category according to their scores in Sachs et al., 2017, entrepreneurial activity according to their difference to the mean; SDG logos edited from <https://sustainabledevelopment.un.org/>).

(2) Despite the indirect and aggregated effects of entrepreneurs, some goals are less suitable for meaningful entrepreneurial contributions, most notably SDG 17 (partnership for the goals) (pattern "boost"). Sachs et al. (2017) measure progress via government spending on health and education, tax revenues or the national financial secrecy score. The selected indicators depend primarily on the government with little room for independent entrepreneurial solutions. Similarly, SDG 16 (peace, justice, and strong institutions) (Pattern "boost") depends largely on governmental action to improve indicators in the field of public safety, property rights or corruption. Even though there are examples like Parlamentwatch e.V. with their activities around transparent and accountable institutions or Mein Notruf GmbH in the field of public safety, the scope for entrepreneurship is limited (Parlamentwatch e.V. 2018; Mein-Notruf GmbH, 2018) [The stated examples are not part of our sample. They were only selected to exemplify the situation]. Pomare (2018) summarizes external factors, stimulating new

ventures' awareness and internal resources and capabilities, limiting the SDG focus, as further criteria for meaningful contribution.

(3) Identifying active entrepreneurs along the 17 SDGs, we cannot draw causal conclusions on the scale and potential impact of ventures. Therefore, a strong entrepreneurial activity does not automatically mean strong SDG contribution of ventures, and it should not be mistaken as a causal driver for strong national performance. Nevertheless, strong entrepreneurial activity is an important prerequisite and driver for entrepreneurial contribution, especially with regard to future developments in an industry (Bidmon and Knab, 2018; Hockerts and Wüstenhagen, 2010).

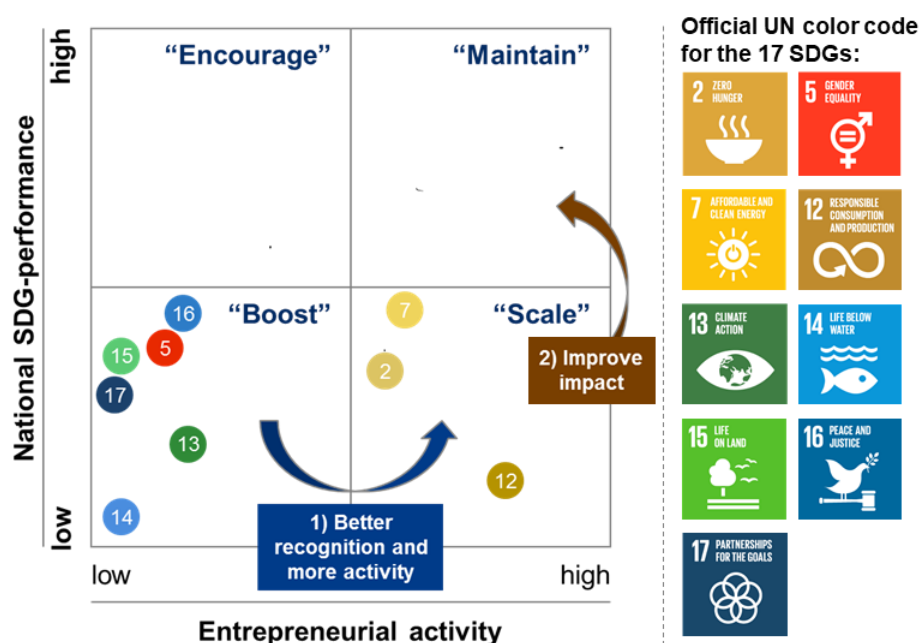


Figure 5 - Improvement path e Boost awareness for SDGs with low entrepreneurial activity and develop measures to scale activities in areas with low national SDG performance (SDG logos edited from <https://sustainabledevelopment.un.org/>).

SDG 7 (affordable and clean energy) constitutes a good example of the lack of scale/impact despite strong entrepreneurial activity today. For meaningful performance on a national level, these SDGs require a system transition (Loorbach and Wijsman, 2013). For the SDG 7 (affordable and clean energy) sub-level indicator “share of national renewable energy in total final energy consumption” (Sachs et al., 2017) this means that effective clean energy ventures obtain a dominant market share. This requires massive structural changes as part of the long-term transformation of the German energy system, the so-called “Energiewende”. Consequently, we can assume that today's entrepreneurial activities can improve national performance only where structural circumstances allow effective clean energy ventures to scale-up and gain meaningful market shares. This requires strong political involvement, and it leads to a time lag between entrepreneurial activities and measurable performance improvements.

Additionally, our sample shows, that most of the Germany's new venture activity is centered in 3 federal states. This might also limit the entrepreneurial scale across the nation and so affect the national performance overall. In order to improve the contribution to certain goals, policy makers

should create support systems and reliable ecosystems to further spread SDG related entrepreneurship across the entire country.

3.7 Conclusion

The purpose of this article was to increase our understanding to what extent new ventures contribute to achieving the SDGs on a regional or country level. We examined 193 venture competitions in Germany and collected data on 588 rewarded ventures. The method chosen was a semi-automated content analysis that helped to allocate those ventures based on their activities to the 17 SDGs. Our research results revealed a very heterogeneous distribution of entrepreneurial activities along the SDGs that we contrasted with the national overall performance of German ventures (Figure 3 and Figure 4). Plotting the SDGs in a matrix of entrepreneurial activity and national SDG performance, we identified four simplified patterns of entrepreneurial activities and national SDG performance. The need for action differs strongly between these four patterns. In terms of contributions to practice, we suggest policymakers should focus their attention on those areas with low national SDG performance and low entrepreneurial activity (pattern “boost”) and those areas with low national SDG performance and unscaled entrepreneurial activity (pattern “scale”). Identifying and removing institutional and structural barriers for entrepreneurs particularly in these patterns has the largest potential to make entrepreneurship a more important contributor to sustainable development. Contributions to science are primarily the development of a novel and scalable method to map contributions of new ventures to achieving the SDGs on a regional and country level.

Key limitations include the fact that the approach chosen does not take the actual magnitude of a venture's contribution to achieving an SDG into account and that the content analysis depends on publicly available data which certainly leads to some inaccuracy. Nevertheless, we believe the benefits of this method clearly outweigh the disadvantages. We suggest that this attempt to identify entrepreneurial activity towards the SDGs needs to be continued by research, both in scale and geography, as well as in depth regarding contributions and impact. Continuing this research will improve our understanding of SDG related entrepreneurship and it will help to better direct political and entrepreneurial actions towards sustainable development.

3.8 Appendix – supplementary data

Coding scheme:

| SDG | Selected key words (German and English) |
|---------------------------------|---|
| SDG 1: No poverty | Armut "ärm*" Sozialsystem Sozialschutzsystem Grundsicherung Mikrofinanz* Basisschutz "arm*" poverty poor social protection system microfinanc* basic income basic provision basic social security |
| SDG 2: Zero hunger | Hunger Nahrung* nachhaltige Landwirtschaft Landwirtschaft Agrar* Saat* *Ernährung "essen*" "Bauer*" Kleinbauer Übergewicht* Fehlernähr* Adipositas Adipös Fettleibigkeit Obesitas food agricult* hunger farm* *nutrition sustainable farm* pastoralist fisher seed cultivat* domesticate livestock obesity overweight obese "eat*" |
| SDG 3: Good health & well-being | Gesund* Wohlergehen Müttersterb* Kindersterb* Epidem* Krankheit* Frühsterblich* Impf* Lebendgeburt* Neugeb* Arznei* Medikament* Medizin* Todes* Aids* Tuberkulose* Malaria* Behandl* "Sucht*" "Drogen*" Verletz* Lebenserwartung* Sterblichkeit Unfalltot* sex* Hygiene sauber* Ärzt* Arzt Doktor Patient Praxis Betreuung behind* Therapie Wohlbefinden Lebensqualität Pflege health diseas* medicin* mortal* birth* death* vaccine* well-being newborn neonatal mortality epidemics aids tuberculosis malaria narcotic* drug* injur* accident reproductive illness* hygien* life expectancy Doctor Therapy pharma* "Care" Handicap disab* |
| SDG 4: Quality education | *Bildung *bilden Qualifi* *schul* Analphabet* Schüler* lernen Unterricht* student Lehr* educat* vocation* training school literacy illiterate pupil teach* learn |
| SDG 5: Gender equality | Geschlechterm* Chanceng* Selbstbestimm* Diskrimi* Menschenhandel Verhütung* Gleichstellung* Mädchen Diversit* Kinderheirat Zwangsheirat Zwangsehe Genitalverstü* Beschneidung Gender Pay Gap Gender Wage Gap equality gender empowerment self-determine* discriminat* trafficking forced marriage genital mutilation circumcision child marriage Gender Pay Gap Gender Wage Gap emancipat* Emanz* Frau* Woman Women Girls |
| SDG 6: Clean water & sanitation | Sauberes Wasser Sanitär* Wasserknapp* Wassernutz* Trinkwasser Notdurftverricht* Wasserqualität Abwasser Wasserressourcen Grundwasser Frischwasser WC clean water water usage water scarcity water quality water reuse water recycling water resources sanitation wastewater open defecation freshwater water-related wetland aquifer water efficiency water harvesting desalinat* toilette toilet |

| | |
|---|---|
| SDG 7: Affordable & clean energy | Energie* Erneuerbare Energie Energiewende Brennstoff* Strom* Windturbine Photovoltaik* Solar* Biogas* PV*Anlage Batterie* clean energy green energy modern energy renewable energy sustainable energy photovoltaic wind turbine solar biogas energy efficiency clean fossil-fuel energy infrastructure energy technology energy storage power supply energy grid power grid |
| SDG 8: Decent work & economic growth | Kinderarbeit Vollbeschäftigung Wirtschaftswachstum Bruttoinlandsprodukt* Arbeitspl* menschenwürdig* nachhaltiges Wachstum Zwangsarbeit Sklaverei Menschenhandel Kindersoldat* Arbeitsrecht* Wanderarbeit* prekär* Beschäftig* nachhaltiger Tourismus Arbeitslos* Arbeitsbeschaffung* *employ* labor labour economic growth gross domestic product economic productivity job creation sustainable growth job decent work slavery child soldiers sustainable tourism working environment worker |
| SDG 9: Industry, innovation & infrastructure | Infrastruktur* Industrialisierung Technologieentwicklung Technologieförderung Forschung* Internetzugang verkehr industrie 4.0 "Fahr* Mobilität Logistik* Industrie 4 künstliche Intelligenz maschinelles lernen infrastructure industrialisation industrialization research technology transfer technology support technology development access to internet internet access development spending R&D smart traffic transport digital* IoT internet of things industry 4.0 automat* augmented reality virtual reality driv* vehicle* "Mobility logistic* industry 4 machine learning artificial intelligence |
| SDG 10: Reduced inequalities | Ungleichheit* Einkommenswachstum Selbstbestimm* Inklusion Geschlechterg* Chanceng* Diskrimi* Lohnungleichheit* Arm and Reich Lohnunterschied* Entwicklungsl* Migration* Flüchtling Flucht Teilhabe Partizipation barrierefrei* Behinder* Diversit* flücht* Rollstuhl inequalit* unequal* income growth inclusion discriminat* equality poor and rich developing countr* migration inclusive refugee Disabilit* Wheelchair |
| SDG 11: Sustainable cities & communities | Nachhaltige Städte Nachhaltige Stadt Nachhaltige Gemeind* Gemeinde* Wohnraum Slum* *Verkehr* öffentlicher Nahverkehr ÖPNV Verstädterung Siedlung* Weltkulturerbe Weltnaturerbe Gentrifizier* komunal* Naturkatastrophen nachhaltiges Bauen nachhaltiges Baumaterial* nachhaltige Baumaterial* stadt städte kommun* städti* Elektro* Mobilität Logistik* sustainable cit* sustainable communit* public transport traffic settlement slum sustainable transport affordable transport safe transport accessible transport housing urbanization urbanization public space green space safe space disaster sustainable building building sustainable construction cultural heritage natural heritage city cities communit* electr* "Mobility logistic* |
| SDG 12: Responsible consumption & production | Konsum* nachhaltige Produktion Produktionsmuster Ressourceneinsatz Ressourcennutz* Ressourcenproduk* Abfall* Abfälle Nahrungsmittelverschwendung Nahrungsmittelverluste Nachernteverluste Kreislaufwirtschaft Wiederverwendung Wiederverwertung Elektroschrott |

| | |
|--|---|
| | nachhaltiger Einkauf nachhaltiger Tourismus nachhaltig* umweltfreund* Recycling Recyc* E*waste sustainable production sustainable consumption consumption resource efficiency food waste food loss* post-harvest loss* circular economy circular business recycling waste reuse sustainable procurement sustainable tourism e*waste fair trade sustain* eco-friendly environmentally friendly share sharing organic "bio*" ecological |
| SDG 13: Climate action | Klimawandel* Klimaschutz* CO2 Treibhausgas* klimabedingt klimafolge* Klimaanpassung* Klimaauswirk* Emission* climate change climate action climate mitigation climate adaptation CO2 greenhouse gas climate related Emission |
| SDG 14: Life below water | Ozean* Meeresressource* Fischerei* Überfisch* Küstenökosystem* Fischbestand Fischbestände Aquakultur* Meerestechnolog* Kleinfischer marine ocean* fishing fisheries coastal overfishing aquaculture fish |
| SDG 15: Life on land | Bodendegradation Landökosysteme Desertifikation Wald* Artenvielfalt Wälder Wüstenbild* *aufforst* Wilderei Entwald* Biodiversität ökologische Vielfalt biologische Vielfalt bedrohte Arten Aussterben Neobiota invasive Arten invasive* gebietsfremde* Art* Ökosystemdiversität Flächenversiegel* Erosion biodiversity forest* desertificat* poach* reforest* terrestrial ecosystem* renaturation* natural habitat* extinction threatened species wildlife invasive species alien species eradicat* non-indigenous species impervious surface |
| SDG 16: Peace, justice & strong institutions | Friede* Gewalt* Justiz* Krimin* Rechtsstart* Waffen* Korruption Bestechung Kleptokrat* Völkerrecht* Menschenrecht* Mord* Verbrechen* leistungsfähige Institutionen rechenschaftspflichtige Institutionen inklusive Institutionen Sicher* justice peace violence "war" effective institution* accountable institution* inclusive institution* "crime" "criminal" judici* torture rule of law weapon illicit corrupt* brib* transparent institutions human rights international law kleptocracy participat* Secur* |
| SDG 17: Partnerships for the Goals | Entwicklungshilfe* Entwicklungszusammenarbeit* Nord-Süd-Zusammenarbeit Süd-Süd-Zusammenarbeit Dreieckskooperation* Leapfrog* Technologietransf* Kapazitätsaufbau* Capacity Building fairer Welthandel gerechter Welthandel Handelsbarriere* Protektionismus development aid development assistance development cooperation foreign aid capacity building north-south "ODA" official development assistance least developed countr* south-south triangular cooperation technology transfer technology facilitation leapfrog* fair trade trade barriers |

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4 Article II - Sustainable Entrepreneurship: How to measure future sustainability impact for early stage new ventures

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4.1 Abstract

Purpose: The paper provides an overview on existing measurement approaches and the respective suitability to predict, to support and thus to increase the future sustainability value generation of new ventures along the three domains: economic, environmental and social impact. It aims to identify required complements and adjustments to close the existing gap of suitable measurement tools, determining holistic sustainability for new ventures.

Design/methodology/approach: A systematic literature review is chosen to assess existing measurement tools, methods and concepts from theory across relevant disciplines. Scope of measurement and applicability in the described context are the main assessment criteria.

Findings: The literature review reveals that I.) there is a lack of sustainability measurement tools appropriate for early stages of a new venture, II.) that holistic measurement tools, covering environmental, social and economic value generation, are needed and that III.) the relative improvement of generated value needs to be taken into account in order to allow a meaningful comparison of different ventures and business models and to significantly reduce the complexity. IV.) Research needs to integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only.

Research/practical implications: The research findings provide a basis for measuring, predicting and increasing sustainability impact generated from new ventures. The suggested complements and adjustments are shared for use in other benchmarking approaches and to help establishing the research field of sustainable entrepreneurship. Its application will provide important decision criteria for new ventures (how to increase sustainability), early stage investors (where to invest), policymakers (which types of ventures and business models to support) and sustainability dedicated accelerators (how to support the sustainability generation of new ventures).

Originality/value: The contribution to existing concepts and tools is especially the starting development of early stage sustainability measurement and prediction approaches for new ventures. The literature review has shown that measurement tools are often too complex for early stage measurement. It is at these stages however, that public funds are invested and private investors decide on which business to help to achieve the growth stage.

4.2 Introduction

The problem is that measuring sustainability impact across the three domains (economic, social and environmental) is extremely challenging, as in some cases it is even hard to judge whether an organizational sustainability impact is positive or negative (Hahn et al., 2014; Jay and Gerard, 2015). Best practices currently used primarily in mature organizations such as the Triple Bottom Line, the Global Reporting Initiative, and Corporate Sustainability Reporting are very valuable, but are criticized for important shortcomings (Milne and Gray, 2013). And the measurement problem becomes even bigger in early stages of new ventures, due to uncertainty, unavailability of data and frequent changes to products, services and business models. However, without measurement, we cannot make informed choices which new ventures have the potential highest sustainability impact. Additionally some elements of our traditional criteria for successful new venture support systems (accelerators, investors and policies) are likely to be inappropriate in this context, as we currently cannot fully adjust them to maximize sustainability impact. Knowledge about the most important indicators and success factors will increase the outcome.

Sustainability has been identified as a key future path for entrepreneurship research (Shepherd, 2015) and new ventures as a key for disrupting existing production and consumption systems (Hockerts and Wuestenhagen, 2010). Significant resources are spend by governments, investors and new ventures on sustainable entrepreneurship without having solved the problem of measuring, predicting and increasing respective impact.

The Brundtland Commission first mentioned sustainability in the still used context in 1987, stating the overarching and inherent objective as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987)

An applicable and more detailed definition of sustainability for the context of this research can be derived from sustainable entrepreneurship research:

“Sustainable entrepreneurship is focused on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society.” (Shepherd and Patzelt, 2011, p.142)

The definition captures two important aspects. First, the broadly accepted three sub-domains economic, environmental and social sustainability are mentioned by this definition, emphasizing also non-economic objectives. Second, it states the necessary ability of continuing an activity indefinitely into the future as a characteristic of sustainable entrepreneurship, hence sustainability is future orientated.

Previous research has developed measurement approaches across all domains of sustainability in various complexity. Measurement of economic impact, e.g., growth and profit for new ventures is well accepted and already performed by the majority of ventures across the globe. Environmental impact measurement has a younger history, resulting in both broader reporting approaches (e.g., GRI, CDP or IR) and specific methods such as life cycle assessment or ecosystem valuation. Latest research contributes in the field of social impact measurement, developing measurement tools to quantify impact in this domain. However, these existing methods need to be adapted for the purpose described above, as they are either measuring only parts of the total sustainability value generation, are too

complex and time intense for early stage new ventures or do not offer the possibility to compare sustainability impact with help of single denominators.

Consequently, the research question to be answered in this article is: What approaches exist to measure sustainability impact, how suitable are they to determine holistic sustainability for new ventures and what supplements or adjustments are required to determine sustainability for new ventures in early stages?

The contribution to existing concepts and tools is especially the starting development of future sustainability measurement and prediction approaches for new ventures in early stages. The literature review will show that measurement tools are often too complex for early stage measurement. It is at these stages however, that public funds are invested and private investors decide on which business to help to achieve the growth stage.

4.3 Methodology

A systematic literature review is chosen to assess existing measurement tools, methods and concepts from theory across relevant disciplines. By applying a systematic approach using an explicit and repeatable search algorithm, it is ensured that the existing literature is screened in order to generate reliable and high quality findings (Tranfield et al., 2003; Petticrew and Roberts, 2006). Although the large amount of information creates challenges, such as data synthesis (Pittaway et al., 2004), it is the preferred method to deal with the different research streams existing for the broad field of sustainability.

We conducted the review in three steps: first, the literature collection, where the selection algorithm is applied on the defined sources. Second, the literature analysis, providing the required insights for the following synthesis of results and consolidation into frameworks before required adjustments and complements are discussed.

Our goal in this review is to create a comprehensive overview of existing measurement approaches and a conceptual consolidation in developed frameworks, rather than an empirical analysis. The methodical limits, focusing on breadth rather than on depth for the reviewed approaches can be accepted, since the review is performed as a starting point of further research towards the goal of measuring future sustainability for early stage new ventures.

4.3.1 Literature selection criteria and search words

Removing subjectivity during the data collection process is the key characteristic of a systematic literature review and differentiates the selected approach from others, such as employing a panel of experts and using knowledge of existing literature (Crossan and Apaydin, 2009). Hence, the planning stage is the most important step, defining selection criteria upfront (Tranfield et al., 2003).

Being aware of the broad meaning of sustainability and its multiple usage in different fields, we needed to define the search words to cover breadth but also to identify measurement approaches and explicit application for early stage new ventures. In addition different research streams use different keyword describing similar content (e.g., sustainable entrepreneurship vs. social entrepreneurship). Therefore we both used sustainability and its derivatives (sustain*) as well as the three domains according to the definition mentioned above (economic, environmental or ecological and social). Similarly, we included

related search words to further describe the topic. The resulting search word stream ensures that all key words are represented in one of the defined forms:

“(Sustain* OR Economic* OR Environmental OR Ecologic* OR Social) AND (Impact OR Value OR Performance) AND (Measure* OR Report* OR Account* OR Evaluat* OR Benchmark*) AND (New Venture OR Startup)”

4.3.2 Key data sources and search restrictions

Data sources were limited to peer-reviewed journals, being considered as validated knowledge and representing state of the art research in this field (Podsakoff et al., 2005).

We selected to use Web of Science to collect the literature, using the Science Citation Index Expanded (SCI-EXPANDED) containing data from 1945 to present and the Social Sciences Citation Index (SSCI) with publications from 1956 to present. Being one of the most comprehensive databases and having suitable analysis options (Crossan and Apaydin, 2009) the source fitted well for this review.

Our initial search in the data base for “topic” contained the mentioned search words for document type “article”, language “English”, without any additional restrictions. Books, book chapter and conference papers were excluded to ensure availability and to reduce variability in peer review processes (Jones et al. 2011).

4.4 Literature collection

The team, using the predefined key words and selected databases with named restrictions, conducted the collection. All findings were checked against exclusion criteria and relevant titles were selected (Jones et al., 2011). The resulting list was further reviewed and analyzed in the second step.

Total number of articles found with search words was only 253, of which only very few discussed the targeted measurement approaches to an extent that could be used for the further analysis. Consequently we can state, I.) that there is a lack of sustainability measurement tools appropriate for early stages of a new venture that can be found in the data base.

The search criteria was consequently adjusted to increase the number of findings and to include literature without focus on new ventures or startups. Instead, we added “method”, “approach” and “concept” to further focus the search on relevant publications. We conducted a second round of literature collection with the following search words:

“(Sustain* OR Economic* OR Environmental OR Ecologic* OR Social) AND (Impact OR Value OR Performance) AND (Measure* OR Report* OR Account* OR Evaluat* OR Benchmark*) AND (Method OR Approach OR Concept)”

This time, 124,167 articles were found using the adjusted selection criteria. In order to efficiently process the review, we needed to apply further restrictions for the search, using Web of Science Categories closely related to the field of sustainable entrepreneurship to narrow down the findings: (environmental sciences OR ecology OR engineering environmental OR economics OR environmental studies OR energy fuels OR management OR green sustainable science technology) resulting in 29,657 entries. It confirms the assumption that the key words are used in various research fields and contexts.

This round of review should be focused on identifying those articles clearly introducing or discussing approaches and methods to measure sustainability or one of its domains. Single aspect measurement approaches were excluded since they focus on very specific aspects of one domain (e.g., waste water as an aspect of ecological impact) and are not seen to contribute to the research question at hand. Assuming that approaches and methods introduced in the past would be cited if seen valuable by the community, we focused on the top-cited publications with more or equal than 100 citations, resulting in a list of 723 publications to be analyzed in the second step literature analysis.

4.5 Literature analysis

Selected literature was first grouped during the analysis phase in order to achieve compiled stacks of publications. The grouping was done along the three domains of sustainability, also determining the measurement scope of identified measurement approaches, either being a single domain measurement, measuring primarily all aspects of one sub-domain, namely economic, environmental OR social, or being multi-domain measurement, measuring sustainability across all domains, namely economic, environmental AND social. As stated above, measurement methods focusing on only single aspects of one domain are not taken into consideration for this review.

The following approaches to measure holistic sustainability were identified: Many approaches trying to measure holistic sustainability are examples of an integrated accounting or reporting, meaning they cover all three domains of sustainability. The well-known concepts are Triple Bottom Line Accounting ("TBL"), Global Reporting Initiative ("GRI"), Integrated Reporting ("IR") or Sustainability Reporting ("SR"). All these concepts were developed as a reaction to the increasing importance of initial environmental concerns being extended to sustainability later on (Pope et al., 2004). Hence, the assessment approaches focus on supporting decision making in order to determine if an action should be taken or not, taking into consideration all three domains. Additional focus was on integrating sustainability in existing economic reporting, in order to deeply connect each organization with those ideas (Milne and Gray, 2013). Being reporting and accounting principles, these methods do not calculate a single denominator nor do they provide quantitative information in any case.

Figge and Hahn (2004) first described the concept of Sustainable Value Added ("SVA"). Emphasizing the importance of social impact beyond eco-efficiency, trying to develop a measure that truly integrates all three domains of sustainability. It focuses on opportunity costs to determine if resources are used optimally to generate sustainable value added (Figge and Hahn, 2004). Although the approach seems promising, the research stream is not further followed by other fellows, resulting in little implementation and examples. One reason may be, that for benchmarking and opportunity cost determination, respective macro-economic data is needed and the monetarization requires complex conversion (Figge and Hahn, 2004). Compared to the former approaches, the SVA allows to determine a single denominator for every domain or even for holistic sustainability.

Approaches focusing on measuring economic sustainability: Traditionally economic sustainability was measured by Balanced Scorecards ("BSC"), ensuring that not only one measure, e.g., profit, is on target, but also other key performance indicators are met. The sustainability discussion caused some companies to adapt their BSC to so called sustainability balanced scorecards (Hansen and Schaltegger, 2016), including sustainability indicators, most often single aspect measures. Consequently we cannot really state that multi-domain measurement is observed using the BSC.

Cost Benefit Analysis ("CBA") is widely used for projects and policy assessment (Gasparatos, 2008). It has been adapted to not only determine economic feasibility of a project, but can also monetarize other effects (e.g., environmental) including net present values.

Next, we identified methods to measure environmental or ecological sustainability: Current research sees the origin of today's Ecological Footprint ("EF") approach in the 1990s, developed by E. Rees and M. Wackernagel (Gasparatos, 2008). It is seen as a tool and at the same time as a metric, indicating the total area of land and water required to produce a resource, estimating respective consumption of resources and assimilation of waste (Rees and Wackernagel, 1996). Application still happens mainly for geographical areas, e.g., cities and in the last years more often for organizations (Gasparatos, 2008).

The evolving need for companies to reduce greenhouse gas emission was based on political agreements and increasing public awareness. The Carbon Disclosure Project ("CDP") represents the effort to communicate and report carbon disclosure (Kolk et al., 2008). The effort is still voluntarily and so inconsistent across regions and industries, it is criticized because it has never left the reporting stage, and so does not offer proper risk management and decision-making support (Kolk et al., 2008). One reason seems to be the complex calculation and massive data requirement in order to assess the holistic carbon disclosure value, requiring expert resources (Kiernan, 2008).

The approach of Ecosystem Valuation ("EV") has been developed in order to determine the value of goods and services in ecosystems (de Groot et al., 2002). Starting in the 1960s until today researchers aimed to assess the importance of ecosystems for human society. Again, decision-making should be influenced with help of informed valuation. The biggest challenge is seen in finding matching data and right scaled information required to correctly value these products and services (de Groot et al., 2002).

Life Cycle Assessment ("LCA"), also called life cycle analysis or accounting, is often seen as the most detailed method to define environmental performance, since it considers all stages of a product's life cycle from required resources to ultimate disposal (Tyteca, 1996). It was first mentioned by N. Kirkpatrick in 1992 and developed further in the following decades, still focusing primarily on environmental indicators. Due to the focus on single products or units, it is hard to apply the LCA for entire organizations or ventures, since it requires the summation of all units produced (Tyteca, 1996).

Environmental impact assessment ("EIA") has been developed based on the early methods, focusing more on forecasting environmental impact of activities, trying to inform and educate individuals and organizations about their impact on sustainability (Pope et al., 2004).

Last, social sustainability impact is measured with the following approaches identified in the selected publications:

The Social Return of Investment ("SROI") approach was initially developed to capture and monetarize the full social impact of the employment services program in San Francisco (Nicholls, 2009). Soon, more and more stakeholders participating in NGOs or social ventures became interested in this method, to assess their social impact. Although named social, it can also contain environmental impacts to some extent. Focusing on the benefiting stakeholders and the respective impact value chain, the SROI compares outcomes or impacts to required input and investments for the stakeholders (Millar and Hall, 2012) (Nicholls, 2009). Advantages are seen in the detailed information collected during the assessment and the net gain for society in monetary terms (Yates and Marra, 2016). Disadvantages are the unevaluated ratios and the complex analysis of several stakeholders and various outcomes. A certain level of subjectivity is also associated to this approach (Nicholls, 2009).

Several slightly different approaches are combined under the name Social Life Cycle Assessment ("SLCA"), all are clearly focusing on social impacts, in order to either compare and benchmark them or to improve the social impact (Jørgensen et al., 2008). Because this research is quite new, most of them are conceptual and currently applied for the first time. Key success factor for this approach is the definition of social impacts, which is less straight forward compared to product LCA and its indicators and impacts (Jørgensen et al., 2008). Additional challenge is the valuation of impacts and consistency across applications.

4.6 Literature synthesis

Creating a comprehensive overview on existing methods to measure sustainability and the respective suitability for early stage new ventures to forecast future sustainability is the main goal of the third step in this review. In order to achieve this goal we will introduce simple frameworks, building on the described grouping along the domains and assessing the methods and approaches with help of additional criteria. All introduced criteria will support the final assessment if a method is directly applicable for the question at hand or has only limited applicability. This approach equals a conceptual consolidation of the findings as a first result of the literature review.

First assessment criteria can be derived from the stated definition of sustainable entrepreneurship. The grouping criteria used during the analysis will be used as an assessment criteria, since it determines if a method is capable to cover all domains of sustainability. Hence, we will assess if only one domain is covered or if multiple domains are included in the measurement scope, as proposed in the given definition. The measurement approach can also be assessed by the used measurement period. It can either be historical data used to create a backward looking value or it can be a forecast, using estimated information to create an outlook which is required to predict sustainability (Gasparatos, 2008).

Current research and use cases show that additional criteria is important. The measurement focus will be used to describe if an approach focuses on holistic sustainability determination for an organization including its sold product or if it only focuses on the operational footprint for a given venture. Similarly, we will assess the required measurement effort to perform the measurement. Relatively low effort can be achieved by streamlining the measurement with help of delta or gap analysis for example, whereas complex and full data requirements result in more effort. Additionally, the required expertise and resources to maintain and perform the measurement is indicating the required effort (Johnson and Schaltegger, 2015). Applicability will be the aggregated assessment criteria.

Applying the criteria to all identified methods and approaches allows to visualize them in the above-explained frameworks. First, measurement period is displayed vs. measurement scope (Figure 6).

Looking at the framework one can state that, II.) holistic measurement tools, covering environmental, social and economic value generation, are needed especially for forecasting sustainability impact. The majority of measurement approaches is focusing on single domains. This shows the challenge to integrate as measurement across all domains, but also identifies potential to holistically measure sustainability. Those methods with broad scope are most likely historical measurements.

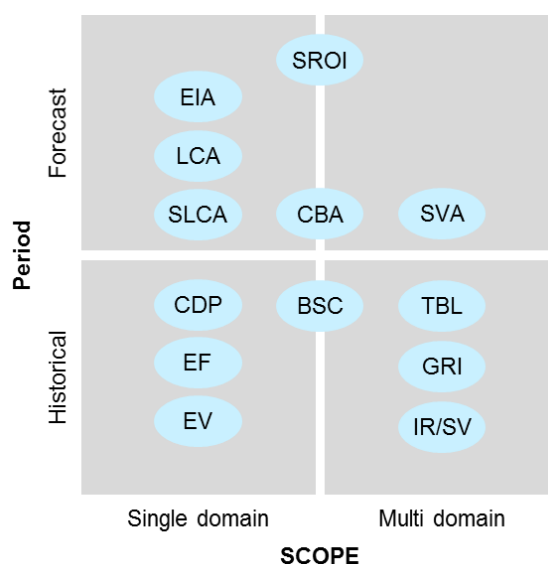


Figure 6 – Framework Scope – Period. Source: Own figure.

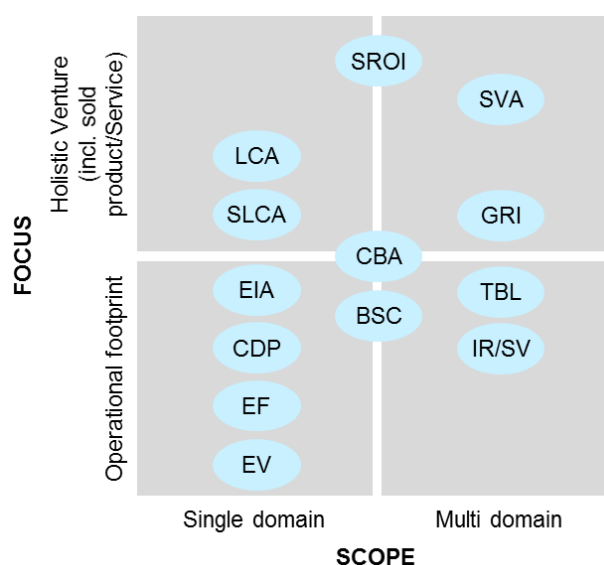


Figure 7 – Framework Scope – Focus. Source: Own figure.

Hence, IV.) research needs to integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only in order to ensure knowledge transfer between the domains.

Best fit according to the requirements developed in this review can be stated for SROI, CBA and SVA, since all three methods allow forecasting of holistic sustainability to an extent that is assessed as suitable.

The second framework applied compares measurement focus and scope, determining the overall complexity of an approach, which is required to achieve a holistic measurement of sustainability impact (Figure 7).

The various methods and approaches do have different measurement focuses. Especially those from the environmental domain, are clearly looking rather at operational footprint, whereas LCAs have a more holistic focus. The GRI contains measures for both product/service and operations, which generates better fit for this criteria. Again the SVA and SROI provide multi-domain measurement and at the same time holistic focus, as required for the question at hand.

The third framework compares measurement effort and scope, showing the trade-off between broad coverage and resources needed to perform the measurement (Figure 8).

Obviously most of the methods identified create relative high measurement effort, either by being multi-domain approaches or by being very detailed and specify single domain approaches. Most of the times, data requirements, analysis complexity, expert resource requirement and the broad scope create this effort.

CBA and BSC are assessed to generate less effort by focusing on important aspects only and/or using delta and gap analysis. In order to minimize the effort for new ventures forecasting their sustainability impact (due to expected changes and willingness to participate) we propose to III.) focus on the relative improvement of generated value in order to allow a meaningful comparison of different ventures and business models and to significantly reduce the complexity. SROI and SVA could be enhanced by this complexity reduction to better fit the requirements.

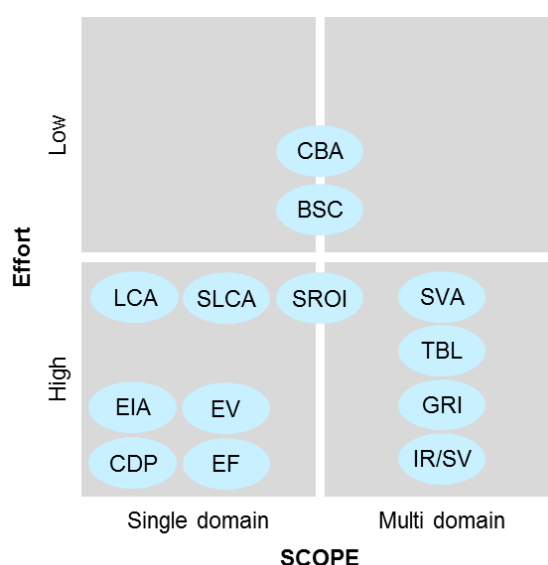


Figure 8 – Framework Scope – Effort. Source: Own figure.

If one sums up the single assessments above, the following framework can be generated, indicating the applicability of measurement approaches in the defined context (Figure 9).

Understanding that this qualitative synthesis can only serve as a first orientation point, one can still identify the applicability of certain methods. The former criteria can help to identify adjustments needed to create direct applicability in this context. First, there was no method identified being a multi-domain measurement tool directly applicable, which confirms the relevance of the research question.

Next, we can identify SROI and SVA as two methods, which have the best potential to fill the explored gap.

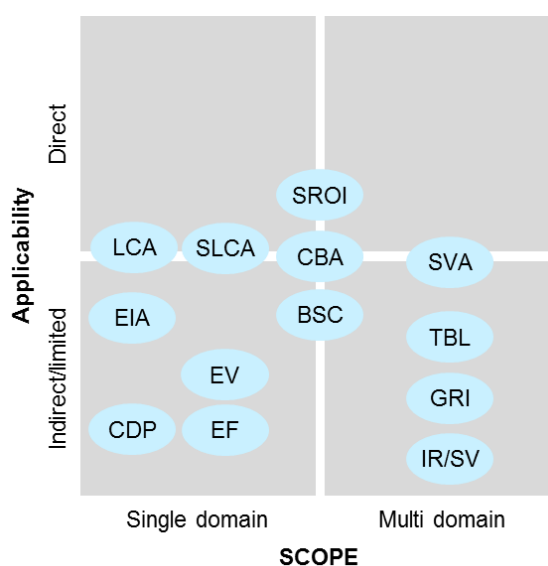


Figure 9 - Framework Scope – Applicability. Source: Own figure.

SROI would need to clearly measure holistic sustainability, which could be achieved by integrating outcomes and impacts from all domains. In addition it would improve its applicability if complexity could be reduced, according to the special needs and options of early stage new ventures. Additional research will be needed to define the possibility and to identify those specific adjustments.

Since SVA is not yet fully implemented and analyzed it is hard to estimate the effort required, although it seems to be too complex for early stage forecasting. It clearly offers the potential to integrate all three domains and to apply delta or gap analysis, as seen for CBA.

4.7 Conclusion

Although we could not identify an approach to be directly applicable, we can draw relevant conclusions from this review. The literature review reveals that I.) there is a lack of sustainability measurement tools appropriate for early stages of a new venture, II.) that holistic measurement tools, covering environmental, social and economic value generation, are needed and that III.) the relative improvement of generated value needs to be taken into account in order to allow a meaningful comparison of different ventures and business models and significantly reduces the complexity. IV.) Research needs to integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only.

We could identify methods that do better fulfill requirements compared to others and we could identify some methods performing quite well in some dimensions, which allows future transfer to other methods in order to e.g., reduce complexity.

However, there will be adjustments needed to the selected method creating full applicability. The team has decided to continue this path, instead of developing new methods, because it continues existing

efforts and allows transition to other methods with venture growth (e.g., shortcut or simplified version for early stages).

Although there are many existing ideas of how to assess sustainability, there remain very few effective examples of implemented sustainability assessment (Pope et. al., 2004). This can be stated even more for the analyzed context of measuring future sustainability for new ventures as shown in this review.

The research findings provide a potential way for measuring, predicting and increasing sustainability impact generated from new ventures. The suggested complements and adjustments are shared for further research and to help establishing the research field of sustainable entrepreneurship. Its application will provide important decision criteria for new ventures (how to increase sustainability), early stage investors (where to invest), policymakers (which types of ventures and business models to support) and sustainability dedicated accelerators (how to support the sustainability generation of new ventures).

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5 Article III - Evaluating the future sustainability impact potential of new ventures in early phases - a five-dimension approach, suitable for self- and external evaluation

Malte Recker

5.1 Abstract

With growing awareness and activity in the various fields of sustainable entrepreneurship many researchers highlight the emerging need to better understand the impact potential of new ventures. This is especially true for early phases, since this is when founding teams, support systems and investors are allocating resources and are making crucial decisions resulting in evolving positive change and sustainable business models as the foundation for future impact. However, there are limited frameworks and tools available matching the special needs for early stage new ventures. Consequently, practitioners and researches need to better estimate and improve a new venture's impact potential early on.

Two research questions guide through the article and define the research methods used: 1): "How can a new venture's sustainability impact potential be evaluated in early phases, using an effective but also efficient approach, relying on existing, often limited, information and data?" and 2): "How applicable is the developed approach and which limitations are observed by first practitioners, testing the approach to evaluate impact potential of new ventures in early phases?".

First, this article aims at developing and testing a conceptual impact model that is applicable in the defined context and allows for internal and external assessment of potential impact to close the defined gap. Existing approaches and evolving standards are reviewed and synthesized to a holistic 5-dimension approach. Three main impact levers – scale, degree of change and duration - are combined with the overall importance of the tackled problem and the associated risk to the achieve the impact.

Second, the developed approach is applied and tested with more than 300 new ventures and external experts as pilot users. The empirical setting are ventures in Germany/Europe participating in a new venture support system, focusing on sustainable value creation. The piloting of the developed approach shows the good fit to early stage startups in various industries and a high degree of insights and valuable information for both target audiences. In addition, some refinements have been developed and added to the evaluation, improving applicability for future utilization and including improvement feedback from the pilot audience.

5.2 Introduction

The growing field of sustainable entrepreneurship research has shown that entrepreneurs can significantly contribute to the required transformation towards a more sustainable planet and community (Horne et al., 2020; Dean and McMullen, 2007; Hall et al., 2010; Schaltegger et al., 2016; Shepherd and Patzelt, 2011). Existing research attempts to explain and quantify contributions by focusing on underlying impact business models (Bocken et al., 2016; Boons et al., 2013; Hall et al., 2010; Schaltegger et al., 2016), impact measurement and assessment approaches (Horne and

Michelfelder, 2017; Trautwein, 2021) or required support systems and external factors influencing entrepreneurs.

Practitioners currently founding new ventures or offering support for respective sustainable entrepreneurs however still lack guidance on how to estimate and improve the sustainability impact potential. Primarily, missing fully applicable approaches, fitting the special needs for early stage new ventures, are hindering them in decision making and impact model adjustments (Bengo et al., 2016; Arena et al., 2015; Dichter et al., 2016; Geissdoerfer et al., 2016; Hansen et al., 2009; Mudaliar et al., 2008; Schaltegger et al., 2016). And most approaches face understandable criticism (Bengo et al., 2016; Hadad and Găucă, 2014; Mulgan, 2010; Nicholls, 2009). Consequently, there has no overarching standard approach to forecast, management or measure impact emerged, solely standards for some specific context can be found (Bengo et al., 2016; Clifford, 2014; Clark and Brennan, 2016; Figge and Hahn, 2004; Hadad and Găucă, 2014; Kroeger and Weber, 2014; Mulgan, 2010; Nicholls, 2009; Weber and Kratzer, 2013; Recker and Michelfelder, 2017; Nicholls et al., 2015). However, there are emerging standards found in non-academic sources, aiming to close the identified gap. E.g., the impact management project provides a common view on impact measurement, still not fully covering the forecasting aspect (The Impact Management Project, 2021). Hence, the article aims to develop a suitable approach and builds on emerging standards.

First approaches targeting early stage new venture exist, but need improvement (Horne and Michelfelder, 2017; Recker and Michelfelder, 2017; Trautwein, 2021). Overseeing existing practitioner tools, adding valuable guidance to the limited scholarly body of information, one can identify first sources of relevant and accepted approaches. Those approaches formulate emerging standards (Center for Social Innovation at Stanford Graduate School of Business, 2020), which will form the foundation for this paper. Knowing that this article will not fully solve above mentioned challenges in measurement and explanation of impact, the article focuses primarily on developing a conceptional approach to evaluate sustainability impact potential for early phase new ventures. Therefore, the author combines existing information and research to an applicable approach. Third, the approach is piloted and evaluated initially in scope of this research. This alternative way of evaluation looks more promising to reach a solution suitable for the specific context of this paper, without extensive trials and resource needs, often required for more complex approaches (Center for Social Innovation at Stanford Graduate School of Business, 2020). Precise design criteria is developed throughout the article to explain the decisions and tradeoffs faced during the development of the presented evaluation concept.

After reviewing existing approaches and defining guiding criteria, the concept development will form the first major part of the article. The piloted approach will be evaluated in a major second part of the paper, allowing to draw initial conclusion, formulate required adjustments and further research needs.

5.3 Background

Understanding the widespread research fields of sustainable entrepreneurship, social value and sustainability, it is required to define impact in this specific context at the beginning of this article. Variations can be identified both in terminology and scope.

A widely accepted attempt to standardize definitions for social impact measurement has been made by the European Commission's GECES sub-group on Impact Measurement (Clifford, 2014). Here the

impact value chain is of high importance to better understand and define impact and its creation (Rosenzweig, 2004). Starting with invested resources as inputs to the intervention, activities describe the doing of the new venture. Tangible outputs characterize how the intended beneficiaries are touched and the outcomes define the change for the affected stakeholders' lives. Lastly, the impact is merely defined as the extent "to which that change arises from the intervention" (Clifford, 2014), taking into account counterfactuals, such as deadweight, attribution and drop-off. Consequently, impact can be defined as the positive and negative changes for affected stakeholders, that clearly relate to the intervention at hand.

The above mentioned definition is well in line with definitions of social value proposed by Emerson et al., presenting the Social Return on Investment (SROI) approach. Here improvements in the lives of individuals or for the society, that are based on combined resources, inputs, processes and policies, are defined as social value created. (Emerson et al., 2000)

These academic definitions describe the phenomenon of impact well, but do offer only little guidance to structure the intended evaluation along specific dimensions. Hence, the authors includes widely used practitioner tools and approaches to describe, measure or manage impact into the article, aiming to structure impact in greater detail.

Stanford's Center for Social Innovation introduced three "big no's" and six dimensions in their **Impact Compass** to evaluate the impact potential of new ventures and other projects in organizations (Center for Social Innovation at Stanford Graduate School of Business, 2020). The compass is targeted to create an alternative option compared to established randomized control trials, serious modeling capabilities and complex studies to estimate potential future impact.

Initially the impact compass asks to clear an screening, checking for no proven failure, no negative societal outcome and no unethical behavior. Those new ventures clearing the screening are analyzed with help of the six dimensions in a second step.

"Value to Society" - Differentiating between private interest and social progress, the first dimensions aims to "address a dire societal need" (Center for Social Innovation at Stanford Graduate School of Business, 2020). Interventions should create changes where needed most.

"Efficacy" - Asking to "design effective interventions" that create certain changes, the second dimension checks for effectiveness solutions that work (Center for Social Innovation at Stanford Graduate School of Business, 2020).

"Impact Magnitude" – The third dimension assesses the solution's completeness in solving the beneficiaries' problem. Only if projects "address the issue in depth" (Center for Social Innovation at Stanford Graduate School of Business, 2020), the problem can fully be eliminated.

"Scalability" – Locally or globally affected stakeholders determine the scalability potential. The fourth dimension requires a project to "deliver at scale" (Center for Social Innovation at Stanford Graduate School of Business, 2020), ideally on system level to create significant changes.

"Mission Alignment" – The fifth dimension tries to "anchor their [the project's] mission through organizational features that will carry them for long haul" (Center for Social Innovation at Stanford Graduate School of Business, 2020). Having a documented theory of change and impact measurement, as well as reporting, creates fundamental requirements to achieve the impact. Additionally the

dimension questions, if appropriate business choices are made to protect the mission and if the financial and impact model are balanced.

“Environmental and Societal Governance” – To “operate in a way that adds value to all constituents involved” (Center for Social Innovation at Stanford Graduate School of Business, 2020) is evaluated in the last dimension. Strong public stewardship is targeted here.

Using three-point scales for each dimensions, the assessment creates a multiplied score that can be used to “compare the significance and nuances of the potential for impact of various organizations” (Center for Social Innovation at Stanford Graduate School of Business, 2020). The compass weights all dimensions equally to ensure that all elements are set up correctly.

Creating the biggest community of over 2000 impact practitioners and organizations, the **Impact Management Project** contributes to standardize and structure impact management and measurement. It worked on a widely accepted definition of five impact dimensions (The Impact Management Project, 2021). The dimensions are supported by 15 categories of data, further detailing and underlining each dimension.

“What” – The first dimension asks for the importance of the outcomes “to the people (or planet) experiencing them” (The Impact Management Project, 2021). The stakeholders’ perception and inherent need determine the importance, as well as a favored contribution to the Sustainable Development Goals.

“Who” – Stakeholder characteristics form the second dimension. Description of the stakeholders, geographical expansion, the current experience prior to impact and further attributes are important to understand who is affected. This dimension is purely descriptive, being the baseline for desired changes.

“How Much” – The third dimensions combines three major impact levers: scale, depth and duration. The number of affected stakeholders determines the potential scale. The degree of change reflects on how the baseline situation (the who) changes with help of the contribution (the what). Additionally, “the time period for which the stakeholder experiences the outcome” is included (The Impact Management Project, 2021).

“Contribution” – The fourth dimension estimates counterfactuals, both in terms of time and depth. By describing how much of the desired outcome would have happened for how long without being active, the Impact Management Project pushes for precise impact measurement rules and to avoid double counting and impact inflation.

“Risk” – The last dimension accounts for the type and level of risk, connected to the execution of the outcomes. Both likelihood and severity of potential risks are considered here.

The five dimensions can be used to perform a qualitative assessment, providing insights into the characteristics of impact. Negative impacts are qualified as “does cause harm” or “may cause harm”. A middle category is “act to avoid harm”, where certain negative outcomes can be avoided. Two positive categories are “benefit stakeholders” and “contribute to solution”. Each category depends on a defined combination of results for each dimension.

Both the impact compass and the impact management project offer the potential to apply the defined dimensions, categories and scales for this article.

5.4 Research questions

Based on the presented status quo and intended contribution, the article tries to answer two research questions:

Research Question 1):

How can a new venture's sustainability impact potential be evaluated in early phases, using an effective but also efficient approach, relying on existing, often limited, information and data?

Research Question 2):

How applicable is the developed approach and which limitations are observed by first practitioners, testing the approach to evaluate impact potential of new ventures in early phases?

In order to answer the two questions, the article consist of two main parts. First the concept development, designing an evaluation approach. And second, the validation and feedback part, assessing the application and analyzing first results.

5.5 Concept development

The development of the evaluation approach will be done with regard to the following design criteria:

- Forecast the holistic impact potential, allowing financial, economic and social impacts

With respect to the expected variety of impacts in a large set of new ventures, the approach needs to be generic enough to allow all three dimensions of sustainability to be reflected, including potential tradeoffs (Brundtland Commission, 1987; Nilsson et al., 2016). On the other side it shall not be too specific, targeting only one dimension of sustainability impact, e.g., CO2 reduction. This can be realized by taking the stakeholder perspective as guiding principle (Millar and Hall, 2013), allowing one exception, when targeting the planet as the sum of all possible stakeholders. Also, the article promotes measurement on impact level, and not assessing proxy measures like activities, outputs or outcomes (Clark and Brennan, 2016; Clifford, 2014; Grabenwarter and Liechtenstein, 2011; Hornsby, 2012). The forecasting will be performed in the commonly used time period of five years (Nicholls and Cupitt, 2012).

- Ensure applicability for especially early phase new ventures

New ventures in early phases typically bring a high degree of uncertainty and future pivots in their still uncomplete or early business and impact models (Picken, 2017; Clarke-Sather et al., 2011), resulting in required assumptions and hypotheses when forecasting impact potential. Consequently, long-term historical data availability and is often limited and/or future data not perfectly reliable (Dichter et al., 2016; Judl et al., 2015), which pushes the approach towards a more qualitative one and uses data only in combination with transparent assumption. New ventures in early phase have shown that resource scarceness and other limitations often hinder the team to perform impact measurement activities (Clifford, 2014; Manetti, 2014; Picken, 2017; Lepoutre and Heene, 2006; Skala, 2019). Hence, the targeted approach shall be as efficient as possible, to allow also repeated execution without significant

waste, allowing to react on changing business and impact models (Sarasvathy, 2001; Clark and Brennan, 2016; Picken, 2017; Ries, 2014-2011; Clarke-Sather et al., 2011). Changing assumptions and pivots on business and impact models create a need for frequently repeated evaluations and resulting improvement made visible (Wickert, 2016).

- Achieve meaningfulness and usability for a variety of business models and various new ventures

The evaluation approach shall be targeted for the easy and low effort general application, no matter what type of venture and business model is at hand (Hansen and Schaltegger, 2018; Shields and Shelleman, 2017). Thus, again the approach should not limit itself by focusing in specific theories of changes and impact models, but instead take the stakeholder perspective, applicable for products and services, contributing to sustainability impact (Millar and Hall, 2013; Lingane and Olsen, 2004). The evaluation should be possible to complete in a short time frame without interruption, e.g., due to lack of information or resources (Calabrese et al., 2016), ensuring results and insights.

- Allow the possibility to be performed as self- and external evaluation

Having new venture team members and external coaches, experts or other persons as potential evaluators needs to be reflected in the approach. Compared to the team's focused knowledge of the business model and intended contributions, external evaluators might have more profound and broad knowledge of the industry or stakeholder group, but most likely lack the level of business and impact model detail for the respective new venture (Elford and Daub, 2019; Lepoutre and Heene, 2006). By implication, the external evaluators need a minimum amount of information, which can be obtained by receiving written information and/or having joint conversations. Still, the evaluation questions should allow for both target groups to use their respective level of information to answer based on assumptions and hypotheses. The approach should not be adjusted or be changed for each group to reduce complexity and allow comparability. Subjective judgement needs to be accepted as part of a qualitative assessment, but can be mitigated with help of contrasting evaluations.

- Enable automated execution as a digital survey and standardized result analysis

Aiming for large sets of new ventures and easy implementation, the approach shall be designed in a way to be executed with help on automated digital survey. Also the result analysis needs to be automated, allowing immediate standardized responses for the new ventures and external evaluators, as well as third parties making decisions on supporting new ventures. Therefore fixed answers and no free text options to reduce effort are mandatory. Also a fixed result grid helps to allow standardized lean processing (Dichter et al., 2016).

- Identify improvement areas and allow benchmarking between new ventures

One main value-add is seen in the identification of improvement areas, potentially addressed by the new venture team, external coaches and support systems. Secondly, a benchmark option is thought of, in order to compare impact potentials and allow decision making (Bengo et al., 2016; Grabenwarter

and Liechtenstein, 2011; Kaplan and Norton, 2001; Lingane and Olsen, 2004). Accordingly, each answer to one of the 6 questions should be replayed relative to the scales, showing the respective next steps to increase impact potential in the dimension. Additionally a benchmark, comparing results for multiple new ventures in similar areas, could be helpful to relate the impact potential to comparable ventures and indicate possible improvements (Grabenwarter and Liechtenstein, 2011; Lingane and Olsen, 2004).

The evaluation model (see Figure 10) is developed based on the presented approaches (Ref. 5.3 Background) and existing definitions. Both Stanford's impact compass and the proposed Impact Management Project framework do not directly fulfill the defined criteria, hence adjustments and further development is required.

Following the entrepreneurial process, the desired impact is likely to be determined starting at the very beginning of the new venture activity, the opportunity recognition phase (Sarasvathy, 2001; Zahra et al., 2014; Belz and Binder, 2017). In the context of sustainability impact, the importance of the tackled problem determines the future impact potential. Choosing a less relevant problem to solve reduces the potential, whereas selecting an important challenge to contribute to increases the potential significantly. This first defined dimension is in line with Stanford Impact Compass' value to society question and partly includes the initial screening (Center for Social Innovation at Stanford Graduate School of Business, 2020). The question for "What" (The Impact Management Project, 2021) includes the problem importance and supports the selection.

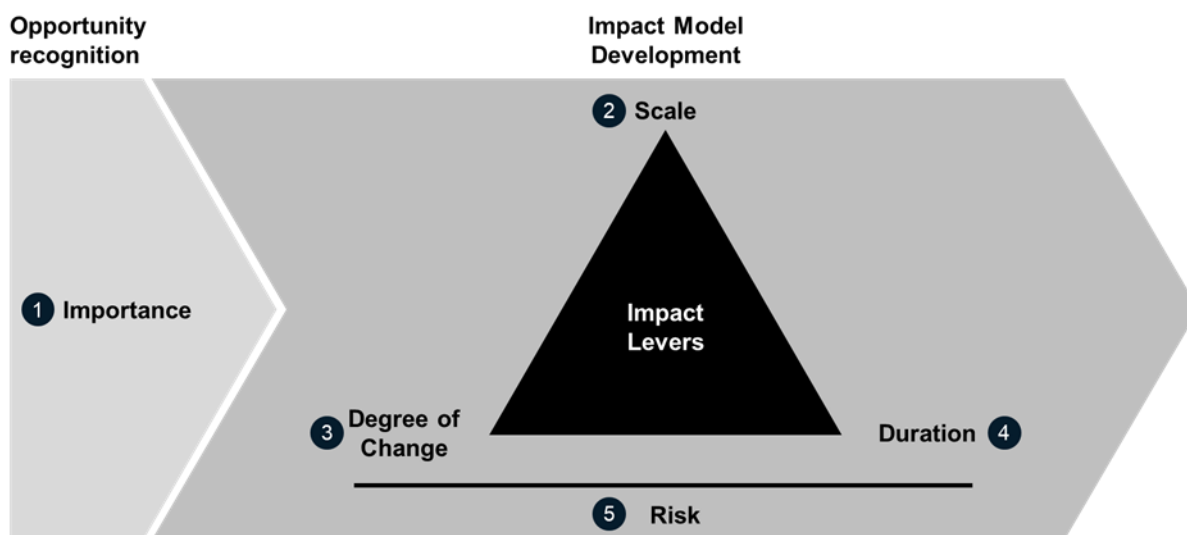


Figure 10 - Impact potential evaluation model. Source: Own figure.

During the impact model and new venture development phase (Zahra et al., 2014; Belz and Binder, 2017; Schaltegger et al., 2016), the targeted impact needs to be translated into an impact model. Here three major impact levers have been identified and used in the existing approaches: scale, degree of change and duration. Those levers ideally increase the contribution by either affecting many stakeholders, solving the problem as good as possible and/or lasting for a long time period. The impact

management project asks for those 3 levers in the dimension “how much” (The Impact Management Project, 2021). While other parts of the framework are more descriptive, those three questions can be evaluated along scales and with data. Typically these levers contain trade-offs and cannot be maximized equally at the same time. It is often recommended to focus on one lever at a time, keeping in mind the tradeoffs and respective limitations. Impact magnitude and scalability are also included in the impact compass (Center for Social Innovation at Stanford Graduate School of Business, 2020) supporting the choice.

Underlying risk needs to be thought of as well during the development phase. The major risk defined by studied approaches is the execution risk for the impact to happen and to contribute as intended. This important dimension is taken out of the two underlying approaches. Efficacy describes the inherent risk in the Impact Compass and The Impact Management Project Framework contains a detailed dimension of risk (Center for Social Innovation at Stanford Graduate School of Business, 2020; The Impact Management Project, 2021).

Other dimensions of mentioned approaches have not been considered due to missing fit to defined criteria. For example mission alignment and environmental and societal governance are less applicable for early stage new ventures due to missing or not yet standardized organizational structure.

The evaluation approach is operationalized with help of one question per defined dimension. In order to simplify the assessment, each questions asks to select an answer from a widely used 5-point-scale. Either adjusted and specified Likert-scales or quantitative scales with specific number ranges are applied. Since the article is not targeting advanced statistical analysis, a 7- or more point scale is not selected, to keep the scope of answers manageable for the audience (Krosnick and Presser, 2009). For each question answers have been developed, using conventional wisdom and specific guidance on how to formulate respective answers (Krosnick and Presser, 2009). Especially familiar wording, simple syntax and specific details are seen to be important in this context of varying definitions and terminology.

1) Importance

Following the above introduced stakeholder perspective, the first questions needs to offer two options to answers. For those new ventures targeting beneficiaries that can be identified and narrowed down precisely, the importance of the contribution can be assessment against the level of how underserved the individuals are before the intervention. Whereas those new ventures affecting the entire planet, by e.g., improving overall environmental conditions, need to determine the importance with help of the contribution to the SDGs. A 5-point scale is adjusted to fit the two options by offering multiple levels of how underserved individuals could be, including examples for the intervention. Similarly, the second option offers multiple degree of contribution towards achieving the SDGs.

2) Scale

The first defined impact lever offers the potential to be assessed quantitatively. Nevertheless, one needs to keep in mind, that data availability is limited and the number of stakeholders can only be forecasted with help of assumptions and estimations (Ref. 5.5 Concept development). Hence, the article offers five answers with exponential number ranges, ensuring that new ventures can find a suitable answer, no matter if they plan to affect hundreds or millions of people. The last category of billions of people includes the entire planet, for those cases where no individual stakeholders can be

defined. Here the lever scale is used strongly, expecting that the other levers, especially degree of change and maybe duration are typically less developed for new ventures tackling global challenges.

3) Degree of Change

The second lever is asking for the degree to which the problem is solved, either for the affected stakeholders or for the planet. A 5-point scale is defined starting at “no change” and ending at “problem eliminated”. It is important to differentiate this dimension to the duration, following next, where the time period for which the change occurs is evaluated. In this dimension solely the improvement compared to the baseline (the level of how underserved an individual is) needs to be reflected.

4) Duration

The third impact lever assesses the duration of the intervention intended. Here the time period is questioned for which the change lasts and is visible for the beneficiaries. The 5-point scale covers interventions lasting only a few hours or days (one-time-only intervention) up to sustainable improvement of conditions that last for years or even forever.

5) Risk

With literature offering many different aspects of affiliated risks (The Impact Management Project, 2021), the article decided to incorporate the new venture’s ability to achieve the intended impact, which is in line with the efficacy concept presented above (Center for Social Innovation at Stanford Graduate School of Business, 2020). In the context of impact models, the major driver is the certainty with which the intended theory of change is working. This can either be a pure intention without existing proof, or, in the best case, a proven and documented solution that is already working in practice. A 5-point scale has been developed accordingly, integrating existing scales (Weber and Kratzer, 2013).

Results

Sacrificing the last criteria defined, the evaluation will be summarized with help of a simple spider graphic, showing the result structure for each dimension primarily. The expected insights will be gained by benchmarking the single dimensions for a new venture in order to identify improvement areas and current strengths of the impact model. An average value of a greater set of new ventures per dimension could be used to identify further options, here the selection of new ventures to compare against is critical, since comparison would only make sense between comparable ventures with similar impacts and impact models (Horne, 2019). A total overall score is not seen as helpful, since the evaluation model relies on interpretation of scores, which would be limited by aggregating total scores.

The evaluation model is operationalized with help of a standardized survey for self- and external assessment (see Figure 11):

Impact Potential Evaluation

Your future impact potential is evaluated with help of the following six questions. The questions analyze common impact dimensions and holistically test the intended contribution in order to highlight improvement areas and provide first insights to reflect on.

*The first question focuses on the **importance** - assuming your new venture would succeed. It is estimated with help of the beneficiaries' specific needs or the alignment to the Sustainable Development Goals (SDGs), if affecting the planet.*

I) How underserved are the individuals the new venture will be serving? (Or how important will the new venture's contribution be for achieving the Sustainable Development Goals (SDGs)?)

- 1) Not underserved - improving self-esteem of individuals or optimizing already good environmental conditions (no contribution to SDG targets)
- 2) Slightly underserved – increasing well-being or improving negative, but less threatening environmental conditions (low contribution to SDG targets)
- 3) Partially underserved – improving living conditions of individuals or negative and threatening environmental conditions (medium contribution to SDG targets)
- 4) Significantly underserved - basic needs of individuals unfulfilled or achievement of viable environmental conditions (high contribution to SDG targets)
- 5) Completely underserved – change decides about saving lives or our planet's survival (very high contribution to SDG targets)

*The next question addresses a major lever to impact, the **scale** with which beneficiaries or stakeholders can be affected.*

II) How many beneficiaries will be reached by the new venture's contribution and impact in the next 5 years?

- 1) 0-100 individuals
- 2) 101-10.000 individuals
- 3) 10.001-999.999 individuals
- 4) Millions of individuals
- 5) Billions of individuals or the planet (global impact)

*A next major impact lever is the **degree of change**, indicating if the problem is completely solved.*

III) What will be the average degree of change (how much of a change) for the affected individuals or the planet?

- 1) No change
- 2) Slight improvement
- 3) Problem partially solved
- 4) Much better

5) Problem eliminated

Additionally, the impact lever **duration** asks the question, of how lasting and sustainable a solution creates the desired outcome and resulting impact.

IV) How long will the new venture's change last? How long is the time period for which the individuals or the planet experience the outcome change?

- 1) Only very short term improvement (e.g., a few hours or days)
- 2) Short term (weeks to months)
- 3) Medium term (for years)
- 4) Long term (for decades)
- 5) Forever (improvement lasts sustainable)

Concluding we will assess the associated **risk** with which the intended impact is going to happen.

V) How would you rate the project's ability to achieve the intended outcome? How probable is the impact to happen?

- 1) Theory of change or impact model could not be tested and proven yet (by others or new venture)
- 2) First indication based in trials and pilot projects, but evidence not documented (by others or new venture)
- 3) First documented evidence shows tangible outcomes with supportive quantitative and qualitative documentation (by others or new venture)
- 4) Tangible impact is practically proven and documented (by others or new venture)
- 5) Outcome is based on existing and proven solution already in use (by others or new venture)

The results are summarized in the following impact spider graphic.

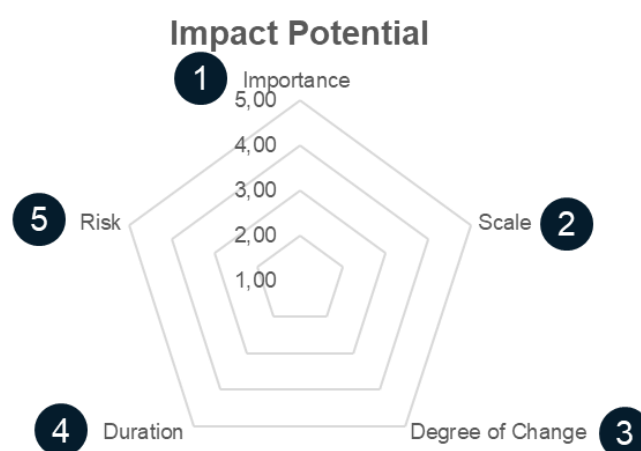


Figure 11 – Survey for self- and external evaluation. 2 pages. Source: Own.

5.6 Application and evaluation

5.6.1 Data and empirical setting

The designed approach, aiming to evaluate the future sustainability impact potential, has been piloted in a Berlin based incubation system, supporting early stage new ventures across Germany and Europe. The approach was included into the application survey and filled out by applying new ventures, as well as by external coaches and experts after their initial contacts with respective new ventures, supporting them during the participation in the acceleration program.

239 new ventures have completed the survey and hence have piloted the impact evaluation approach. Additional 79 external evaluations could be collected for participating new ventures. Most new ventures in the data set were founded in 2019, with the oldest venture started in 2006 and the youngest ones founded in 2020, resulting in mainly concept and development activities for the teams. Average team size is on average 4, matching a typical founding team with first employees in early phases.

5.6.2 Methods and analyses

In order to assess the five questions and respective answers' applicability, the results have been analyzed with help of descriptive statistics. Especially respective answer distributions indicate the questions' quality and provide insides to potential adjustment needs (Kaplan, 2004). Second focus lies on differences between self- and external evaluation answers, trying to better understand biases and patterns for the two different target groups.

The first question on the importance of the problem tackled by new ventures, indicates normally distributed answers with an average of three, being the middle answer (see Figure 12). External evaluators selected slightly higher answers, but still the distribution shows good usage of all answer options. Only the lowest answer was rarely replied by externals, which could be caused by increased awareness and perceived importance for the underlying problem and undersupply of beneficiaries in their respective field of expertise. Comparing self- and external answers, one can see that answers differ on average in less than one category and most new ventures show the same evaluation (Figure 13) by the team and by the external individual.

The second question on the impact scale shows a different picture. Looking at distribution of answers, one can see right-skewed results with an average of 4 and a slightly lower average for external answers (see Figure 12). Understandably, the lowest answer was rarely replied. Still the 5-point scale seems applicable, covering the potential span of beneficiaries exhaustively (Krosnick and Presser, 2009). Interestingly the self-evaluation results are higher compared to external evaluators in more than 50 percent of the cases (see Figure 13). Either the insights and the knowledge differs in this dimension, or, also likely, new venture teams overestimate the scalability compared to external and possibly more objective judgement. In this case contrasting evaluations can provide additional insights and increase prediction quality.

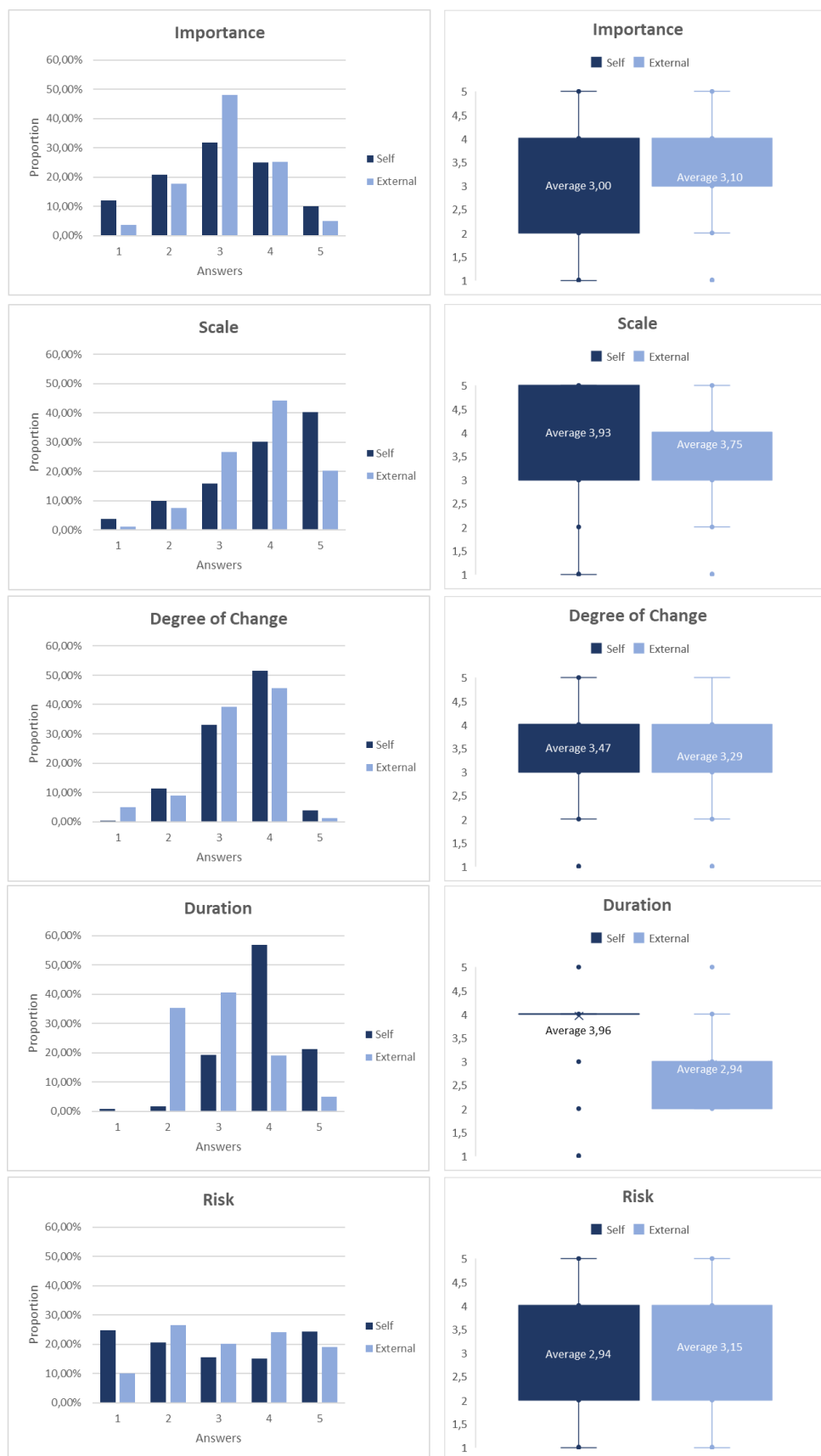


Figure 12 - Descriptive statistics

Replies for the degree of change dimension indicate a limited use of the answers provided (see Figure 12). With almost no bottom and top answers, both averages are slightly below the middle. Admitting that the situation is not improved or stating that the problem is totally solved are two challenging conditions, but form a complete scale for the question (Krosnick and Presser, 2009). Both evaluations indicate a similar distribution of answers with more than 50% of same replied for single cases (see Figure 13). The author expected a higher bias on the new venture side, caused by increased trust in the developed solutions, but this could not be observed in this case.

The fourth question on duration again shows limited use of all answers by the evaluators and teams (see Figure 12). For this question a clear difference between the respective responses could be observed. New ventures replied higher in 75% of the cases and consequently scored more than 1 answer category higher on average (see Figure 13). Again, two potential explanations could be offered, a bias on the new venture side, caused either by confidence and motivation to offer a long lasting solution, or by better knowledge on the impact model. One can observe that externals were significantly more restrained compared to the teams in replying that a problem is solved permanently.

The last dimension risk shows a completely different picture compared to the other questions. All answers were selected almost equally by teams and externals, showing averages around 3 (see Figure 12). The good distribution of answers indicates a good fit for the context with realistic extreme points (Krosnick and Presser, 2009), either having no prove for impact or relying on existing solutions. It is also the only question with higher external evaluations compared to the new ventures (see Figure 13). Here one could think of better knowledge and trust in underlying technologies for the external coaches and experts, resulting in desired impact. On the other side, a realistic (obviously not biased) answer distribution for the new venture teams looks promising to estimate underlying risks in impact delivery appropriately.

Looking at the overall replies for the questions, one sees that scale and duration were evaluated highest (see Figure 12). Both categories rely on assumptions and estimates in early phases, offering the highest risk in overestimations.

One main design criteria was the target to identify improvement or focus areas to increase impact potential for new ventures. Typically such an area could be one dimension of impact potential that is less well marked compared to others. Seeing that all dimensions show similar averages in scores, the article estimates those lower evaluated dimensions by searching for a single dimension, that has been evaluated lower than all others for one new venture.

In 60% of the self-evaluations and 35% of the external evaluations such a single dimension could be identified. The distribution of those findings can be seen in Figure 14. Remembering that scale and duration have slightly higher averages, it is not surprising that those dimension came back least often. On the other hand risk and importance were identified as focus dimensions most often, by both new venture teams and external evaluators. Looking at the developed evaluation model (see Figure 10), this finding indicates that typical impact leavers are well formulated by new ventures in the data set, pursuing future impact. On the other side, recognizing the right opportunity and ensuring the delivery of impact, both show potential to increase the evaluation and hence the impact potential. Fellow researchers have shown that successful market tests are a critical precondition for new ventures to succeed, which seems to apply for impact new ventures as well (Ref. Chapter 6 Article IV -).

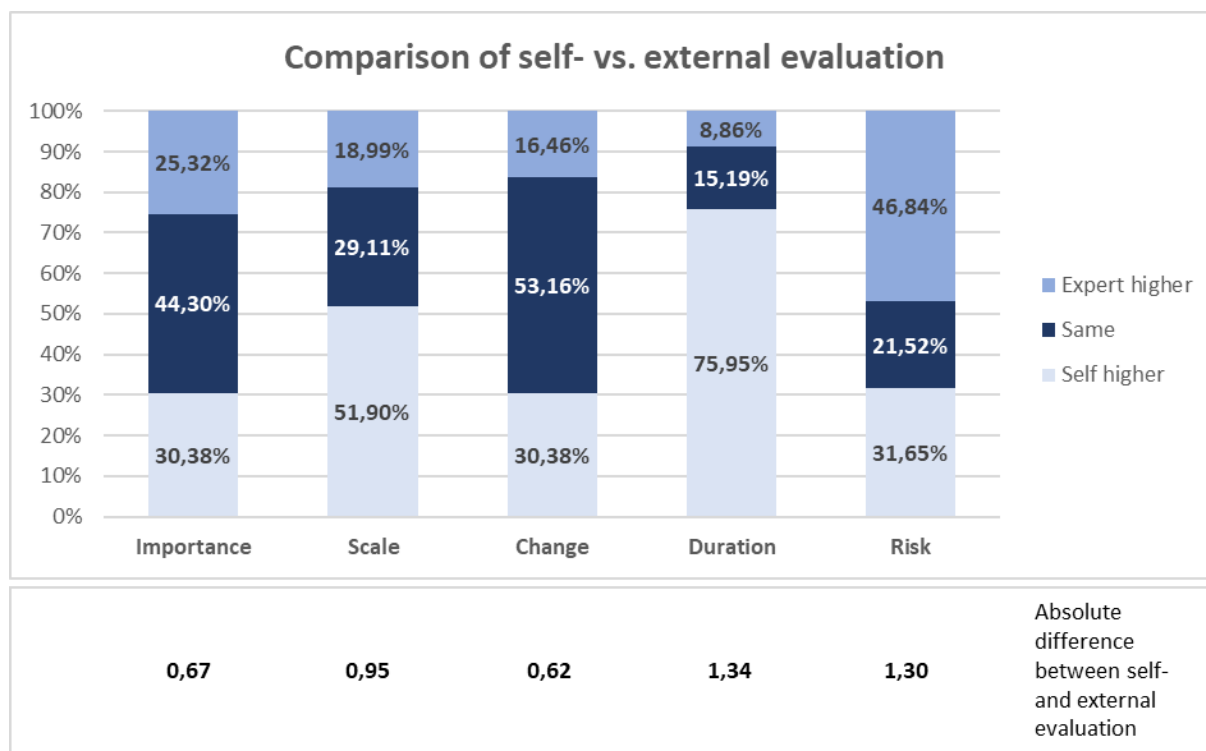


Figure 13 - Comparison of self- vs. external evaluation

Adding an external benchmark perspective to those improvement opportunities, new ventures can be assured that other impact models show the possibility to increase impact potential in respective scores (see Figure 14). Comparing the identified answers with the average score of the others new ventures in the data set, we see that the majority of cases shows potential (see Figure 14). Only some answers are already higher than the average answer and hence might contain less potential to improve. The results show that those cases are clearly worth to continuously optimize the impact model in order to increase the future impact. This is great guidance for the new venture team itself, for external coaches but also for support systems. Those systems could focus on bringing in the right resources and/or knowledge to improve single dimensions preferably.

The external evaluators have been asked to provide feedback on the developed approach and the applicability for the respective new ventures. The feedback was collected with help of a short qualitative survey, asking two open questions:

- 1) How applicable and suitable is the approach to evaluate the future sustainability impact potential of the coached new ventures?
- 2) What challenges and shortcomings did you experience during the evaluation?

The answers are analyzed with help of coding and clustering the answers in categories, deriving strengths and weaknesses in the external evaluation, using the new developed approach.

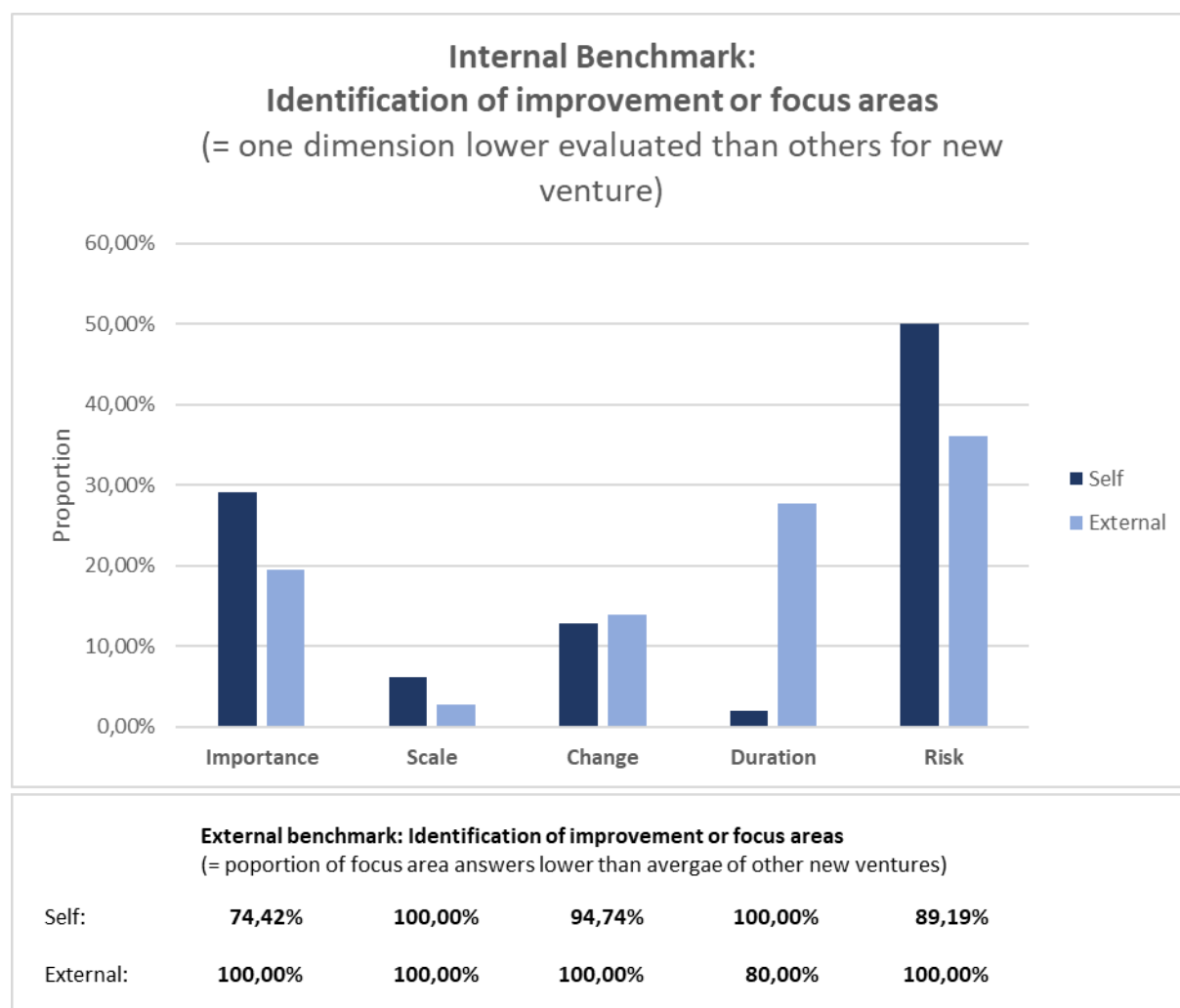


Figure 14 - Internal and external benchmark

Strengths

The external evaluators mentioned the well understandable questions and answers most often. Especially in this complex field, using various definitions and terms (see chapter II Background), the evaluators praised the high degree of applicability. Specific descriptions of questions and answers, as well as additional examples, allowed the easy application for the new ventures at hand. Clear and definite answers for each question helped to answer those and to reduce subjective influence according to the feedback. Specific thresholds and steps in the answers were perceived as helpful.

Second, the clear structure and transparent focus was mentioned. Balancing holistic impact dimensions, covering the different impact levers, and manageable time and resource effort to perform the evaluation, seem to work well for the targeted audience. With help of not too many questions, but enough level of detail, the evaluators confirmed sufficient breadth and depth for a first evaluation. In addition, the inherent uncertainty in early phases was mentioned. The developed approach was recognized as a reasonable approach to forecast impact potential without having all information at hand and knowing all details in early phases.

As a third strength, the feedback revealed the opportunity to identify improvement areas and gaps easily. Applied scales benchmark the different dimensions for a single new venture or between

different new ventures. Clear action points and next steps could be derived and used for further coaching and support in the program.

Weaknesses

The received feedback also identifies two areas where the developed approach needs refinement.

First, the evaluators criticize the high degree of subjectivity in the assessment. Based on the limited contact to new venture teams and initial knowledge on business model and product or service, the assessment seemed to be hard in some cases. Similarly, some feedback pointed out, that missing data makes the assessment of the quantitative question for “Scale” tough. Understanding the lack of data in those early phases (see chapter IV Concept development) the article faces a dilemma, requesting objective data to evaluate the impact potential on the one hand, but requiring a certain degree of subjectivity in an early evaluation.

Second the applicability seems to be limited in some special cases. One of those cases are impact models with multiple changes, affected stakeholder groups and resulting multiple impacts. Here the evaluators highlighted the need to reflect this in the evaluation. The current approach forces to average the assessment over all impacts. Another constellation with limited applicability are new venture not offering typical products or services, resulting in somewhat unclear answers for the questions asked. Examples are initiatives and campaigns, focusing in awareness and information, rather than on new products or services.

Improvement ideas

In order to address the identified weaknesses, the author will discuss potential adjustments and options to improve the approach.

The inherent subjectivity for the evaluation is something that can hardly be removed for the self- and external evaluation (see chapter 5.5). Nevertheless, it is without any alternative for the targeted early stages. Merely options to reduce the influence can be thought of. If possible, one could increase the number of external evaluations, which might result in an more appropriate average evaluation. However, the level of knowledge will not be increased. The forecast will always rely on assumptions and expected developments, which can only be documented transparently. The documentation of assumptions is something one should include into the assessment. It would merge the call for more data and the critique on subjectivity. On the downside it would reduce the automated processing of answers and analysis of results. Here the intended audience and stage for evaluation creates a strong circumstance that has to be accepted.

Additionally the feedback hints the author to even further explain and describe the evaluation questions and answers, especially mentioning expectations and areas of limited applicability (e.g., untypical business models and new ventures not offering a product or service) to avoid misunderstandings and misevaluations.

For the first dimension importance, the question and explanation will not be adjusted. It clearly takes the stakeholder perspective and is hence independent from business models, product or service types, industries and geographical settings. In cases where no stakeholder can be identified, the first option

is to answer the question based on the importance for the entire planet. In case where neither individual stakeholders nor the planet can be identified as beneficiary, the probability to have tangible impact is very low and those cases will not be further taken care of in the approach, respectively there is little importance as a consequence.

Although the second dimension scale is again based on the stakeholder perspective, the author will clarify the relationship to potential customers and other stakeholder groups in order to improve the evaluation of affected individuals better. Direct stakeholders can be customers of a product, service or activity, that benefit from the product or service attributes. Indirect stakeholders are individuals located in the sphere of organizational facilities or experiencing changing environmental or societal conditions, directly caused or influenced by the new venture's product or service. The third option is a scale extended to the entire planet, for solutions affecting the environment globally and/or the biosystem as a whole.

The initial introduction text "The next question addresses a major lever to impact, the scale with which beneficiaries or stakeholders can be affected." is extended by "Three categories of beneficiaries need to be considered: 1) (paying) customers benefiting from a product, service or activity, 2) individuals experiencing changes in environmental or societal conditions caused by the new venture's activities or outputs or 3) the entire planet by improving environmental or biosystem conditions."

The degree of change as the third dimensions needs to also link the new venture's activity better to the change, experienced by the beneficiaries. This ensures that the evaluators can clearly assess the contribution by a new venture. "A next major impact lever is the degree of change, indicating if the problem is completely solved." is clarified with the following accompanying sentence, stating the need to link the new venture's activity or output to the change: "The to be evaluated change shall be directly or indirectly caused by the new venture's activity or output, e.g., the offered product or service."

Similarly the fourth dimension duration will be specified further. "Additionally, the impact lever duration asks the question, of how lasting and sustainable a solution creates the desired outcome and resulting impact." Clarifying examples might help to better answer the question at hand by offering two ways to define the duration, first using the life time expectation for a product, or second to forecast the time period for which the effect can be experienced or observed after the intervention: "The duration can be either determined by the time period for which a product or service operate and so directly affect beneficiaries, or it can be assessed with help of the time period for which individuals experience a positive change after the intervention, which might be decreasing again over time, e.g., increased education level, improved health conditions, raised awareness, or changed habits."

The last dimension of risk seemed to be self-explaining according to the feedback, hence not adjustments are incorporated. The evaluators shall assess the degree of certainty with which the impact is happening in the future. This probability is mainly caused by the level of novelty and hence the caused uncertainty for a theory of change.

A last idea coming out of the feedback, is to allow multiple changes and resulting impacts to be reflected in the evaluation. A first way to include this, is an additional question. Alternatively one could extend the evaluation for each impact, by asking the questions multiple times. An additional question would solely provide the information about the fact, that there are multiple impacts, but not provide further insights. Hence, the author would prefer the option to include the option to evaluate not only one impact chain but instead evaluate multiple impacts. This would allow to clearly distinguish between impacts, offering to prioritize and focus coaching and development (Horne, 2019).

Nevertheless, the new ventures and external evaluator should limit the evaluation to maximum three impacts, to keep the evaluation short and neat.

The overall introduction paragraph is extended by offering the opportunity to evaluate multiple contributions and resulting impact individually. "The five questions best evaluate a single theory of change with a distinctive resulting impact. In cases where new ventures target multiple impacts, various affected stakeholder groups and/or planning to contribute in different ways, it is recommended to perform the evaluation multiple times, for each impact individually. The evaluator shall list the top impacts before the assessment and decide on up to three different areas to investigate the impact potential for."

5.7 Discussion

First, the article's results and initial findings are discussed by summarizing the answers to the two research questions formulated in chapter III.

Research Question 1): How can a new venture's sustainability impact potential be evaluated in early phases, using an effective but also efficient approach, relying on existing, often limited, information and data?

The article demonstrates that a suitable qualitative approach has been developed, using five dimensions of sustainability impact to evaluate the future potential of new ventures in early phases. Essential impact levers (scale, degree of change and duration) are combined with the importance and risk dimensions associated. Those are determining the impact potential upfront and respectively during the development and execution phases.

The approach builds on existing practitioner tools and emerging standards by aggregating and combining existing dimension to a holistic, but also efficient and well manageable approach, delivering results and insights without requiring extensive resources and information. While other researches are trying to solve the quantitative measurement and forecasting challenge, this article takes a different path by using a more qualitative evaluation.

The results indicate that all developed questions and answers are applicable for the targeted audience and return valuable insights. The used answer ranges fulfill general requirements (Krosnick and Presser, 2009) and seem to return valuable results (see chapter 5.6). The approach should be taken into account for future attempts to forecast sustainability impact in especially early phases, an important enabler to achieve clarity on potentials, but also essential to support and manage impact better for new ventures and linked support systems (Trautwein, 2021; Horne et al., 2020). Applicability is also given for later phases, although typically more data and information is existing and more resources can be spend on the evaluation on both sides. Those characteristics for later phases are creating the opportunity to use more complex and sophisticated approaches, which would be the general recommendation to apply phase-specific approaches and tools meeting the requirements and being feasible in the respective circumstances (Millar and Hall, 2013; Mulgan, 2010; Horne, 2019; Hadad and Găucă, 2014; Figge and Hahn, 2004; Clifford, 2014; Bengo et al., 2016; Arena et al., 2015). Nevertheless, continuity in the evaluations and consistent assumptions shall be used in order to maintain general accounting principles and allow comparing evaluations between different phases. Mainly stakeholder perspective and underlying impact value chains need to be integrated into all approaches.

Research Question 2): How applicable is the developed approach and which limitations are observed by first practitioners, testing the approach to evaluate impact potential of new ventures in early phases?

The demonstrated pilot with a set of new ventures and external evaluators provides first insights, not only into the quality of the designed approach, but also into the applicability for new venture teams and external evaluators, evaluating impact potentials during early phases of a new venture development. The article focuses on the specific needs and circumstances associated with new ventures in early phases, mentioning data and information availability as well as typical resource limitations to perform an impact potential evaluation (see chapter 5.5). Tradeoffs between data availability and the expectation on evaluation quality have been identified for the external evaluators. On the one hand, the comprehensive structure, the low level of detail and limited scope has been valued, whereas on the other hand the call for a more data driven and objective evaluation has been observed. Satisfying the design criteria stated above (see chapter 5.5), the author does not see a way to solve this tradeoff. Hence, the feasibility and approach's structure need to sacrifice more subjective evaluation and potential biases. The comparison of self- and external evaluation shows, that those biases exist (see chapter 5.6), but are limited to single dimensions with manageable differences. Especially here, the contrasting evaluations can be used to manage the evaluation risk. Potential adjustments and refinements have also been discussed and prioritized (see chapter 5.6).

Overlooking the results, one can state, that the article's contribution can be found in offering a comprehensive approach to forecast impact potential in early phases. Being in line with emerging standards and having completed a successful pilot application, the approach is ready to be used for practitioners and researchers. The article tries to contribute to an existing gap in research and offers relevant, often requested and practical guidance. The compatibility to other evolving or already existing approaches (also for non-new venture specific approaches) to measure impact is important for future application, allowing comparability and the chance to upgrade the evaluation step by step with higher data and resource availability.

Still some limitations need to be considered. The foundation of the developed approach relies on work in progress practitioner tools and evolving standards. Consequently, continuous updates, refinements and potential adjustments are expected to be necessary before applying the approach in new contexts, in order to keep the approach aligned and based on state of the art research. The targeted early stage new ventures also define an important limitation for the scope of the approach, this needs to be considered for further application in varying contexts, where other approaches are better suitable for the specific needs.

The results have been analyzed on a limited sample size, especially for the external evaluation. Hence, the findings can also be a starting point to formulate hypothesis. Overall scoring and weighting of single dimensions have been out of scope for this article. The generalizability is further limited by the new venture data set characteristics. Mainly early stage new ventures in Germany have been asked to apply the approach. Further geographic extension and application on later stage new ventures is expected to provide deeper insights by comparing different stages against each other.

Since this paper focuses primarily on the designed approach's application and first assessment of feedback, future research shall primarily investigate the forecast quality and accuracy in terms of achieved impact in future stages. Hence, longitudinal studies could examine the impact realization and compare initial forecasts based on this approach to future impact measurement results. Also further

refinement of questions and scales is seen helpful to improve the approach's quality, adding future insights on impact models and mechanisms into the evaluation approach to keep it up to current research. The emerging field of research in new venture support systems could also further study the role this evaluation could play for their respective decision making and support improvement, based in the generated insights.

5.8 Conclusion

Seeing innovative new ventures as major contributors to the required sustainability transformation (see chapter 5.2), the importance to enable and support those organizations is undisputed. Hence, researchers and practitioners shall jointly provide guidance on how to recognize promising impact opportunities and on how to develop feasible impact models with high probabilities to achieve the desired impact. Existing information and tools (see chapter 5.3) are seen as only partly helpful in evaluating the impact potential in early development phases.

Consequently, the article attempts to fill that gap by developing a qualitative and manageable evaluation approach, allowing to assess future impact potential, support decision making and identify improvement areas. The developed holistic five dimension approach covers three main impact levers (scale, degree of change and duration) and includes the importance of the tackled problem as the main upfront criteria, as well as the associated risk to achieve the impact.

Each dimension is evaluated with help of stakeholder focused questions and five answer options, creating an exhaustive 5-point scale. Each question and respective answers are formulated in understandable language and in a way that each question is relatable for a broad range of new ventures in different industries and with various underlying business models.

The approach is suitable for self-evaluation by the new venture teams and, without changes, also for external evaluations, e.g., performed by coaches, experts and support system employees. The opportunity to compare the evaluations helps to manage the risk of biased evaluations and provides further insights into improvement areas. Some dimensions seem to be evaluated more realistically by the new ventures themselves, whereas others tend to be assessed better externally (see chapter 5.6).

Both evaluation results are returned in 5 dimension spider graphics, allowing to internally benchmark impact dimensions against each other and also to compare the own results against an external average benchmark of other new ventures. First, strength and weaknesses in new venture impact models can be identified efficiently and so realistic improvement areas can be agreed on. Second, external support systems can use the insights to focus their support and resources to optimally support the new ventures in their impact journey.

The piloting of the developed approach shows the good fit to early stage startups in various industries and a high degree of insights and valuable information. In addition, some refinements have been developed and added to the evaluation concept (see chapter 5.6), improving applicability for future utilization and answering feedback from the pilot audience. Compared to the pilot, the second generation evaluation will contain adjusted introduction text, explaining more detailed how to apply the questions to different new venture business and impact models. A second major change is the future opportunity to evaluate multiple impacts for one new venture in different evaluations, ensuring precise assessment and less averaging of answers.

5.9 References

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6 Article IV - Antecedents for new venture sustainability impact: Combining traditional with impact specific enablers to explain the sustainability value creation of new ventures

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6.1 Abstract

Sustainable entrepreneurship is seen as one of the major levers to drive innovation that will help us reach the UN's Sustainable Development Goals. While there is a rich body of research examining antecedents for the financial and economic success of new ventures, antecedents relevant for high sustainability value creation in new ventures still need significant theoretical and empirical contributions. Empirical studies looking at sustainability impact specific enablers are still scarce. And the construction of dependent variables that capture the multi dimensionality of sustainability value makes these studies more complex. This is relevant when different types of sustainability-oriented ventures from different impact areas are combined in a single study. Getting a better understanding which antecedents might lead to high sustainability value creation will help managing sustainability oriented ventures in its early phases. The empirical setting of this article consists of 77 sustainability-oriented ventures in Germany and the USA. The article uses correlation and regression analyses to investigate the relationship between seven antecedents and several dependent variables measuring sustainability impact, including an aggregated measure combining four subsidiary impact dimensions. Key findings are that traditional antecedents for new venture success do not predict sustainability value creation exhaustively, and are also not universally applicable for impact oriented new ventures. Results further suggest that a balanced set of traditional and impact-oriented antecedents is an appropriate way to measure and predict the dependent variable new venture sustainability impact.

6.2 Introduction

Back in 1987, the Brundtland Commission defined sustainability as “development that meets the needs of the present, without compromising the ability of future generations to meet their own needs” (Brundtland Commission, 1987). Over 30 years later and after having agreed on global Sustainable Development Goals (SDGs) (UN General Assembly, 2015) to fuel the transformation of our planet, we are still not achieving the required sustainable development (Sterman, 2012) and are consequently also not meeting the pursued SDGs (The Sustainable Development Goals Report 2019, 2019). Research has suggested that it is possible and also necessary to achieve the Sustainable Development Goals (Griggs et al., 2014) and the number of activities to reach the goals has significantly increased. Businesses (Loorbach and Wijsman, 2013; Sullivan et al., 2018; Figge and Hahn, 2004; Weissbrod and Bocken, 2017; Bocken and Short, 2016), but also entrepreneurs starting new ventures are seen as the key actors to support innovations that help us meet the SDGs together with politicians and policy makers, who are creating and supporting the required system for new ventures to act in (Dean and McMullen, 2007; Shepherd and Patzelt, 2011; Cohen and Winn, 2007; Apostolopoulos et al., 2018).

New sustainable business models help to create change by improving shortcomings and fixing system failures, such as negative externalities (Isaak, 1998; Schaltegger and Wagner, 2011; Schick et al., 2002;

Boons et al., 2013; Evans et al., 2017; Schaltegger et al., 2016; Gladwin et al., 1995). Especially new ventures are important actors to innovate and disrupt existing systems with new solutions and operational models (Schneider and Veugelers, 2010; Hockerts and Wüstenhagen, 2010). Accordingly, sustainable new ventures support not only economic growth but also sustainability impact creation (Gregori et al., 2019; Meek et al., 2010). Initial research has shown that new ventures can contribute to reach the SDGs (Horne et al., 2020). Entrepreneurial activity is the basis for resulting outcomes and impacts to work towards the transformation needed.

As sustainable new ventures are key actors in the transition towards a more sustainable society, it is important to better understand how to support this type of new ventures in creating sustainability impact. This is especially important in early phases, because this is the time when products or services are developed, and impactful business models are created (Bocken, 2015; Fichter and Tiemann, 2020). Empirically testing antecedents and conceptualizing and empirically testing the dependent variable sustainability impact will help to support entrepreneurs to be better in contributing to the SDGs.

Entrepreneurship research focused for a long time on traditional new ventures with growth and wealth focus (Mair and Martí, 2006; Austin et al., 2006), accordingly antecedents were mostly analyzed against venture growth and increased revenues, most often not including sustainability value in analyses of the dependent, nor the independent variables (Song et al., 2008). Initial research on sustainable entrepreneurship has shown that traditional new venture success factors are not fully aligned with sustainable new venture enablers (Shaw and Carter, 2007). Additional research has indicated that there is a certain tradeoff between financial growth and sustainability impact creation (Austin et al., 2006; Weerawardena and Mort, 2006; Parrish, 2010).

On the one hand, impact-oriented success factors have often been studied in specific areas (such as industry, function, geographic location, sustainability dimension, etc.) and often not together with traditional indicators to contrast the prediction quality (Keskin et al., 2013; Hörisch et al., 2017). Most predictors of sustainability value on the other hand, have been analyzed for mature businesses, general innovations and existing business models (e.g., González-Benito and González-Benito, 2005; Hart and Milstein, 2003; Jiang et al., 2018), but not for early phase new ventures. This gap in focus on early phases (pre-seed, seed and start-up) (Terán-Yépez et al., 2020) is attempted to be worked on with this article.

It is widely agreed on, that entrepreneurship still is a relevant field of study with a strong need to better understand (Shane and Venkataraman, 2000). Sustainability and entrepreneurship should be researched jointly to support the inherent impact potential (Shepherd, 2015). This article focuses on the prediction of sustainability value, which is important to support new ventures and support systems in managing and increasing the respective value creation. A lack of quantitative exploration (Weber and Kratzer, 2013) to validate predominantly qualitative research in this field (Mair and Martí, 2006; Short et al., 2009) has been our starting point.

Better insights on significant enablers have the potential to increase value creation and to increase the probability for successful changes ignited by new ventures. Results might be relevant for sustainability impact specialists and also for general entrepreneurship practitioners to better understand impact specific requirements and implications for new ventures. Additionally, decision making guidance is expected to be improved for the allocation of specific support resources by policy makers and support systems, but also to be enhanced for the guidance of entrepreneurs on where to focus their development process towards successful value creation. This is especially important, since sustainable

business models are seen as more complex and harder to execute compared to generic ones (Patzelt and Shepherd, 2011; Lans et al., 2014) and consequently require special attention and support (Evans et al., 2017).

6.3 Theoretical foundation and hypotheses

In this theoretical foundation, the authors will first discuss the research topic of sustainable entrepreneurship. Hypotheses will be developed covering the relationship of traditional vs. sustainability specific antecedents to sustainable value generation and a discussion of the dependent variable sustainability impact.

6.3.1 Sustainable Entrepreneurship

Sustainable entrepreneurship still is an emerging field of study and therefore, has to handle with varying definitions and frameworks used (Binder and Belz, 2015; Muñoz and Cohen, 2018). Emerging research builds on and aggregates existing research on e.g., social entrepreneurship by including environmental or green entrepreneurship to a joint area. Pacheco, Dean and Payne (2010) define sustainable entrepreneurship as the process of discovering, creating, evaluating and exploiting opportunities to create new solutions (products and services) supporting the SDGs. Respective new solutions were characterized as more complex, related to higher uncertainty and more challenges in terms of resolving the underlying issue compared to traditional entrepreneurship (Lans et al., 2014; Patzelt and Shepherd, 2011).

6.3.2 Sustainability value/impact

Successful exploitation of those opportunities results in sustainability value creation (Apostolopoulos et al., 2018; Shepherd and Patzelt, 2011; Dean and McMullen, 2007; Cohen and Winn, 2007), often also called sustainability impact. New ventures contribute to impact value creation (Zahra et al., 2009) by helping to overcome environmental and social challenges and by bringing change. Sustainable entrepreneurs, being the ‘agents of change’, focus their resources and business models to important social and environmental problems (Santos, 2012) and to fight negative externalities (Gladwin et al., 1995). Especially new ventures are important actors to innovate and disrupt existing systems with new solutions and models (Schaltegger et al., 2016; Schneider and Veugelers, 2010; Hockerts and Wüstenhagen, 2010). Creating new business models is a key competency of new ventures and as a result, offers the possibility to overcome existing challenges (Austin et al., 2006; Rao-Nicholson et al., 2017; Scott et al., 2016). In addition it has been observed, that new ventures often develop new markets and industries with new sustainable products to expand impact by scaling up and replicate in new environments (Casasnovas and Bruno, 2013; VanSandt et al., 2009; Fichter and Clausen, 2013).

Whereas there are established dependent variables allowing to measure the success for traditional new ventures, there is much more uncertainty how sustainability impact as a dependent variable can be conceptualized and measured (Tuan, 2008). Quantitative variables, that are also appropriate for early-stage new ventures, are currently not established and not standardized (Horne, 2019; Recker and Michelfelder, 2017) and consequently there is no simple variable available. But research has developed some measurement frameworks to assess the sustainability value creation of new ventures (see e.g., Weber and Kratzer, 2013; Kalleberg and Leicht, 1991), covering different perspectives of impact such

as system transformation, geographic expansion, adaptability and tangibility. The combination of these four perspectives is an attempt to describe key dimensions of impact holistically.

6.3.3 Antecedents for new venture performance

Various research has contributed to identify antecedents to new venture performance (Hall and Hofer, 1993). A valuable aggregation of these different approaches was provided in a meta-analysis, that can serve as an indication of the most important antecedents (Song et al., 2008). This meta-analysis shows reoccurring independent variables with significant prediction quality to new venture success. The dependent variable new venture success is predominantly measured by venture growth in number of employees and in revenue increase. Antecedents can be categorized in three groups: market & opportunity, entrepreneurial team and resources (Song et al., 2008; Chrisman et al., 1998; Gartner, 1985; Timmons and Spinelli, 2004).

The degree of product innovation and market scope are two significant factors out of the market and opportunity group (Stuart and Abetti, 1986; Schoonhoven et al., 1990; Song et al., 2008). Additionally, product and service validation with help of market tests show high significance to future success (Sharir and Lerner, 2006).

Determinants describing the entrepreneurial team, focus on the experience of founding team members. Highest significance towards new venture success was found for industry and marketing experience (Song et al., 2008), but also stakeholder contact and experience is seen as important for future success (Kirchberger and Pohl, 2016; Korunka et al., 2010; Kessler and Frank, 2009).

Most predictors that have been published can be categorized in the group resources. Direct resources, such as financial resources (Song et al., 2008; Robinson and McDougall, 2001), team size and firm age show high significance to new venture success (Song et al., 2008). But also indirect resources show the same significance: supply chain integration (Gemünden et al., 1996) and intellectual property protection (Cooper, 1984; Lefebvre et al., 1992; Zahra and Covin, 1993).

6.3.4 Antecedents for new ventures and impact-oriented ventures

Wry and Haugh (2018) mention in their review on antecedents to social impact, that there is limited direct research in the category “social impact activities”. As this study is still fairly recent, this shows the great need to increase our understanding which antecedents are important for high sustainability value generation, as one can expect that activities leading to high sustainability impact are likely to be higher than activities not related to high sustainability impact. Social entrepreneurship scholars have suggested to focus on the entrepreneur’s experience with the underlying problem and development need as antecedents to sustainability impact (Hockerts, 2015). Environmental entrepreneurship research has identified risk exposure as a significant predictor for new venture success in this specific field (Middermann et al., 2020). They mention however research studying entrepreneurial energy and human resources. Some of these antecedents are meaningless for pure economic performance. Accordingly, we could combine these specific predictors in the context of sustainable entrepreneurship, problem exposure is the resulting factor, applicable for social and environmental solutions similarly.

Hypothesis 1: Traditional new venture success factors are not sufficient to predict sustainability value creation exhaustively and are not universally applicable for impact oriented new ventures.

To assess the applicability and significance of traditional enablers, the authors include a set of antecedents into the model that is able to describe the business model of new ventures in its different components (Osterwalder and Pigneur, 2010). Sustainable business models do not differ in those components, but have additional perspectives along the sustainability definition (Joyce and Paquin, 2016). The integration of sustainability in to early phase business models is seen as the key to future sustainability impact (Bocken, 2015). The article included innovation, supply chain, intellectual property, stakeholder contact and market test; since those are covering the most important business model components and are also describing necessary preconditions to create impact.

Additionally, those indicators that are less applicable for early stage new ventures were excluded. In particular, firm age and team size are less important until new ventures grow and exist over a longer period. In early phases, relevant success factors were found to describe the team and its activity, rather than scale and growth determinants, that are significant for financial success (van Gelderen et al., 2005). Also, industry and marketing experience were seen less important for sustainable entrepreneurs, where stakeholder experience and problem exposure can be used and applied analogous.

The number of independent variables has been limited to seven, expecting survey responses to create a sample size of 70 -100 and following the rule of thumb to calculate 10-12 data sets per independent variables, to create a significant model.

Hypothesis 2: A balanced set comprising of traditional profit oriented and impact specific antecedents will predict sustainability value more accurately, than any of the two categories of antecedents individually.

The authors include problem exposure as a predictor, purely focusing on the impact orientation. Additional balance is created by extending the factors stakeholder contact and market test into the context of sustainable entrepreneurship. An important stakeholder group are the beneficiaries. Products and services cannot only be validated in the market regarding its value proposition, but also regarding its impact proposition.

Hypothesis 3a: A multi dimension approach to the dependent variable sustainability value can help to assess and compare the sustainability impact creation of a new venture.

Hypothesis 3b: Subsidiary impact variables can help to specify the interrelationship to certain predictors and to better interpret their explanatory power.

Measurement of sustainability impact (dependent variables) is complex and not yet fully standardized nor understood (Recker and Michelfelder, 2017; Horne, 2019; Weber and Kratzer, 2013) although there is no perfect standardized measurement yet (Tuan, 2008; Clark and Brennan, 2016; Wei-Skillern et al., 2007), existing measures can be used to quantitatively explore this field further

The article is using measures already applied in similar research (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) and applicable for environmental and social impact. Based on the existing impact measures, a four item aggregated measure is created to assess sustainability impact creation. The four items will be additionally assessed in individual models to better understand significance and make the different items comparable in prediction quality.

The resulting model with respective variables is summarized in Figure 15, showing the seven selected predictors and the one plus four impact measures tested in separate statistical models.

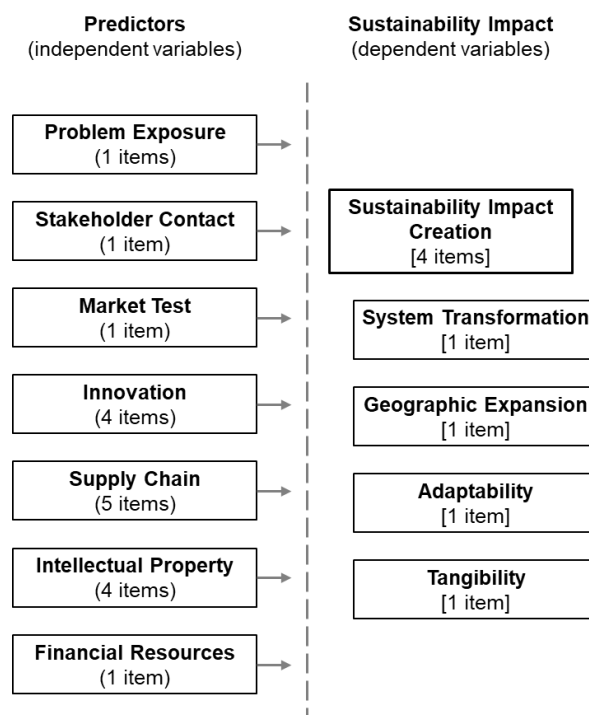


Figure 15 - Model summary

6.4 Research Design

6.4.1 Empirical setting and data collection

The data collection was performed with help of surveys, completed by participants in preparation of sustainability impact workshops in Germany and the USA. The sample of 77 global new ventures contains mostly for-profit ventures with a strong sustainability impact orientation. The new ventures are active in various industries and offer a wide range of products and services. 8 out of 10 participants assess their profit probability with more than 50 percent, but at the same time see their main focus on sustainability impact creation rather than on pure profit. The participating new ventures pursue their ideas for on average of 4 years and exist for 2,5 years on average, in case the founding already took place. The new venture teams consist of an average of 6 employees often supported by additional volunteers. These statistics confirm the initial goal to collect data for early stage new ventures.

6.4.1.1 Measurement and validation of constructs

| Independent Variables | Items | Sources |
|---|--|---|
| Problem Exposure (1 item) | <i>The team has had exposure to the problem the new venture is addressing. E.g., ecological or social problem has been experienced by individual(s) out of the new venture team.</i> [5-point-Likert-Scale: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | Own, based on (Hockerts, 2015; Middermann et al., 2020) |
| Stakeholder Contact (1 item) | <i>The team has experience or past contact with at least one of the venture's relevant stakeholders, e.g., customers or beneficiaries.</i> [5-point-Likert-Scale: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | (Kirchberger and Pohl, 2016; Korunka et al., 2010; Kessler and Frank, 2009) |
| Market Test (1 item) | <i>Our product/service has been successfully validated in a market test, showing its ability to fulfill the requirements.</i> [5-point-Likert-Scale: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | (Sharir and Lerner, 2006) |
| Innovation (4 items, alpha=0,757) | <i>The core technology of the venture is new.</i> <i>The target markets served by the venture are new.</i> <i>The competition faced by the venture is new.</i> <i>The user for the offering is new.</i> [5-point-Likert-Scales: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | (Stuart and Abetti, 1986; Schoonhoven et al., 1990) |
| Supply Chain (5 items, alpha=0,800) | <i>Suppliers are important discussion partners.</i> <i>Suppliers are important to generate new product ideas.</i> <i>Suppliers are important to conventionalize new products.</i> <i>Suppliers are important for developing new products.</i> <i>Suppliers are important to test new products.</i> [5-point-Likert-Scales: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | (Gemünden et al., 1996) |
| Intellectual Property (4 items, alpha=0,844) | <i>The venture holds important patent rights.</i> <i>The venture has more patents than its key competitors.</i> <i>The venture uses license agreements extensively to sell its products.</i> <i>The venture has increased its patenting efforts over the past year.</i> [5-point-Likert-Scales: Strongly agree; Agree; Neutral; Disagree; Strongly disagree] | (Cooper, 1984; Lefebvre et al., 1992; Zahra and Covin, 1993) |
| Financial Resources (1 item) | <i>What financial resources are currently available to the new venture?</i> [Available resources in € (or converted \$)] | (Song et al., 2008; Robinson and McDougall, 2001) |

Table 5 – Independent variables

| Dependent Variable | Items | Sources |
|--|--|---|
| Sustainability Impact Creation (4 items, alpha=0,427) | <i>System Transformation</i> <i>Geographic Expansion</i> <i>Adaptability</i> <i>Tangibility</i> [4-point-scale for each item as defined below in table] | Own aggregation based on Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) |
| System Transformation (1 item) | <i>To what extent will your new venture transform established practices and systems?</i> 1) The initiative provides a service to the community within the structures that exist. 2) The initiative is intended to change established practices and systems, but this is not yet evident. 3) The impact on established practices and systems is becoming evident. 4) The initiative has entirely transformed established practices and/or systems. | (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) |
| Geographic Expansion (1 item) | <i>What is the geographic expansion of the new venture?</i> 1) Application may be restricted largely to initial beneficiaries. 2) Could be expanded to adjacent communities. 3) Could be expanded to neighboring states/departments of the country and/or other countries. 4) Extends into other countries already. | (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) |
| Adaptability (1 item) | <i>How would you rate the adaptability of your innovation/business model/value proposition?</i> 1) Potential for adaption elsewhere is unclear. 2) Some or many elements can be transferred and adapted elsewhere within the same environment. 3) Most aspects can be transferred and adapted to other settings around the world. 4) Extends into other countries already. | (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) |
| Tangibility (1 item) | <i>How would you rate the tangibility of your innovation/business model/value proposition?</i> 1) Not proven yet to what extent peoples' lives have been improved. 2) Results sufficient to surmise that people's lives were improved, but documented evidence still limited or lacking in proof. 3) Rudimentary evidence shows tangible impact on people's lives, with supportive quantitative and qualitative documentation. 4) Evidence is convincing of significant tangible improvements in peoples' lives, with substantial documentation. | (Weber and Kratzer, 2013; Kalleberg and Leicht, 1991) |

Table 6 - Dependent variables

The selected variables in the model (Ref. Figure 15) are operationalized according to the respective sources and existing use cases. Most variables are measured with help of typical scales, only the independent variable financial resources requires a numerical value, indicating the total available resources. Five-point Likert scales are used for the independent variables and specific four-point scales for the dependent variables according to the sources. Used variables, items, scales and sources can be found in Table 5 and Table 6 respectively.

To assess the item's consistency, the authors apply Cronbach's alpha to those predictors with more than one item. The resulting values of at least 0,757 (for innovation) up to 0,844 (for intellectual property) indicate acceptable to good consistency over the respective items for the independent variables (Nunnally, 1978). The consistency for the aggregated sustainability impact value measure (first dependent variable) is reported with 0,427, which is expectedly low. Trade-offs between the different impact perspectives would not allow higher alpha values, since only single impact leavers (importance vs. degree of change vs. scale) can be maximized with resulting conflicts for the others. The aggregated measure is not constructed to show consistency between the items, but instead take a holistic view across the different impact perspectives and leavers to consolidate total impact creation, disregarding the specific leaver. Consequently, the authors accept a lower alpha value here and conversely validate the hypothesis of tradeoffs and conflicting leavers.

6.4.2 Choice of statistical methods

Linear regression models are used to test the research hypotheses and to identify significant predictors for sustainability impact creation by new ventures. Multiple linear regression analysis is the method at choice to relate a set of independent variables (antecedents) to a single dependent variable (the impact measures discussed) (Aiken, 2004; Kaplan, 2004). Linear regression can process both the defined ordinal scales and Likert scales for the variables. The regression models are executed with help of pairwise exception for those data points with missing information, which occur in less than 5% for the data set. In preparation, descriptive statistics and a bivariate correlation test are used to explore the variables and to understand first patterns.

6.5 Analyses and Results

6.5.1 Correlation analysis

The bivariate correlation analysis shows numerous significant correlations between explanatory and response variables, indicating a certain relationship between those. Especially the three antecedents market test, stakeholder experience and problem exposure display numerous significant correlations towards the impact measures, promising high potential to find evidence for good prediction quality. Successful market testing positively influences sustainability impact ($r=0,512$; $p<0,01$), adaptability ($r=0,474$; $p<0,01$) and tangibility ($r=0,331$; $p<0,01$), which was expected to a certain extent. The same three dependent variables are also positively influences by stakeholder experience of the founding team ($r=0,542$; $p<0,01$ / $r=0,496$; $p<0,01$ / $r=0,446$; $p<0,01$). The third independent variable with visible correlation is problem exposure, which has highly significant correlations to all dependent variables, except geographic expansion ($r=0,178$; $p>0,05$).

On the other hand, remaining independent variables show little correlation, which has to be validated in following regression analysis. In addition, the table shows that the independent variables are not

too highly correlated between each other, which is an important precondition for the regression model (Aiken 2004). The correlation analysis shows a positive relationship between the independent variables market test and stakeholder experience (0,446; $p < 0,01$), between market test and problem exposure ($r = 0,335$; $p < 0,01$) and between problem exposure and stakeholder experience ($r = 0,441$; $p < 0,01$). Other assumptions, such as linearity between the dependent and independent variables and normality for the variables are also given. An additional observation one can make, is the high positive and significant correlation between dependent variables. Sustainability impact is correlating positively to all four sub variables.

Means, Standard Deviations, n and Correlation

| Category | Variables | Mean | St. Dev. | n | 1) | 1.1) | 1.2) | 1.3) | 1.4) | 2) | 3) | 4) | 5) | 6) | 7) | 8) |
|-------------|-----------------------------------|------|----------|----|--------|--------|--------|--------|--------|---------|--------|--------|--------|--------|-------|----|
| Dependent | 1) Sustainability Impact Creation | 2,59 | 0,52 | 77 | 1 | | | | | | | | | | | |
| | 1.1) System Transformation | 2,18 | 0,88 | 77 | ,597** | 1 | | | | | | | | | | |
| | 1.2) Geographic Expansion | 2,95 | 0,87 | 77 | ,491** | 0,012 | 1 | | | | | | | | | |
| | 1.3) Adaptability | 2,90 | 0,70 | 77 | ,644** | 0,095 | ,250* | 1 | | | | | | | | |
| | 1.4) Tangibility | 2,32 | 0,97 | 77 | ,686** | ,284* | -0,042 | ,343** | 1 | | | | | | | |
| Independent | 2) Market Test | 1,75 | 0,40 | 77 | ,512** | 0,184 | ,282* | ,474** | ,331** | 1 | | | | | | |
| | 3) Stakeholder Experience | 1,78 | 0,36 | 63 | ,542** | 0,133 | 0,216 | ,390** | ,496** | ,446** | 1 | | | | | |
| | 4) Problem Exposure | 1,84 | 0,34 | 75 | ,538** | ,434** | 0,178 | ,325** | ,369** | ,335** | ,441** | 1 | | | | |
| | 5) Innovation | 3,16 | 0,99 | 77 | 0,110 | 0,128 | -0,051 | 0,128 | 0,072 | ,296** | 0,162 | ,240* | 1 | | | |
| | 6) Supply Chain | 3,45 | 1,01 | 77 | -0,108 | -0,122 | -0,072 | -0,030 | -0,033 | 0,027 | -0,001 | 0,066 | 0,217 | 1 | | |
| | 7) Intellectual Property | 2,57 | 1,25 | 77 | 0,008 | 0,059 | -0,192 | -0,123 | ,225* | -,324** | -0,164 | -0,120 | -0,165 | -0,088 | 1 | |
| | 8) Financial Resources | 1,97 | 1,06 | 62 | 0,131 | -0,015 | 0,081 | 0,085 | 0,142 | 0,222 | 0,090 | -0,099 | 0,022 | -0,037 | 0,070 | 1 |

** . Correlation is significant at the 0,01 level (two-tailed)

* . Correlation is significant at the 0,05 level (two-tailed)

Table 7 - Correlation Table: Means, Standard Deviations, n and Correlation values

6.5.2 Regression analysis

Five regression models are calculated, one for the aggregated impact measure, as well as four for the individual subsidiary dependent variables. Four out of the five models came back with significant regression for single explanatory variables, showing positive contribution to the impact measure (positive regression coefficients β). With the comparable small sample at hand the authors defined three significance levels: * Sig. < 0,1 // ** Sig < 0,05 // *** Sig. < 0,01.

Performing the linear regression for 'Sustainability Impact Creation' as aggregated dependent variable results in significance for four predictors (Ref. Table 8). Market test ($\beta = 0,344$; $p < 0,01$) and problem exposure ($\beta = 0,269$; $p < 0,01$) show strong significance, stakeholder contact ($\beta = 0,269$; $p < 0,05$) and intellectual property ($\beta = 0,182$; $p < 0,1$) return with lower significance. This findings lead to a balanced set of predictors focusing on market, entrepreneurial team and on resources. Additionally, it covers generic success factors as well as impact oriented ones.

Choosing 'System Transformation' as dependent variable and running the regression model reveals only problem exposure ($\beta=0,456$; $p<0,01$) as highly significant predictor. Understanding the underlying problem and having experienced the challenges is definitely a valuable precondition to change existing systems towards more sustainable ones.

The next model tested is 'Geographic Expansion' as depend variable. None of the included predictors are significant here. The impact variable focuses on geographic growth and scale, two dimensions that have been excluded from the predictor set, hence the result is of little surprise. It is expected that alternative and generic growth predictors result in higher significance.

The third individual dependent variable tested is 'Adaptability'. Market test has high significance in predicting adaptability of new solutions ($\beta=0,372$; $p<0,05$), which is understandable since new markets can easier be accessed with a validated and tested solution.

Linear Regression Results

| Independent Variables | Sustainability Impact Creation | | System Transformation | | Geographic Expansion | | Adaptability | | Tangibility | |
|------------------------|--------------------------------|--------------|-----------------------|--------------|----------------------|-------|-------------------|--------------|-------------------|--------------|
| | Std. co-efficient | | Std. co-efficient | | Std. co-efficient | | Std. co-efficient | | Std. co-efficient | |
| | Beta | Sig. | Beta | Sig. | Beta | Sig. | Beta | Sig. | Beta | Sig. |
| Market Test | 0,344*** | 0,006 | 0,105 | 0,491 | 0,207 | 0,206 | 0,372** | 0,015 | 0,269** | 0,025 |
| Stakeholder Experience | 0,269** | 0,022 | -0,104 | 0,477 | 0,077 | 0,620 | 0,175 | 0,219 | 0,272** | 0,017 |
| Problem Exposure | 0,355*** | 0,002 | 0,456*** | 0,002 | 0,106 | 0,483 | 0,137 | 0,322 | 0,271* | 0,053 |
| Innovation | -0,068 | 0,514 | 0,059 | 0,656 | -0,161 | 0,256 | -0,029 | 0,824 | -0,036 | 0,731 |
| Supply Chain | -0,108 | 0,279 | -0,157 | 0,214 | -0,059 | 0,657 | -0,040 | 0,745 | -0,013 | 0,894 |
| Intellectual Property | 0,182* | 0,083 | 0,127 | 0,334 | -0,135 | 0,335 | 0,035 | 0,785 | 0,362*** | 0,001 |
| Financial Resources | 0,050 | 0,621 | 0,001 | 0,995 | 0,049 | 0,720 | -0,003 | 0,983 | 0,045 | 0,657 |

* Sig. < 0,1 // ** Sig < 0,05 // *** Sig. < 0,01

Regression Model Summary

| | | | | | |
|---------------------------|--------------|--------------|-------|--------------|--------------|
| <i>R</i> | 0,725 | 0,487 | 0,369 | 0,531 | 0,606 |
| <i>R-Square</i> | 0,525 | 0,238 | 0,136 | 0,282 | 0,367 |
| <i>Corrected R-Square</i> | 0,461 | 0,135 | 0,020 | 0,185 | 0,303 |
| <i>Standard Error</i> | 0,380 | 0,823 | 0,863 | 0,631 | 0,806 |
| <i>Model Sig.</i> | 0,000 | 0,039 | 0,335 | 0,012 | 0,000 |

Table 8 - Linear regression model output

'Tangibility' is the last dependent variable tested in a regression model. Similarly to the aggregated measure, four predictors showed statistical significance. Tangibility is the core aspect in sustainability value creation and assesses tangible impact as the last step in the IOOI framework. Consequently the same predictors apply here compared to the first model. Intellectual property returns with highest

significance ($\beta=0,362$; $p<0,01$), documentation efforts for intellectual property protection include documentation of impact value and expected change, which leads to high prediction quality for tangibility. Problem exposure ($\beta=0,271$; $p<0,1$) shows the lowest significance, pure experience and awareness of a problem might hence not be enough to create tangible impact, market validation ($\beta=0,269$; $p<0,05$) and beneficiary contact ($\beta=0,272$; $p<0,05$) are slightly better applicable to predict the change happening, according to resulting coefficients.

Checking the overall significance of the individual regression models, one can see that four out of five significance values are below 0,05 (see Table 8), which proves the validity of the regression models and the identification of significant predictors for the respective dependent variables. Only the regression model for geographic expansion as dependent variable shows no significance, which is in line with the zero observed significant independent variables as predictors for this model (see above).

6.6 Discussion

Hypothesis 1: Traditional new venture success factors are not sufficient to predict sustainability value creation exhaustively and are not universally applicable for impact oriented new ventures.

The results indicate that generic predictors are less significant to predict new venture sustainability impact creation. Although two adjusted antecedents (stakeholder contact and market test), that are based on traditional ones, and one generic one (intellectual property) are significant in the aggregated impact measure model, the results suggest that the other validated antecedents have less prediction power to the sample at hand. Most generic success factors focus on certain parts of a business model that are equally important for sustainability-oriented ventures, but the additional sustainability perspectives on those business models seem to change the predictors applicability. As stated before, business growth and financial success are only indirectly connected to sustainability value creation. Consequently, additional impact oriented indicators are required in early phases.

Hypothesis 2: A balanced set comprising of traditional profit oriented and impact specific antecedents will predict sustainability value more accurately, than any of the two categories of antecedents individually.

The set of significant antecedents shows great balance of generic and impact-oriented predictors. Similarly to generic new ventures, it seems to be helpful to have intellectual property under control, especially the capability to document and protect the specific value creation by the innovation and business model is equally applicable for sustainable entrepreneurs. Market testing is allowing both to validate products and services in its value proposition but also in its impact potential and change for beneficiaries, hence this predictor is not surprisingly applicable for sustainable new ventures. It is the better indicator compared to the innovation variable, that is trying to describe the degree of innovation, which is more complex for social and environmental innovations. In order to deep dive on the targeted beneficiaries, prior stakeholder contact of the entrepreneurs is obviously helpful to better adjust the theory of change to the needs of specific stakeholder groups. Problem exposure, meaning being exposed to a certain social or environmental threat, is the next level of relevant experience in this context that helps entrepreneurs to better understand their impact creation opportunity. Stakeholder contact and problem exposure consolidate comparable industry, functional and market experience in traditional entrepreneurship success factors.

Hypothesis 3a: A multi dimension approach to the dependent variable sustainability value can help to assess and compare the sustainability impact creation of a new venture.

Hypothesis 3b: Subsidiary impact variables can help to specify the interrelationship to certain predictors and to better interpret their explanatory power.

Reviewing the results from the different regression models, the authors can conclude that the aggregated measure has the broadest coverage of significant predictors. The respective subsidiary variables show relationships to single predictors, but do not add additional predictors to the set. Tangibility has the biggest overlap to the aggregates measure, whereas the other dependent variables only show relationship to less independent variables. This indicates that the aggregated measure covers the main impact dimensions. Applying the impact management project norm (Impact Management Project, 2020) the article can see, that the major dimensions are covered by our impact measures. System change explains the magnitude of the “What”, geographic expansion determines the “How much” jointly with adaptability, which additionally describes the “Who”. Tangibility is focusing in the contribution and the risk associated to the impact. Again the authors see the possible tradeoffs between the subsidiary variables, also indicated in the low Cronbach’s alpha (see Table 5 and Table 6). The aggregated dependent variable covers all impact levers and indicates impact value creation on a high level. Further details can be derived from the specific variables, which are linked to respective predictors.

The impact management project norm (Impact Management Project, 2020) can also help to explain the contribution of the predictors to the certain impact dimension and hence validate the found relationship to the impact measures. Market test validates the outcome threshold experienced by the beneficiary and mitigates the execution risk. Problem exposure helps to understand the What and Who jointly with Stakeholder Experience. The contribution is indicated by both predictors as well. Overseeing the predictors matched to the dimensions one can realize that How Much is not directly represented, which is intended since the authors excluded scale and growth variables for early phase new ventures. Still this might be a gap in the predictor set, which future research to focus on how to align growth or scaling and impact.

6.7 Conclusion

Problem exposure of the founding team members, sufficient stakeholder or beneficiary contact and hence knowledge, successful market testing of the product or service offered and good control over intellectual property, by either patents or license agreements, have been identified as applicable independent variables to predict sustainability impact of new ventures in early phases. Accordingly, it should be highest priority to focus on those activities positively influencing the independent variables in early phases, increasing the chance to achieve high sustainability value creation.

Various dimensions and level of impact (from output over outcomes to impact) are measured with the aggregated variable sustainability impact. This attempt to close the existing gap in research focusing on impact predictors in early phases, comparing traditional success factors and impact-oriented ones, has shown that an adjustment and complement, of those validated in previous research, is improving the prediction quality for the defined context and scope. This paper broadens the empirical and conceptual foundation, which is an important contribution to the research field (Shepherd and Patzelt,

2011). Sustainable entrepreneurs, individuals in support systems and policy makers can take advantage of those findings by first focusing their resources and attention on the areas determining impact most and second by applying antecedent specific measures to track impact potential in early phases, where quantitative measurement is complex and less applicable. Understanding the predictors allows to design and implement support systems that are focusing on increasing the problem exposure and stakeholder contact to entrepreneurs (e.g., bring together entrepreneurs and potential beneficiaries and stakeholder), but also promoting market testing and intellectual property documentation for social and environmental new ventures that often do not regularly apply those methods (e.g., provide specialist resource support to build methodical capabilities).

Limitations of this research come from a relatively small sample size, which limits the number of variables that can be added to the regression analyses. Comparable research often applies larger samples. The smaller size of sample also can reduce the significance and might limit the insights to a certain extent, but the study can still indicate significant predictors as discussed above. The sample composition is not completely representative, due to different, but not exhaustive, geographic settings and characteristics of new ventures in scope. But it has the advantage of an unbiased sample, without industry or impact area focus to apply indicators for various new ventures, which is different than existing research (see. chapter 6.3).

The decision to exclude control variables from the regression models potentially causes additional limitations. The exclusion of control variable is based on the assumption that exogenous variables are less relevant in early stage where new ventures can develop business model from scratch and are not exposed directly to their environment. Typical controls (age, size, etc.) are less applicable for early stage new ventures. It implies the risk to underestimate exogenous variables and to creating inaccurate models. Still the outcome indicates a good fit of the defined models. Future research should continue the started assessment of predictors with both larger and representative samples and also investigate the effect of other antecedents and control variables.

Also, it is likely that there are more antecedents to sustainability value, which needs to be operationalized and tested empirically, leading eventually to meta analyses. An important limitation is also the basic conceptual and theoretical foundation we have on the depend variable sustainability value. The multi-dimensionality causes problems in creating an aggregate dependent variable, as Cronbach's alphas in such a dependent variable are not surprisingly low, given the different dimensions of impact that need to be captured.

Future research should continue to further specify and validate predictors in studies, hence impact related predictors need to be listed in surveys and other research tools more frequently. Compared to a well-established body of general success factors for entrepreneurship, it should be targeted to achieve a similar result over the next years. With growing attention on sustainable entrepreneurship and more and more research, there is a great chance to use the large number of data and insights to accomplish this near to mid-term.

6.8 References

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7 Overall conclusion

Summarizing first the key conclusions of each article (see Figure 16), leads to the overall contributions to improve the future sustainability impact of early stage new ventures.

In order to improve the future sustainability impact of early stage new ventures, the four articles show, that adjusted measurement, forecasting and prediction approaches are required to reflect the special needs and context of sustainable entrepreneurship. In addition, the author could demonstrate, that already in early phases of new ventures, with high degrees of uncertainty, limited data availability and frequent business model and product/service changes, there is a benefit in applying suitable approaches to measure and forecast future sustainability value creation. Generated insights on, e.g., improvement areas and potential levers, can be used to improve sustainable business models and to support decision making within the new venture or in external support systems. In addition, first insights on significant predictors for future sustainability value creation help to better understand similarities and differences between general entrepreneurship and sustainable entrepreneurship characteristics, ensuring that either focused and targeted resources are applied to support early stage new ventures, or entrepreneurs themselves have increased awareness of what will make the difference when aiming to achieve future impact.

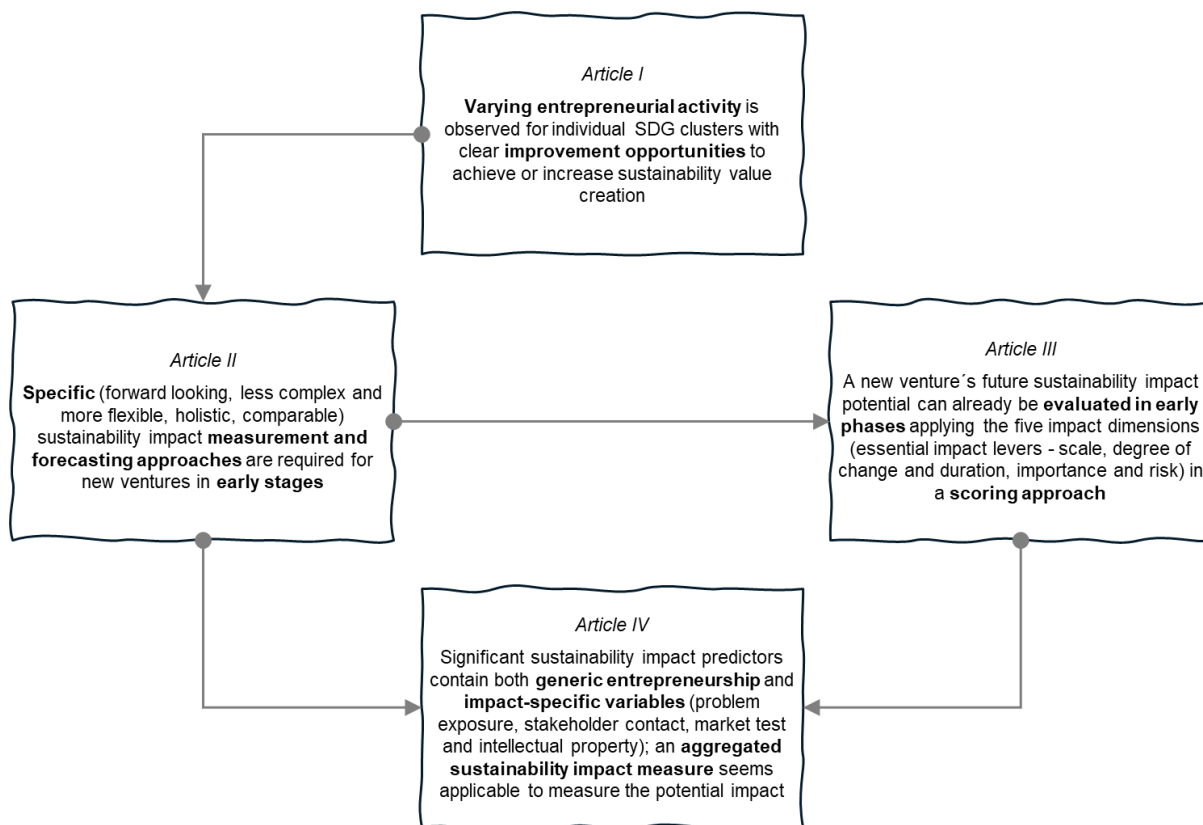


Figure 16 - Overview key conclusions

The **first article** explores entrepreneurship related to the Sustainable Development Goals by mapping new venture activities in Germany with semi-automated content analysis. By doing this the authors used freely available web-material, using the semiautomated content analysis for a scalable approach

to map entrepreneurial activities along the 17 SDGs. The analysis shows that entrepreneurs currently do not address all SDGs. There is strong direct engagement around SDG 9 (industry, innovation & infrastructure), SDG 3 (good health and well-being) and SDG 12 (responsible consumption and production). On the other end of the spectrum we find SDG 1 (no poverty) and SDG 17 (partnership for the goals) with little-observed activity. However, the article highlights the expected contribution potential and guides the research to further investigate on how to support the impact potential of new ventures in details. Due to available information and data, the article's analysis focuses on entrepreneurial activity, comparable to outputs or eventually outcomes, according to theory of change methodology. In order to increase transparency on entrepreneurial contribution towards the SDGs and to ensure that sustainability value is created, the article provides four different SDG patterns with respective strategies to pursue.

An important requirement to improve sustainability impact is seen in the ability to measure and forecast impact potential in early phases, this allows the required translation of entrepreneurial activity into entrepreneurial impact on sustainability, either documented for the status quo or forecasted for future activities. The **second article's** systematic literature review reveals that there is a lack of sustainability measurement tools appropriate for early stages of a new venture. Holistic measurement tools, covering environmental, social and economic value generation, are needed to enable sustainable entrepreneurs to improve their business and impact models maximizing impact along the three dimensions of sustainability. Especially in early phases, entrepreneurs rely on the possibility to create a pragmatic and iterative forecast, utilizing the available but limited data and balancing resource requirements with existing shortages, often found in new venture's teams. The relative improvement of generated sustainability value needs to be taken into account in order to allow a meaningful comparison of different ventures and business models and to significantly reduce the complexity. The article emphasizes, that research shall integrate initial findings from other studies looking at success factors covering the social and environmental value generation – rather than the economic outcome only. This has been the starting point to develop evaluation approaches and investigate success factors in article III and IV.

The **third article** demonstrates that a suitable impact scoring approach has been developed, using five dimensions of sustainability impact to evaluate the future potential of new ventures in early phases. Essential impact levers (scale, degree of change and duration) are combined with the importance and risk dimensions associated. The piloting of the developed approach shows the good fit to early stage startups in various industries and a high degree of insights and valuable information. In addition, some refinements have been developed and added to the evaluation concept, improving applicability for future utilization and answering feedback from the pilot audience.

Article IV's results indicate that generic entrepreneurial success predictors are less significant to predict new venture sustainability impact creation in early phases. The regression analysis revealed a set of significant antecedents, showing balance of generic and impact oriented predictors. Problem exposure by the founding team, initial stakeholder contact to important stakeholder or beneficiaries, successful market testing and good control of intellectual property, e.g., with help of patents or license agreements, have been identified as significant predictors, resulting in high sustainability impact. This findings will support entrepreneurs, support systems and investors in focusing on the right areas to ensure maximized impact potential from the beginning. Reviewing the results from the different regression models applied, the authors can also conclude, that the developed aggregated impact measure has the broadest coverage of significant predictors. The respective subsidiary variables show

relationships to single predictors, but do not add additional predictors to the set. Hence, the used impact potential measures proves applicability and can be used and further refined by other researches.

Summarizing the four articles' **contribution to theory** (see Table 9), the dissertation manuscript offers conceptual contribution by pointing out a way on how to first map entrepreneurial activity to the SDGs and accordingly indicate the potential contribution of sustainable entrepreneurship for defined regions and sets of new ventures. Second, an approach to assess impact potential of single new ventures has been developed and tested, showing great potential in targeted early phases. In addition, an impact measure has been developed and successfully tested. Empirical contributions could be generated by creating insights in a large data set of new ventures. First exploring the opportunity to contribute to the SDGs. And second by studying the significance of success factors and predictors based on new ventures' data.

| Contribution to theory (conceptual and empirical) | |
|--|---|
| Conceptual contribution | <ul style="list-style-type: none"> • Novel and scalable method to map entrepreneurial activity towards achieving the SDGs on a regional and country level (<i>Article I</i>) • Assessing applicability of academic impact measurement approaches for early stage new ventures, including recommendations to close gaps (<i>Article II</i>) • A holistic but yet pragmatic approach to assess future sustainability value creation potential in early phases (<i>Article III</i>) |
| Empirical contribution | <ul style="list-style-type: none"> • First research on entrepreneurial activities related to the SDGs, structuring and clustering relevant impact opportunities (<i>Article I</i>) • Set of significant predictors for future sustainability impact (including a aggregated impact measure) of new ventures in early phases (<i>Article IV</i>) |

Table 9 - Overview contribution to theory

The presented articles offer a broad range of **contributions to practice** for different stakeholder groups (see Table 10). In addition to the above mentioned theoretical implications for academia, researches could also benefit practically from the key insights and shared frameworks in their research work. Entrepreneurs and new ventures were key target for the practical contribution. With the defined research approach, it was always ensured to pilot, validate and refine developed frameworks and tools with this stakeholder group to ensure high applicability. Investors, support systems, coaches and policy makers – all aiming to support sustainable entrepreneurship – are also invited to make use of the articles. Guidance on the selection of suitable approaches for impact measurement and/or forecasting, either for a new ventures selection or impact tracking process, is complemented by practical insights on what significant preconditions should be accomplished and which impact levers ensure future impact creation, helping to clearly focus support resources on the areas that will make a difference.

| Contribution to practice (sorted by benefiting stakeholder groups) | |
|---|---|
| Researchers | <ul style="list-style-type: none"> • Pragmatic approach to map entrepreneurial activity to SDGs, using available information, which can be scaled across regions and industries (<i>Article I</i>) • Guidance on the applicability of impact measurement approaches for early stage new ventures (<i>Article II</i>) • Ready to use and fully shared framework and approach to evaluate sustainability impact potentials for new ventures in early phases (<i>Article III</i>) • An aggregated impact measure, suitable to assess a new venture's sustainability value creation potential in early phases (<i>Article IV</i>) |
| Entrepreneurs and new ventures | <ul style="list-style-type: none"> • Practical guidance on impact opportunities suitable for entrepreneurial activity, based on the UN's Sustainable Development Goals (<i>Article I</i>) • Guidance on the applicability of impact measurement approaches for early stage new ventures (<i>Article II</i>) • Ready to use self-evaluation approach pointing out improvement areas for future sustainability impact (<i>Article III</i>) • Overview on significant impact predictors for future value creation (<i>Article IV</i>) |
| Investors | <ul style="list-style-type: none"> • Initial overview on entrepreneurial activity with respect to the SDGs, identifying potential investment opportunities (<i>Article I</i>) • Guidance on how to pragmatically structure and layout the impact assessment from an academic perspective, ensuring applicability and fit for early phases (<i>Articles II & III</i>) • Valuable insights for the assessment and evaluation ("sustainability due diligence") of potential investment targets by highlighting important predictors and success factors on the new venture's way to impact (<i>Article IV</i>) |
| Support systems | <ul style="list-style-type: none"> • Guidance in selecting right projects and people to support (<i>Articles III & IV</i>) • Help to evaluate the impact potential and to track success (<i>Articles III & IV</i>) |
| Coaches and consultants | <ul style="list-style-type: none"> • Pragmatic guide on how to evaluate and increase sustainability impact already in early phases (<i>Articles II & III & IV</i>) |
| Policy makers | <ul style="list-style-type: none"> • Support to identify specific opportunities and to create an ecosystem in which entrepreneurs can flourish and execute their business ideas (<i>Article I</i>) • Understanding which preconditions are required to boost the impact creation and allow entrepreneurship being an effective lever to support the urgently required sustainability transformation (<i>Articles I & IV</i>) |

Table 10 - Overview contribution to practice

The achieved contributions directly open the discussion on **future research** opportunities. Following the underlying research framework (see Figure 1), two main research directions result:

1) Regarding the level of analysis, future research might investigate in more depth the transfer of micro level impact into meso and even macro level perspective. Better understanding in impact realization and potential risks and barriers on the respective levels will support the contribution and effectiveness of single new ventures towards the bigger goal.

2) Overlooking the entrepreneurial stages, future research can support in continuing empirical research on indicators and predictors of early stage impact potential as an important research area to

Overall conclusion

support. Newly developed and more and more standardized approaches to measure and evaluate impact creation shall support this activity. Both impact category specific or industry specific data sets might additionally improve the insights and allow to better understand cause and effect relationships in this more specific contexts.

It is still a long way to completely understand and prove the full potential of sustainable entrepreneurship, however the growing number of researchers and publications in that field create an optimistic outlook for the next years and will most likely generate a fast growing number of additional important insights.

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