Impact Investment for Startups: Conceptualization and Design Support for Impact Assessment

Zur Erlangung des akademischen Grades eines

Doktors der Wirtschaftswissenschaften
(Dr. rer. pol.)

von der KIT-Fakultät für Wirtschaftswissenschaften
des Karlsruher Instituts für Technologie (KIT)

genehmigte

Dissertation

von

M.A. Christin Eckerle

Tag der mündlichen Prüfung: 05.02.2025

Referent: Prof. Dr. Orestis Terzidis

Korreferent: Prof. Dr. Christoph Seckler

Karlsruhe (2025)

Acknowledgment

Danksagungen in Dissertationen haben eine gewisse Tradition und sind, wenn auch für die Autoren und deren Rezipienten von persönlicher Bedeutung, in ihrer Bedeutsamkeit für alle anderen Leser doch recht banal.

Banal ist im Vergleich zum großen Ganzen eigentlich auch der Titel, der einer erflogreich verteidigten Dissertation folgt. Gleichzeitig hat er immer noch eine enorm hohe Gewichtung in unserer Gesellschaft und die Anerkennung übersteigt oft, was man sich selbst eingesteht, der zu Grunde liegenden Arbeit an Wert beizumessen.

Der Wert dieses Titels ergibt sich für mich deshalb nicht in dem neuen Zusatz vor meinem Namen, sondern in der Tatsache, dass dieser für die Existenz einer “strukturelle Dissonanz” steht. Denn das bestehende System ermöglicht einem Kind von Nichtakademikern meist nicht, erfolgreich zu promovieren. Das schaffen, Stand Februar 2025, ungefähr 2 Prozent in Deutschland. Allerdings beginnen auch nur rund 27 Prozent der Schülerinnen und Schüler aus einem Nichtakademikerhaushalt überhaupt ein Studium.

In einer Zeit, in der so viel auf dem Prüfstand steht und demokratische Grundsätze ins Wanken geraten, in der Nächstenliebe und Vertrauen nicht mehr so häufig spürbar sind, ist das eine Tatsache, die mich dankbar sein lässt. Dankbar all denen gegenüber, die trotz aller systemischen Hürden, trotz aller Stigmata, trotz aller unterschiedlichen Grundvoraussetzungen einem kleinen Mädchen, einer jungen Frau, einer sich entwickelnden Wissenschaftlerin es zugetraut haben, dass sie das schon schaffen wird. Es sind wundervolle Menschen, die, oft ganz unbewusst, gegen die bestehenden Strukturen jeden Tag kämpfen und ein klein bisschen mehr Raum schaffen für all die, die bisher keinen Zugang hatten. Ein kleiner Spalt nur, ein Zeh in der Tür aber, kann so viel verändern, kann beflügeln, motivieren, antreiben - hat Wirkung. Dafür sage ich Danke. Und nehme mir fest vor, diesen Beispielen zu folgen, um auch anderen zu ermöglichen, ihren Träumen zu folgen und damit hoffentlich immer mehr Ungleicheit abzubauen.

Abstract

This thesis endeavors to provide a comprehensive understanding of the interplay between impact investing and the unique challenges faced by impact-driven startups. Accounting for the ever-present liability of newness and smallness of startups, the thesis provides pathways to minimize the liability of impact intransparency. This thesis employs a multi-method approach: Ten explorative interviews with investors, consultants, and startups are complemented with a survey of 69 impact investors to understand the criteria for identifying and investing in impact-driven startups. A network analysis of the German impact investor network builds on the previous findings. Additionally, 25 semi-structured interviews with impact-driven startups pinpoint the startups' point of view on impact assessment and measurement practices. A design science approach concludes the empirical findings via 20 semi-structured interviews with experts in impact investing and sustainable innovation, user testing with three impact-driven startups, qualitative evaluation via seven experts in impact investing and sustainable innovation, and a focus group workshop with six researchers from the field of impact investing and sustainable innovation. The first part points out a gap between the fundamental impact investing goals toward a sustainable future and the current impact assessment practices, highlighting the tendency of homophily by impact investors. These findings are complemented by exploring startup requirements and considering challenges such as scalability, resource constraints, and data availability. The second part synthesizes research to propose and validate four design principles via a design instantiation for impact assessment and measurement of startups.

Consequently, this thesis adds an empirical perspective to the limited research about impact investing and entrepreneurship. It emphasizes the theoretical relevance of conflicting goals, social learning, and information asymmetry in the interconnection of impact investors and impact-driven startups. Further, it contributes to the ongoing debate about startups' legitimacy in relation to sustainability. The findings highlight the necessity of translating impact goals into tangible criteria that can be measured at the output level to strengthen the legitimacy of an impact claim.

Zusammenfassung

Die vorliegende Dissertation befasst sich mit Impact Investments in Startups, spezifisch mit den Anforderungen zur Messung der Wirkung und der Bewertung von impact-orientierten Startups durch Impact Investoren. Unter Berücksichtigung der bestehenden Unsicherheit von Investitionen in Startups durch die Neuheit und Kleinheit, bietet die Arbeit Wege zur Minimierung der Intransaprenz über die tatsächliche Wirkung von Start-ups. Die Arbeit verwendet einen multimethodischer Ansatz: Zehn explorative Interviews mit Investoren, Beratern und Startups werden durch eine Befragung von 69 Impact-Investoren ergänzt, um die Kriterien für die Identifizierung von und die Investition in wirkungsorientierte Startups zu verstehen. Eine Netzwerkanalyse des deutschen Impact-Investoren-Netzwerks baut auf den beiden vorangegangenen Studien auf. Darüber hinaus zeigen 25 semi-strukturierte Interviews mit wirkungsorientierte Startups die Sichtweise der Startups in Bezug auf Impact Bewertung und -Messung auf. Ein design science Ansatz rundet die empirischen Ergebnisse ab durch 20 semi-strukturierte Interviews mit Experten aus den Bereichen Impact Investing und nachhaltigen Innovationen, Nutzertests mit drei wirkungsorientierte Startups, eine qualitative Evaluation durch sieben Experten aus den Bereichen Impact Investing und nachhaltiger Innovationen sowie einen Fokusgruppen-Workshop mit sechs Forschern aus den Bereichen Impact Investing und nachhaltiger Innovationen. Der erste Teil zeigt eine Lücke zwischen den grundlegenden Zielen von Impact Investing in Richtung einer nachhaltigen Zukunft und den aktuellen Praktiken der Impact Bewertung auf, wobei die Tendenz zur Homophilie bei Impact-Investoren hervorgehoben wird. Diese Erkenntnisse werden durch die Untersuchung der Anforderungen von Start-ups und die Berücksichtigung von Herausforderungen wie Skalierbarkeit, Ressourcenbeschränkungen und Datenverfügbarkeit ergänzt. Im zweiten Teil folgt eine Forschungssynthese, um vier Designprinzipien für die Bewertung und Messung der Auswirkungen von Startups vorzuschlagen und zu validieren. Dementsprechend fügt die Arbeit der begrenzten Forschung im Bereich Impact Investing und Unternehmertum eine empirische Perspektive hinzu. Die Arbeit unterstreicht vor allem die theoretische Relevanz von Zielkonflikten, sozialem Lernen und Informationsasymmetrie in der Verbindung von Impact-Investoren und Startups. Darüber hinaus leistet sie einen Beitrag zum wissenschaftlichen Diskurs über die Legitimität von Startups in Bezug auf Nachhaltigkeit. Um die Legitimität eines Impact-Ziels zu stärken, unterstreichen die Ergebnisse die Notwendigkeit für Startups, ihre Impact-Ziele in greifbare Kriterien zu übersetzen, die auf der Output-Ebene gemessen werden können.

Content

List of Figures

List of Tables

List of Abbreviations

BII	Bundesinitiative Impact Investing
BNW	Bundesverband Nachhaltige Wirtschaft
CSDDD	Act on Corporate Due Diligence Obligations in Supply Chains
CRIC	Corporate Responsibility Interface Center
CNM	Clauset-Newman-Moore
DSR	Design science research
DR	Design requirement
DP	Design principle
e.g.	exempli gratia
EIA	Environmental impact assessment
ESG	Environmental, Social, and Governance
FNG	Forum Nachhaltige Geldanlagen
GIIN	Global Impact Investing Network
GIIRS	Global Impact Investing Rating System
GN	Girvan-Newman
GRI	Global Reporting Initiative
GRQ	Guiding research questions
HNWIs	High-net-worth individuals
ICT	Information and communications technology
i.e.	id est
IFC	International Finance Corporation
IOOI	input-output-outcome-impact
IRIS+	Impact Reporting and Investment Standards+
KPI	Key performance indicator
MSCI	Morgan Stanley Capital International
NGO	Non-governmental organization
SEND	Social Entrepreneurship Netzwerk Deutschland
SDGs	Sustainable Development Goals
SIA	Social impact assessment
SLR	Systematic literature review
UN	United Nations
VC	Venture Capitalist
WT	Wakita-Tsurumi

Part I – Fundamentals

It is not because things are difficult that we do not dare,
but because we do not dare, things are difficult.
Seneca, Moral Letters to Lucilius

1. Introduction

Impact-driven entrepreneurs imagine a world with fewer inequalities, more inclusion, and more ecological responsibility. In a time when a multipolar world combined with an ecological crisis threatens the prospects of many people, their goal is to have a positive impact on society and the planet with their startup ideas (Canestrino et al., 2020). Common examples of a startup's positive impact include improving clean water or infrastructure availability in a particular region, reducing environmental pollution, or increasing social welfare by providing jobs or healthcare opportunities.

To realize their ideas, startups need partners. Investors, in general, aim to identify potential and invest in it. Impact investors seek to positively impact society and the planet with their investments in addition to positive financial returns (Brock & Knorz, 2020; Trelstad, 2016). Therefore, they can be seen as a perfect fit for impact-driven startups.

However, both sides must accept the other as a legitimate partner to realize this fit between an impact investor and an impact-driven startup. To invest in impact-driven startups, impact investors face the liability of newness and smallness (Abatecola et al., 2012; Freeman et al., 1983) and, additionally, the liability of impact intransparency. This implies that startups must prove they are legitimate cases for an impact investment decision (Dumont, 2024; Scherer et al., 2013).

To prove impactfulness especially imposes difficulties on impact investors and impact-driven startups alike due to the lack of, for example, available data (Trautwein, 2021) for the startup to measure the potential impact. This, in turn, hinders the assessment of impact, though it is central to impact investing (Lee et al., 2020; Reeder et al., 2015). Not being able to assess a startup’s impact prevents impact investors from realizing social or environmental potential through their investments (Verrinder et al., 2018).

More research is necessary about the so-called impact of impact-driven startups. First and foremost, it is of interest to analyze what truly matters to impact investors in assessing startups and how these startups need to demonstrate their ability to unlock the full potential of a sustainable future (Eckerle et al., 2022). This is the aim of this thesis. Accordingly, this thesis investigates the following overarching research question:

How can startups minimize the liability of impact intransparency to be assessed as a legitimate investment case for impact investors?

Multiple studies are conducted to address this question, investigating guiding research questions (GRQ). First, an explorative study is conducted to understand the current decision criteria for identifying and assessing impact-driven startups in theory and practice. It is therefore asked:

GRQ1: *What are conceptually grounded and empirically validated criteria for an investment decision for an impact-driven startup?*

Specifically, based on a systematic literature review concerning the criteria of impact investors to identify suitable investment cases, semi-structured interviews are conducted with experts in the field of impact investing. The results of this initial study highlight a phenomenon that has been scarcely investigated, especially concerning "impact" and its operationalization. The interview study informs future research paths, leading to a quantitative study. Here, a survey with impact investors is conducted based on a set of impact criteria systematically derived from the literature. While a comprehensive set of impact criteria can be validated through this study, the findings show that certain preferences seem to exist in impact investors' decisions to invest in startups. This informs the second question.

GRQ2: *What are the underlying preferences of impact investors when investing in startups?*

An extensive social network analysis of the German impact investor network supports the formerly deducted assumptions about prevalent preferences in impact investor behavior. Certain characteristics reveal underlying preferences of impact investors, which can influence the current practice of impact assessment of startups, as some impact criteria will be predominantly measured over other relevant ones.

While these studies add new knowledge to understand impact investors better in their pursuit of identifying legitimate impact-drive startups, up to date, the startup's point of view has been neglected in impact investing research. How impact-driven startups currently conduct impact measurement and what specific barriers and challenges they face in measuring their impact is the focus of the analysis surrounding the third question:

GRQ3: *What are startup-specific barriers and challenges for impact measurement?*

A qualitative interview study with impact-driven startups and investors/investor consultants is deemed fitting to understand the current practices and their related obstacles in-depth and deduct recommendations to support impact measurement and, in turn, impact assessment of startups.

In entrepreneurship research, it is common practice to support young entrepreneurs along their journey to found and grow their company with helpful guidance to approach this endeavor systematically. One paradigm for this is design science research, which can be used to design relevant and rigorous artifacts, such as methods or tools (Terzidis et al., 2023). Overarching guiding principles for designing an appropriate methodological artifact could help enhance the efficiency and effectiveness of the impact assessment of young companies. Hence, this thesis aims to establish prescriptive guidelines to craft appropriate future methodological artifacts to enable the measurement of impact by startups and, thereby, the assessment of impact-driven startups. Concluding, it is investigated:

GRQ4: *How to design new methodological artifacts to provide support for the impact assessment of impact-driven startups?*

First, design requirements (DR) and design principles (DP) are deducted from the triangulation of research results conducted for GRQ1-3. These are then iteratively validated over three design cycles via a design instantiation. Thus, design principles for designing artifacts for the impact assessment of impact-driven startups have been developed by considering the current literature, the investor, and the impact-driven startup perspective.

2. Research Design and Structure

A multi-faceted research investigation is necessary to explore this phenomenon of assessing startups for a potential investment, especially with the distinction of such a transformative potential as impact investing. Various aspects need to be considered when developing an appropriate methodological approach to this issue:

As indicated, the research field is, up until now, relatively unexplored, with only a few conceptual studies or frameworks based on empirical data that help understand the relationship between impact investors and investees, especially at an early stage of starting a venture (Eckerle et al., 2022). Guiding work is often phenomenological (e.g., Gidron et al., 2021), focusing on success factors of impact startups (Bocken, 2015) or analyzing impact investment readiness, making no clear conceptual distinction to other research branches, such as social entrepreneurship (Hazenberg et al., 2013).

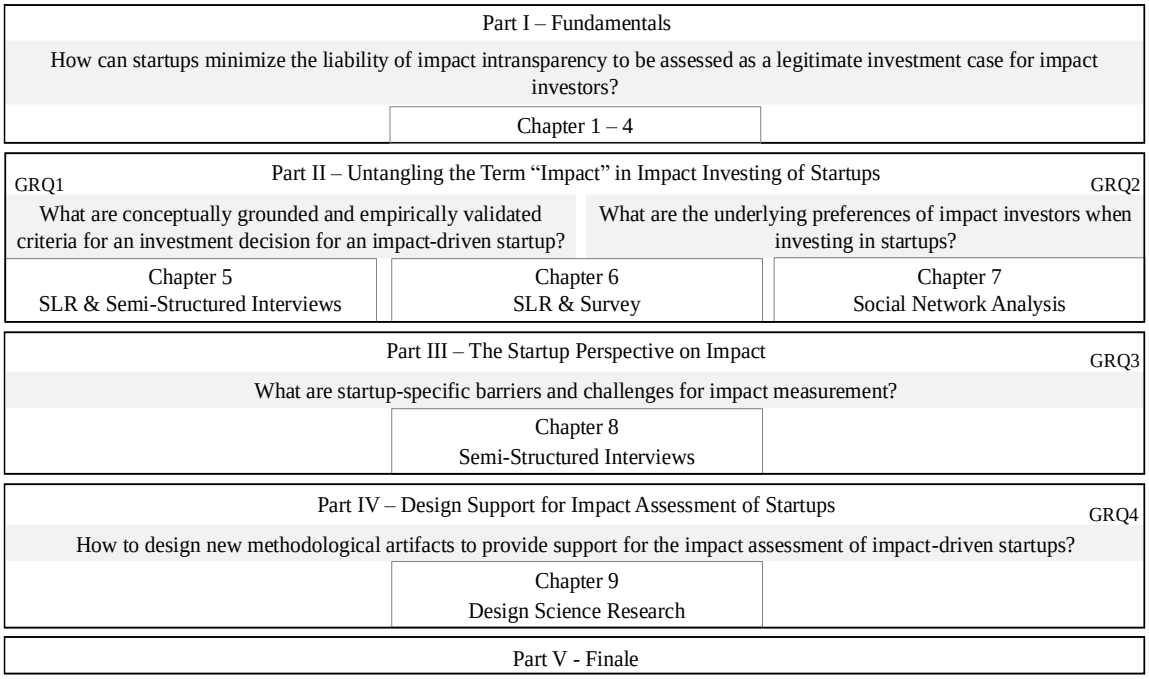
Thus, new research on identifying impact startups must be explorative to enter this field (GRQ1). Second, to close this gap of conceptual unclarity about other forms of sustainable startup and investment types (Olteanu & Fichter, 2022) or the use of different terminology for the same phenomenon (Horne & Fichter, 2022), research needs to be conducted on a more holistic and abstract level, which leads to different aspects needing to be studied separately (GRQ 2). Third, different data sources should be considered for different facets of the research. For example, combining qualitative interviews and a quantitative survey is appropriate for analyzing the underlying impact criteria of investor decisions (GRQ1). At the same time, an analysis via interviews with impact-driven startups and their investors is necessary to understand the challenges and barriers of the startups, as interviews offer nuanced views to be captured in a detailed way (e.g., GRQ3).

Considering these circumstances, comprehensively answering the guiding research questions requires the exploitation of multiple research methods and a pragmatic approach. As such, the research questions are examined through purposefully designed research studies, though interdependencies have been considered to ensure a golden thread. This allows the application of appropriate and different research methods and techniques tailored to the respective research objectives. A combination of qualitative and quantitative research and design science research (Kuechler & Vaishnavi, 2008; Seckler

et al., 2021) has been chosen to address the conceptual and practice-oriented research objectives effectively.

Figure 1 provides an overview of the research studies conducted to examine the guiding research questions. It includes their applied methods and corresponding guiding research questions and provides an overview of the resulting structure of the thesis.

Figure 1: Overview of the Conducted Research Studies and Structure of this Thesis (Own Illustration)



This thesis is divided into five parts. Part I outlines the introduction and foundation of this thesis. Thus, the primary motivation is presented, the structure of this thesis is described, and the state of the art in academic literature is critically discussed (Chapters 1-4). Part II highlights the lack of conceptual clarity concerning identifying impact-driven startups. Three studies are performed to open up the "black box" of impact in relation to impact criteria to identify impact-driven startups (Chapters 5-7). Part III then puts the startups front and center and investigates their reality and problems concerning impact measurement (Chapter 8). Part IV consolidates the findings from the former studies to deduct design recommendations for artifact development to foster impact assessment of startups (Chapter 9). Part V discusses the overall findings of this thesis and concludes after discussing limitations and an outlook for future studies (Chapter 10).

3. Development of the Thesis and Publications

As with any well-conducted research, this research is not the work of solely one person. While the different studies present the author´s unique contribution, they have all benefitted from numerous academic discussions, talks, and other exchanges with colleagues, conference track chairs, reviewers, or entrepreneurship students. The following publications and conference presentations, as well as bachelor and master theses supervised by the author, contributed to this thesis:

Journal Publications and Conference Proceedings

- Eckerle, C.; Manthey, S.; Terzidis, O. (2022). How to Valuate Impact Startups – Towards a Taxonomy (Research-in-Progress). 17th International Conference on Design Science Research in Information Systems and Technology (DESRIST), 1st - 3rd June 2022, St. Petersburg, FL, USA
- Eckerle, C.; Manthey, S.; Terzidis, O. (2022). The Entrepreneurial Perspective in Impact Investing Research – A Research Agenda. Proceedings of the 17th European Conference on Innovation and Entrepreneurship: Hosted by Neapolis University, Pafos, Cyprus, 15–16 September 2022. Ed.: P. Sklias, 189–196, Academic Conferences International (ACI). doi:10.34190/ecie.17.1.389
- Eckerle, C.; Finner, A.-S.; Terzidis, O. (2023). Patterns in Preferences? Key Impact Categories in Investors' Valuation of Startups. Academy of Management Proceedings, 2023 (1). doi:10.5465/AMPROC.2023.12092abstract
- Eckerle, C.; Finner, A.-S.; Terzidis, O. (2024). Investor perspective on impact-driven startups – the prioritization of certainty. Social Enterprise Journal. doi:10.1108/SEJ-02-2024-0028
- Eckerle, C.; Terzidis, O. (2024). Designing impact due diligence for startups. Journal of Business Venturing Design, 3, Articel no: 100020. doi:10.1016/j.jbvd.2024.10002

Book Chapter

- Eckerle, C. (2025): Impact Messung und Management für Startups. In: Anzengruber J. & Schallmo, D. (Hrsg.). (2025): Impact Entrepreneurship. Springer Verlag. Forthcoming.

Conference Presentations

- Eckerle, C.; Manthey, S.; Terzidis, O. (2022). An Empirical Investigation of Impact Investment Categories for Early-Stage Venture Valuation – Global Versus Local Perspectives. 82nd Annual Meeting of the Academy of Management (2022), Seattle, WA, USA, August 5–9, 2022
- Eckerle, C. (2023). Unraveling Criteria for Impact Startups. 23rd EURAM 2023, Dublin, Ireland, June 14–16, 2023.

- Eckerle, C.; Finner, A. S. (2024). Enhancing Transparency of Startup Impact Assessment. 84. Wissenschaftliche Jahrestagung des Verbandes der Hochschullehrerinnen und Hochschullehrer für Betriebswirtschaft e.V. (2024), Lüneburg, Germany, March 6–8, 2024

Currently Under Review

- Eckerle, C. and O. Terzidis. Designing and Testing a Tool for Startup Impact Assessment. *Small Business Economics Journal*. (2025).

Supervised Theses

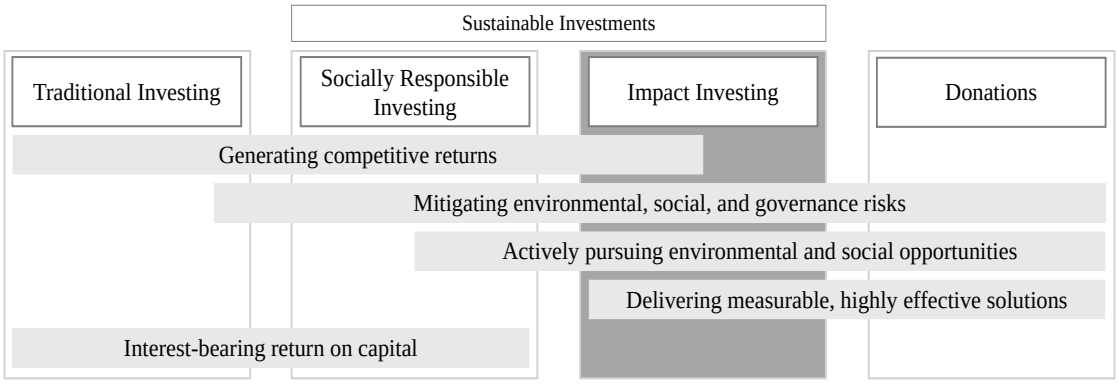
- Edelmann, I. M. (2021). Testing and Evaluating of the Practical Application of Different Tools for the Impact of Start-ups – a Case Study. Department of Economics, Karlsruhe Institute of Technology.
- Wegner, T. M. (2021). Impact Investment - A Systematic Literature Review. Master's thesis, Department of Economics, Karlsruhe Institute of Technology.
- Wilking D. (2022). Impact Assessment Criteria – A Survey-based Evaluation by European Impact Investors. Master's thesis, Department of Economics, Karlsruhe Institute of Technology.
- Blättner, D. V. (2022). Evaluation of the Importance of Impact and Investment Criteria in Impact-Investing of Early-Stage Startups. Bachelor's thesis, Department of Economics, Karlsruhe Institute of Technology.
- Bernhardt, M. (2023). Identification of Requirements for Impact Assessment of Sustainable Startups. Master´s thesis, Department of Economics, Karlsruhe Institute of Technology.
- Thiel, J. A. (2022). Designing an Impact Evaluation Template for Early Stage Start-ups. Master´s thesis, Department of Economics, Karlsruhe Institute of Technology.
- Rogulsky, V. (2023). Impact Investoren: Definition und Netzwerkanalyse in Deutschland. Master´s thesis, Department of Economics, Karlsruhe Institute of Technology.
- Joshua, L. K. (2023). What Signals of Early-Stage Startups Matter to Impact Investors? Master´s thesis, Department of Economics, Karlsruhe Institute of Technology.

4. State of the Art

To approach the emerging field of impact investing and impact-driven entrepreneurship and to contribute knowledge to the initial starting point of the relationship between investors and entrepreneurs, the two concepts need to be explained in more detail.

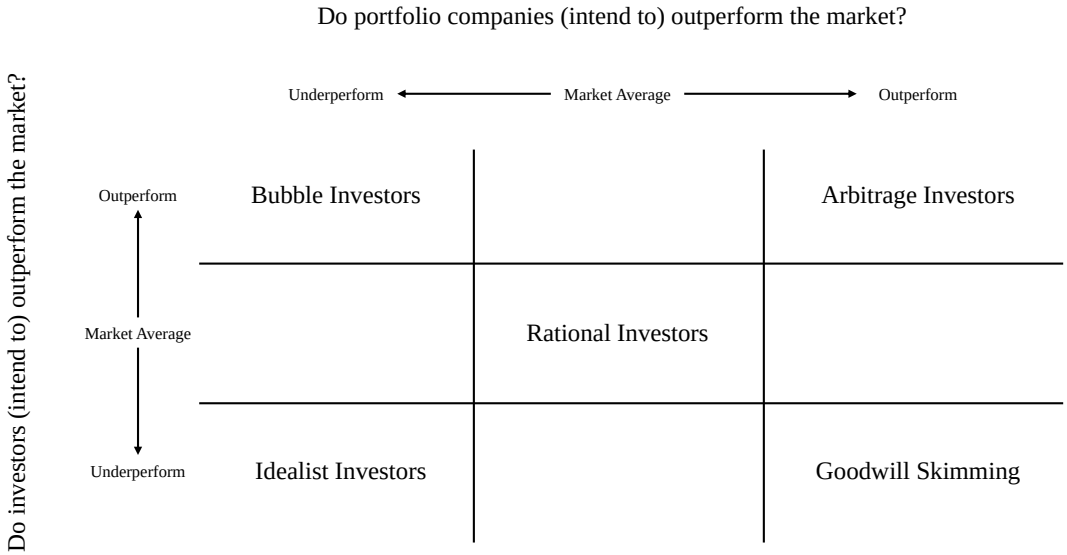
Impact investments differ from dominant sustainable investment types (Bose et al., 2019). As Figure 2 illustrates, impact investing can be seen as a form of capital that merges traditional investors' motivation to optimize risk-adjusted financial return with donations that actively work towards a positive impact (O'Donohoe et al., 2010; Petrick & Birnbaum, 2016). Impact investing is characterized by three features compared to other modes of social investing: (1) social and environmental returns are not random but are defined and constantly (tried to be) measured, (2) social impact is proactively sought, and (3) at least the invested capital is expected to be repaid (Calderini et al., 2018). Therefore, impact investments are investments made to generate positive, measurable social and environmental impact alongside a financial return (GIIN, 2020; Roundy et al., 2017).

Figure 2: Classification of Impact Investing (adapted from Petrick & Birnbaum, 2016)



The literature distinguishes impact investors based on a continuum of "impact-first" to "finance-first" approaches (Barman, 2015; Cetindamar & Ozkazanc-Pan, 2017; Höchstädter & Scheck, 2015; Ormiston, 2019). (Hockerts et al., 2022) comprise this continuum in a matrix with five different impact investor types. As Figure 3 depicts, the horizontal axis represents the expected returns of the companies in which investments are made (portfolio companies). In contrast, the vertical axis represents the expected returns of the investors or fund managers (Hockerts et al., 2022).

Figure 3: Sub-Groups of Impact Investors (adapted from Hockerts et al., 2022)



Idealist impact investors, who prioritize social or environmental impact over financial returns, follow a theory of change that recognizes transformative investments overlooked by conventional financiers due to unattractive risk/return profiles (Hockerts et al., 2022). For example, Shared Interest, a UK credit cooperative, exemplifies this approach by providing concessionary loans to fair trade organizations (Mellor & Moore, 2005). Idealistic impact investing balances maximizing impact and preserving capital and illustrates the fine line between investment and philanthropy, such as microfinancing, where investors receive only their capital back without interest (Yunus et al., 2010).

Arbitrage impact investors believe impact investing can outperform traditional markets by identifying hidden complementarities (Hockerts, 2015). Their transformative role is illustrated by early investments in companies such as Tesla, which shaped the electric car market (Hockerts et al., 2022). Hence, they acknowledge the need for sustainable solutions but seem to follow the path of least resistance, leveraging opportunities of sustainable trends.

Rational impact investors engage in active governance, influencing investee companies towards more significant impact and aligning with environmental, social, and governance (ESG) and sustainable investment principles (Chen & Yang, 2020; Halbritter & Dorfleitner, 2015). They navigate deviations in aligning financial and impact objectives, contributing to sustainable investment practices (Hockerts et al., 2022). One

example could be the investment and active engagement in Vytal, a software-enabled reusable packaging solutions provider, to eliminate single-use packaging waste (Crunchbase, 2024). One of their board members, as of June 2024, is from the investment firm Emerald Technology Ventures, who claim to invest in sustainable industrial innovations (Emerald, 2024).

Bubble impact investors target companies with low market capitalization but high interest, risking inflated valuations (Hockerts et al., 2022). A study by Can (2023) highlights the risk of overvaluation in sustainability indices in financial markets and the need for balanced assessment by impact investors. Thereby, bubble investors risk investing in "impact-washing" startups, which can damage the reputation of both the investor and the startup (Azmat et al., 2022).

This is even more prevalent for the last group identified by Hockerts and colleagues (2022): Goodwill skimming investors provide concessionary capital to profit-driven investees, risking the misdirection of impact subsidies. (Thirion et al., 2022) explore this issue, showing how impact-related bonuses can be exploited and highlighting the ethical dilemmas in balancing financial profit motives with social impact goals.

From the conceptual model by Hockerts and colleagues (2022), it becomes evident that a clear distinction between impact investor types is not easy to make; instead, they act on a continuum between impact first to finance first investment behavior. Therefore, it can be deduced that impact investors are characterized by a constant effort to balance the hybrid goals of financial returns and the intent to generate a positive impact.

In a systematic literature review (Eckerle et al., 2022), several further difficulties of impact investing could be identified: the investors often lack the knowledge for (1) adequate theorizing of impact approaches, (2) assessing the drivers and impact itself, and face (3) high transaction costs for additional due diligence. However, if they decide to invest, they are characterized by a strong engagement with their investees and offer tailored financing, extensive support, and organizational capacity building while requesting performance measurement. Likewise, impact investors expect from their investees an explicit social and ecological mission, a transparent and well-defined theory of change, and a well-established track record at a growth stage. In most identified studies,

impact investors mainly focus on developing countries and social inequalities. (Eckerle et al., 2022)

The scientific literature regards entrepreneurship as critical for sustainable development, with startups developing innovative solutions to social and environmental issues (Bocken, 2015; Eckerle et al., 2022; Pacheco et al., 2010). In general, startups can be divided into three stages: 1) (Pre-)Seed Stage, 2) Startup Phase, and 3) Expansion Phase (Hahn, 2018). The boundaries between the individual phases are blurred, and startups can be classified into several life cycle phases.

The early stages – from pre-see to startup phase – of the company foundation are characterized by validating the business model, testing the market, and improving the product or service. During this phase, the ideas are generated, formulated, and then implemented (Kollmann, 2019). In the startup phase, the company is founded, and the market-ready product or service is finalized (Fritsch & Wyrwich, 2021). Moreover, since they expect to make financial losses at this stage, they depend on money from angel investors, venture capital firms, or private equity firms (Fritsch & Wyrwich, 2021; Hahn, 2018). Accordingly, investors are critical stakeholders of early-stage startups.

Just like impact investors must manage hybrid goals, studies highlight the conflict of goals for impact-driven entrepreneurs, which can lead to a mission drift from the sustainability aspect towards financial gains due to, e.g., investor demands (Cetindamar & Ozkazanc-Pan, 2017; Pieniazek et al., 2024). However, studies propose that sustainability, profitability, and growth are increasingly perceived as compatible goals in entrepreneurship (Santos et al., 2015; Vedula et al., 2022). Therefore, as Eckerle et al. (2022) found in the literature, an investee is a hybrid organization that "has a primary mission or is a social enterprise or social purpose organization, is not publicly traded, and may or may not be for-profit" (Höchstädter & Scheck, 2015, p. 459). These hybrid organizations create value for society and the environment by developing progressive business models and applying entrepreneurial and highly innovative approaches (Agrawal & Hockerts, 2021; Eckerle et al., 2022).

In the literature, these hybrid organizations are often called "social enterprises" with the primary goal of solving social challenges (Lall, 2019). However, this is not the only term coined for this phenomenon, with multiple inconsistent definitions in different

contexts (Vedula et al., 2022). Recent work has tried to disentangle the multiple terms used in literature, such as “social” or “green” entrepreneurship, and developed guiding typologies (Haldar, 2019). While a distinction is often made between environmental and social innovation-related issues, a clear line is difficult to draw (Bergset & Fichter, 2015).

This thesis builds on the distillation work by Schäfer et al. (2015), who define sustainable entrepreneurship as an umbrella term for all types of impact-driven startups that intend to enable transformational change by generating social value (for people, communities, and marginalized groups) or ecological value (by preserving or regenerating the natural environment) (Eckerle et al., 2024).

With an appropriate business model that pursues social and economic impact with the effectiveness and efficiency used for commercial activities, impact-driven startups can attract both traditional investors and impact investors (Cetindamar & Ozkazanc-Pan, 2017). However, these companies face unique hurdles in attracting impact investors, which reduces their chances of being perceived as legitimate investment cases.

After the SLR by Eckerle et al. (2022)[1], which only identified one study focusing on startups, research on impact-driven startups has accelerated. This prompted another systematic search until July 2024. Thereby, 14 relevant publications could be identified. They can be grouped into challenges at the miso level inherent to the startups, challenges at the meso level related to the startups' relationship with investors, and challenges at the macro level. In Table 1, the identified challenges are listed with their respective publications.

Table 1: Identified Challenges of Impact-driven Startups (Own Illustration)

Micro Level	
Category	Publications
Hybrid mission	Hirschmann et al. (2022); Schätzlein et al. (2023)
Impact measurement	Fichter et al. (2023); Siefkes et al. (2023); Singhania and Swami (2024)
Staff qualifications	Hirschmann et al. (2022); Pierrakis and Owen (2023)
Research	Singhania and Swami (2024)
Meso Level	

[1] The data was acquired during a master thesis, supervised by the author; see Wegner (2021) (cf. Chapter 3).

Category	Publications
Impact expectation	Bachmann et al. (2024); Heinz and Velamuri (2024); Paetzold et al. (2022)
Investor-Investee mismatch	Pierrakis and Owen (2023); Siefkes et al. (2023); Wöhler and Haase (2022)
Funding / Financing	Fichter et al. (2023); Schätzlein et al. (2023)
Investment decision making process	Wöhler and Haase (2022)
Macro Level	
Category	Publications
Location problem & environment	Boulongne et al. (2024); Jia and Desa (2020); Tunçalp and Yıldırım (2022)
Rating systems	Fichter et al. (2023); Siefkes et al. (2023); Singhania and Swami (2024)
Regulations	Jia and Desa (2020); McCallum and Viviers (2020)

Inherent to the startup is the aforementioned challenge of a hybrid mission. Thus, tension arises between the need to achieve a significant social impact and the challenge of ensuring financial stability. To be financially sustainable in the long term, social enterprises must charge prices that cover their costs, which makes it challenging to balance these competing goals (Hirschmann et al., 2022). Yet, at the meso level, impact expectations are fuzzy. A key problem is the lack of a standardized definition of "impact". Investors may place different levels of importance on impact in their investment criteria, which leads to divergent valuation (Heinz & Velamuri, 2024). This increases the chance of investor-investee mismatch.

A key challenge for impact-driven startups lies in the information asymmetries between the entrepreneurs and the investors. Startups face the problem of missing qualified staff or other resources to invest in research concerning their impact (Hirschmann et al., 2022; Pierrakis & Owen, 2023; Singhania & Swami, 2024) in order to measure and report on their impact (Fichter et al., 2023; Siefkes et al., 2023; Singhania & Swami, 2024). Investors, on the other hand, often lack an understanding of the specific sustainability requirements, especially regarding new products, services, and markets. These competency gaps make it difficult for investors to adequately assess and promote sustainable startups' added value (Siefkes et al., 2023).

Another risk of mismatch is the aforementioned potential for mission drift, where short-term returns are prioritized over long-term sustainability goals. To minimize this risk, young ventures should seek out investors who share their vision. In particular, investors who pay attention to the triple bottom line (economic, environmental, and social value creation) can help prevent such a drift and ensure the company's long-term sustainability (Siefkes et al., 2023).

Outside conditions influence these challenges. Here, unclear or missing regulations, overly sophisticated yet intransparent rating systems, or local circumstances (Boulongne et al., 2024; Fichter et al., 2023; Jia & Desa, 2020; McCallum & Viviers, 2020; Tunçalp & Yıldırım, 2022) may diminish startup aspirations or hinder impact investors, as unclear definitions and legal obligations increase the risk for investing (Burand, 2015).

Looking at the findings, a similar picture emerges between impact investors and impact-driven startups. Especially at the micro and meso level, the two groups have similar perceptions of problems with impact investing. Eckerle et al. (2022) found that impact investors mainly see problems related to the startup stages and growth potential, the impact mission, and impact measurement, as shown in Table 2.

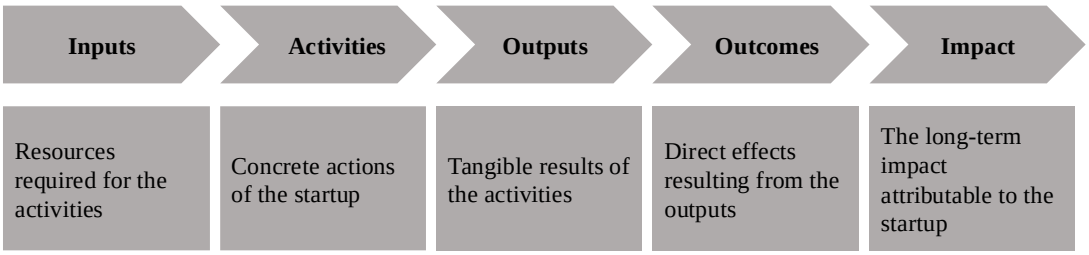
Table 2: Problems Associated with Investing in Impact-driven Startups (Own Illustration based on Eckerle et al., 2022)

Problems	Publications
Investors perceive them as riskier than conventional startups due to the high complexity of the business models, the emerging market focus, the lack of a track record, the small market size, and the associated small portfolio.	Arena et al. (2018); Brandstetter and Lehner (2015)
They are perceived as facing a high probability of mission drift (financial return vs. positive impact).	Cetindamar and Ozkazanc-Pan (2017); Hazenberg et al. (2013)
They are attributed with a limited extending and scaling potential due to collaborative and personal focus, and longer repayment periods are expected by the investors.	Gidron et al. (2021); Hazenberg et al. (2013)
Impact measurement is seen as problematic for startups due to the difficulty in data collection (lack of input and outcome data; inaccuracy and unreliability of data) and determination of causal relationships.	Aschari-Lincoln and Jacobs (2018); Bengo et al. (2021); Castellas et al. (2018); Phillips and Johnson (2021); Spiess-Knafl and Scheck (2017)

To minimize the problems they face when investing in impact-driven startups, many impact investors seek to quantify and/or monetize impact via indicators (Roundy et al., 2017) to gain a better understanding of impact generation and accountability (Ormiston, 2019; Strömmer & Ormiston, 2022). Therefore, certain reference frameworks exist in practice and are used by impact investors to incorporate measurable and comparable indicators into their investment activities. The most prominent ones are the United Nations Sustainable Development Goals (SDGs), followed by the Impact Reporting and Investment Standards+ (IRIS+) framework by the Global Impact Investing Network (GIIN) and the Global Impact Investing Rating System (GIIRS) by B Lab (Castellas et al., 2018; Santamarta et al., 2021; Tabares, 2021).

Likewise, more and more research aims to translate grand challenges, operationalized by, e.g., the SDGs, into business objectives (Bai et al., 2024). This approach is rooted in a so-called "Theory of Change" and aims to collect data structured along an input-output-outcome-impact (IOOI) chain (Wendt, 2021), see Figure 4. The goal is to demonstrate how the company's specific processes and activities contribute to achieving the desired social or environmental outcomes and to measure the effectiveness of those processes over time (Grieco, 2015; Mook et al., 2015).

Figure 4: Theory of Change (Own Illustration)



Ebrahim and Rangan (2014) distinguish between the immediate outputs (results), the medium- and longterm outcomes (effects on individuals), and the overarching medium- and longterm impact on the society of business activities (Crucke & Decramer, 2016).

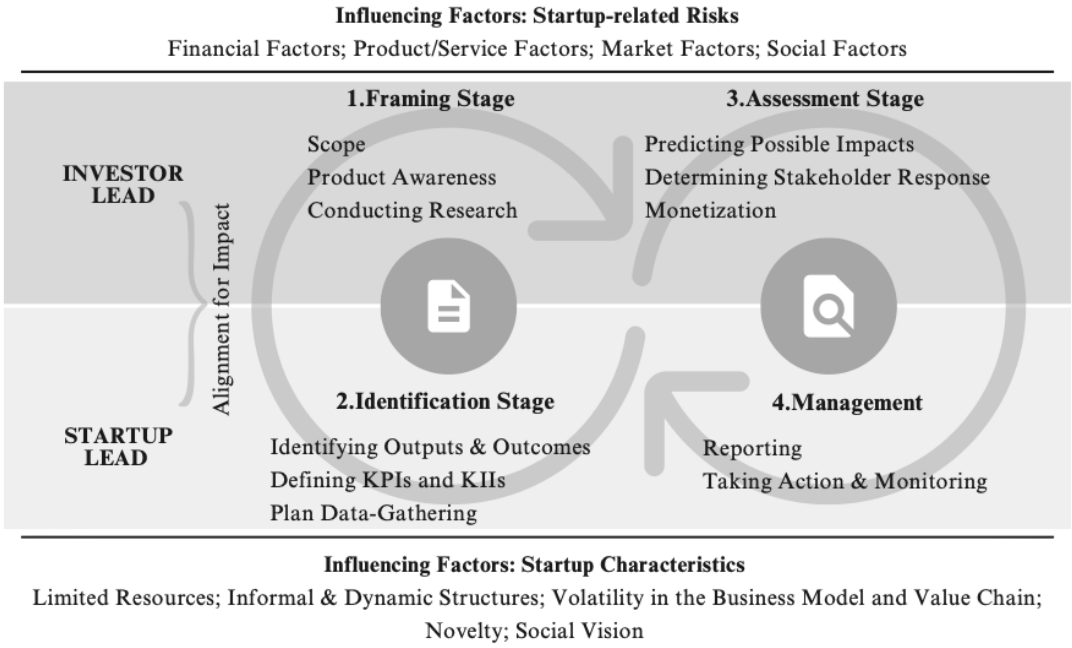
While former research has also tried to develop recommendations for impact measurement frameworks (Grieco et al., 2015), they are primarily aimed at established companies (Crucke & Decramer, 2016). These frameworks face the challenges of being 1) inappropriate for outcome-based measurements (Arena et al., 2016), prohibiting the potential impact from being assessed. 2) Used as a loophole to purely quantify and

monetize impact (Costa & Pesci, 2016; Spiess-Knafl & Scheck, 2017), which makes it hard to understand the broader implications of a company's activities and hinders a thorough assessment of the impact claims. 3) Designed for investors and unable to assess young companies' impact (Costa & Pesci, 2016), as the proposed indicators often demand high and aggregated data input.

Therefore, entrepreneurs seem opposed to standardized frameworks as they are too rigid and complex (Fichter et al., 2023). Their fallback strategy often seems to measure self-defined indicators. However, they often lack market knowledge and have inadequate financial literacy, resulting in the challenges of effectively measuring and valuing potential impact (Phillips & Johnson, 2021). This complexity and disregard for startup capabilities are apparent in all steps of an impact investment decision process, the so-called impact due diligence (Eckerle & Terzidis, 2024).

In their study, Eckerle and Terzidis (2024) highlight the necessity to adapt impact due diligence of startups based on their boundary conditions (see Figure 5). The authors propose that startup-related risks should be accounted for as much as the startup's characteristics. During all steps of impact due diligence, the conceptual framework emphasizes the alignment for impact between the investor and the startup, which demands an ongoing reflection and adjustment of the investor and startup viewpoints. This could minimize information asymmetry and avoid mission drift (Eckerle & Terzidis, 2024).

Figure 5: Impact Due Diligence for Startups (adapted from Eckerle & Terzidis, 2024)



To conclude, the literature shows that the outside perspective of investors and other factors pose major hurdles and pressure to impact-driven startups. This is increased due to unclear expectations concerning the operationalization of impact and the investment decision process of impact investors. Although initial pathways exist on how to overcome these hurdles, startups still seem to struggle internally with their hybrid mission and impact measurement. Considering the literature's findings, there seems to be a misfit between investor expectations and startups' capabilities for impact measurement. Therefore, the goal of this thesis is to better understand what the current reality of impact investments in startups looks like, how impact-driven startups can be assessed as legitimate investment cases, and, as a prerequisite, whether and how they can be supported to measure their potential impact.

Part II – Conceptualizing Impact

While research highlights the need to measure and assess this so-called impact, it needs to be clarified how impact can be operationalized, especially with regard to startups. Therefore, the first question this thesis addresses is:

GRQ1: What are conceptually grounded and empirically validated criteria for an investment decision for an impact-driven startup?

To answer GRQ1, ten expert interviews underpin the theoretical grounding derived from literature, while a quantitative study substantiates the picture. The first study focuses on understanding how impact-driven startups can be identified and the key criteria for an investment or support decision. It was observed that traditional criteria, such as the authenticity of the team or a proven track record, were as relevant as a startup's potential impact. However, when it comes to impact, there does not seem to be a standard set of indicators against which startups are currently assessed (cf. Chaper 5).

Therefore, the second study first consolidates the current state of the art on impact criteria and, based on this, designs a survey questionnaire to understand what preferences, if any, impact investors have when they invest in startups based on their impact focus (social versus environmental). The findings from a survey with 69 impact investors suggest a pattern in preferences of impact investors based on the impact focus of a startup, the startup stage, as well as the target market (Eckerle et al., 2024) (cf. Chapter 6). This already informs partly GRQ2, which the third study will further analyze:

GRQ2: What are the underlying preferences of impact investors when investing in startups?

The patterns mentioned above could entail social learning by impact investors, who look at their (similar) peers to decide on investment cases with similar decision criteria (Gangopadhyay & Nilakantan, 2021; Vives, 1996). If impact investors are typically organized in social networks within specific clusters, this indicates a tendency of homophily (Sun & Tang, 2011). An explorative social network analysis of Germany's impact investor network proves this assumption. The results of the third study verify a tendency for homophily within the network structures (cf. Chapter 7). This highlights the need for impact assessment to be designed to ensure that investments are made in genuinely sustainable and transformative innovations to avoid supporting or favoring "impact-washing" startups (Azmat et al., 2022).

5. Underlying Criteria of Impact-driven Startup Identification

5.1 Introduction

In times of upheaval, innovation can be one of the solutions to keep humanity on the right track if it is conceived sustainably (Kölbel et al., 2020). Entrepreneurs are seen as essential in balancing innovation and sustainability (Bocken, 2015). This potential of sustainable innovation has been recognized and supported by impact investors, who, while expecting a return on investment, focus specifically on the potential impact of the new ventures they invest in (Barber et al., 2021; Castellas et al., 2018). Within the entrepreneurial ecosystem, accelerator programs or intermediaries have likewise emerged to support impact-driven startups (Fichter et al., 2021). However, it is unclear how these actors assess a startup as a suitable, hence legitimate, case for (financial) support. This study aims to improve the understanding of the heuristics and criteria used in practice to assess the impact potential of a new company. Therefore, the research question supporting GRQ1 is as follows:

What are conceptually grounded and empirically validated criteria to identify an impact-driven startup?

From a practical point of view, a better understanding of the decision-making of support organizations (e.g., investors, accelerators, intermediaries) in the assessment process of sustainable startups is necessary to be able to give startups strategic recommendations on how to approach impact-related support (Agrawal & Hockerts, 2019; Cetindamar & Ozkazanc-Pan, 2017). Theoretically, this study contributes to the still young and ongoing research stream on impact investing in entrepreneurship (Eckerle et al., 2022). Furthermore, it adds another empirical perspective to the impact investing debate (see e.g., Höchstädter & Scheck, 2015). Finally, it highlights the societal responsibility of entrepreneurs (Zahra & Wright, 2016).

A two-step process was initiated to answer the research question. First, a SLR was conducted to identify common decision criteria among impact investors. As the output from the SLR is scarce in the field of interest, semi-structured interviews with experts in the field of impact investing were conducted to mirror and extend the findings from the

literature. Further, the study aims to understand why impact matters and why startups should focus on generating a positive impact.

5.2 Methodology

To answer the research question, an SLR is performed to illuminate and contrast the criteria that impact investors of early-stage startups use to make an investment or support decision. Additionally, semi-structured interviews are conducted with experts from the impact investing ecosystem to untangle the term impact, understand its reasoning, and identify impact categories.

5.2.1 Systematic Literature Review[2]

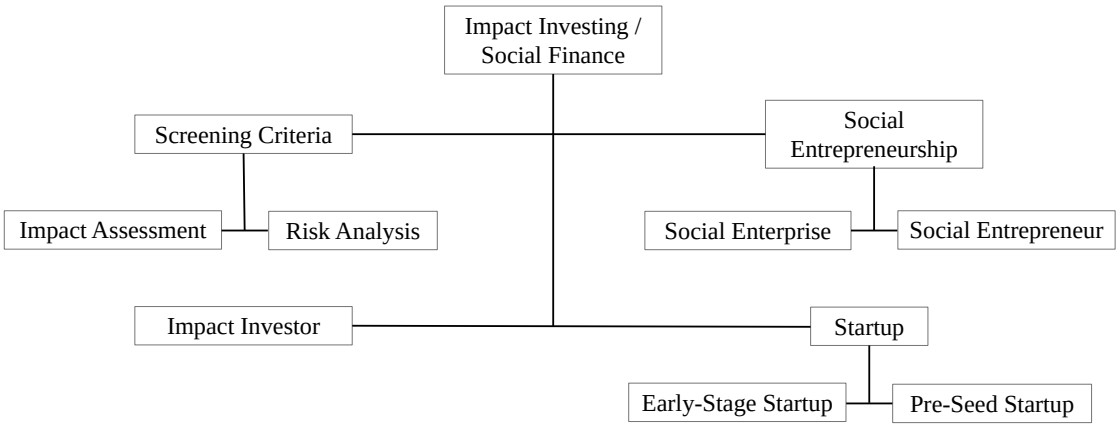
The publication period considered in the search covers the years 2007, when the term impact investing was gaining momentum (Harji & Jackson, 2012), to December 2022. The content will focus on impact investing publications that attempt to analyze impact investors' investment decisions. Since this research focuses on startups, but there is little literature on impact investing in young companies (Eckerle et al., 2022), investment criteria for established companies are not excluded from the analysis.

Based on Kraus et al. (2020), the databases Scopus, Web of Science, Science-Direct, and Springer Link were selected as they are particularly suitable for the entrepreneurship research area. The search string is compiled based on the research question and the base literature. Thus, it includes terms and potential synonyms around impact investing, early-stage startups, and the investigation of the approaches of the investment decision process. Around the topic of impact investing, the synonym social finance is frequently used and therefore applied, as well as the keywords social entrepreneurship, social enterprise, and social entrepreneur (Agrawal & Hockerts, 2021; Clarkin & Cangioni, 2016).

The keywords of the investment decision process and assessments are combined under screening criteria, impact investor, impact assessment, and risk analysis. Figure 6 shows the keywords of impact investing and its subcategories and synonyms in a concept map (vom Brocke et al., 2009).

[2] The data was acquired during a bachelor thesis, supervised by the author; see Blättner (2022) (cf. Chapter 3).

Figure 6: Concept Map (Own Illustration based on vom Brocke et al., 2009)



Thus, the following search string is utilized: "Impact-Investing" OR "Social Finance" AND ("Social Enterprise" OR "Social Entrepreneur" OR "Impact Investor" OR "Screening Criteria" OR "Risk Analysis" OR "Impact Assessment" OR "Early-Stage Startup" OR "Startup" OR "Pre-seed Startup").

The initial result of the literature search led to 352 articles. In addition, three articles were included based on a hand search. After removing all duplicates and the first screening of the title, abstract, and keyword, we screened 14 articles for their relevance to the research question. Based on the research objective, the following relevance criteria must be met to be included in the analysis: 1) Return-oriented impact investors must be studied. 2) The study must include an ex-ante evaluation of the investment (The investment decision process of impact investors). 3) Early-stage startups or at least small companies must be studied. This led to, in total, seven relevant publications that addressed the investment decision process of return-oriented impact investors of early-stage startups.

5.2.2 Semi-Structured Interviews

To bolster the SLR's findings and operationalize the criterion "impact", ten semi-structured interviews were conducted with an expert sample of people involved in impact assessment, measurement, and entrepreneurship. The interviewees included investors, entrepreneurs, startup accelerators, and independent experts (e.g., scientists or consultants); see Table 3.

Table 3: Overview of the Ten Interview Partners (Own Illustration)

Expert Code	Role	Organization / Actor Type
E1	Portfolio Manager	NESsT
E2	Scientific Cooperation Officer	SEND
E3	Co-Founder	Chi-Impact
E4	Co-Founder	Gruenhof
E5	Co-Founder	PlanA
E6	Professor	Sustainability Consultant
E7	Co-Founder	Impact Hub Stuttgart
E8	Product Owner	Loom Impact
E9	Lead Manager	GLS
E10	Project Manager	Social Impact Hub Stuttgart

The interviews took place between July and November 2021. Interviews, on average, took 30 min. The interviews were conducted via Zoom and recorded, for which the interviewees gave their permission either via consent form or right at the beginning of the interview by accepting the Zoom recording, which is a built-in function of Zoom. The interview content was then transcribed and anonymized for the following analysis. Eight out of the ten interviews were held in German, and the coded passages were then translated word-for-word to English, following standard orthography and American spelling conventions.

The semi-structured interviews covered the topics of impact definition, the responsibility of (impact-driven) entrepreneurs, the identification of impact startups, impact measurement, recommendations for impact startups, obstacles to impact investing in new ventures, and future developments around impact investing/impact startups.

Due to the thin and divergent empirical evidence in the literature concerning the assessment process of impact-driven startups, the data was analyzed following an inductive and deductive category system to retrieve as much relevant information as possible, following the qualitative content analysis approach by Mayring (2014).

In this iterative process, a first inductive analysis was performed based on the overarching themes from the interview guideline. Additional categories were identified while analyzing the sentences or cohesive paragraphs. Then, deductive categories from the SLR results were utilized. The interviews were coded multiple times to ensure the inclusion of all relevant parts. Each category was only coded once per expert. To ensure reliability, a second researcher checked for consistency and logic.

5.3 Results

5.3.1 Results of the SLR

The seven publications in the systematic literature review's final analysis are presented briefly below.

The studies of Block et al. (2021) and Roundy et al. (2017) examined "selection criteria" for the investment decisions of impact investors. Scholda et al. (2021) analyzed the cognitive patterns of impact investors based on “information factors” or “investment criteria”, such as the founding team, the product, the investor's suitability, or the business plan's structure. Yang et al. (2020) go beyond the assessment criteria of investors using signaling theory approaches to analyze the relationship between investors and founders based on their gender. Agrawal and Hockerts (2019) utilized an institutional logic framework to explain the inter-organizational relationship between impact investors. Likewise, Cetindamar and Ozkazanc-Pan (2017) verified the institutional logic of investors. In their paper, they present findings on the "mission drift" of impact investors. Paetzold et al. (2022) examined a specific type of investors, high-net-worth individuals (HNWIs), and how they interpret impact investing, how they practice it, and their impact and financial return expectations.

This shows that research has discussed different approaches to understanding the decision-making by impact investors concerning an investment. The main findings from the analysis of the SLR are summarized in Table 4.

Table 4: Investment Criteria of Impact Investors According to Literature (Own Illustration)

Authors	Method	Investment criteria	Impact Relevance	Investor Group
Agrawal & Hockerts (2019)	Case Study	Shared sector specialization; Shared DNA or social and commercial logic; Scalability of impact	N.A.	Impact investors with return expectation
Block et al. (2021)	Conjoint-Analysis	The authenticity of the founding team; Importance of the social or ecological problem	Less important than conventional criteria	Impact investors with and without return expectation

Cetindamar & Ozkazanc-Pan (2017)	Case Study	Shared DNA or social and commercial logic; Potential impact	First consideration before financial goals	Impact investors with return expectation
Paetzold et al. (2022)	Portfolio holdings, Survey, and Interviews	SDG with a high financial return	Slightly higher than financial considerations	Impact investors with return expectation, High-Net-Worth-Individuals
Roundy et al. (2017)	Interviews	Conventional criteria; The social mission of the founding team	N.A.	Impact investors with return expectation
Scholda et al. (2021)	Verbal protocol analysis	Conventional criteria; Social impact	Slightly less important than financial considerations	Impact investors with return expectation
Yang et al. (2020)	Probit Analysis	Social and economic credibility; Gender-typical signals	N.A.	Social Impact Accelerators with return expectation

Block et al. (2021), Roundy et al. (2017) and Scholda et al. (2021) found similar results. Conventional criteria are as relevant in evaluating an investment decision as a social or ecological problem. Looking at the results according to the relative importance of their survey results, the most important criterion, according to Block et al. (2021), is the authenticity of the founding team, followed directly by the importance of the social or ecological problem.

Roundy et al. (2017) found that impact investors have similar criteria to conventional Venture Capitalists (VC), such as the management team's valuation and the company's ability to grow. Still, according to their findings, the social mission of the founding team and how the social enterprise sells its idea is of great importance to impact investors. They found that social enterprises must be able to communicate the creation of social and financial value in the investment decision process. The authors summarized that impact investors were not acting as philanthropists but were seeking some level of financial return (Roundy et al., 2017).

Scholda et al. (2021) concluded that the "financial consideration" is considered first and then the "social impact" criterion. However, according to their findings, the distance between the two is minimal.

Paetzold et al. (2022) examined HNWIs and how they made their investments in line with the SDGs. They concluded that HNWIs want to achieve real impact in the wake of the SDGs but also invest with the prospect of high financial returns (Paetzold et al., 2022). In contrast to Block et al. (2021) and Roundy et al. (2017), the importance of impact (SDGs) is rated slightly higher. Nevertheless, impact investors want to implement this "the most profitable way possible" (Paetzold et al., 2022, p. 12).

Agrawal and Hockerts (2019) and Cetindamar and Ozkazanc-Pan (2017) sought to study impact investors through institutional logic. Agrawal and Hockerts (2019) found that common social and commercial logic is beneficial in reducing the risk of tensions through pre- and post-investment strategies. Pre-investment strategies must include sector specialization and better communication of future scalability and social impact to enable investment (Agrawal & Hockerts, 2019). A shared DNA[3] or similar understanding of social and commercial goals is also beneficial. Cetindamar and Ozkazanc-Pan (2017) clarified in their paper that before the investment decision, none of the impact investors focused on financial logic. However, the potential impact was the first consideration.

Lastly, Yang et al. (2020) researched about gender roles. Yang et al. (2020) illustrated that social impact accelerators select startups with social and economic credibility. They found that both men and women were more likely to invest if they sent signals consistent with their gender. It is not clear from the findings of the last-mentioned research whether the impact is the decisive criterion determining whether an investment is made.

Overall, the SLR could identify distinct selection criteria relevant for an impact investor in assessing impact-driven startups. In the second step, the results from the expert interviews are presented and consequently compared to the findings from the literature.

[3] "Investor DNA" refers to the values and organizational goals (social and commercial) of an investor (Agrawal & Hockerts, 2019).

5.3.2 Results of the Expert Interviews

In the first iteration, overarching topics were used to code and subsequently analyze the data inductively. The topics are "Impact Definition", "Justification for Impact Focus", "Responsibility of entrepreneurs", "Assessment", "Measurement Frameworks", and "Impact Categories".

In their definition of impact, the experts predominantly follow the current understanding that is immanent in the literature. Impact is about positive change at a societal level and addressing societal (environmental or social) issues while avoiding or reducing negative effects. At the company level, achieving a positive impact should be at the core of all actions, for example, by improving the lives of vulnerable people (E1), by significantly reducing CO2 emissions (E2), or by actively shaping solutions for a broad societal transformation (E9).

The reason an entrepreneur should focus on impact is closely related to the perception of employees, customers, and the public, who are demanding more sustainable practices and an alignment of (sustainable) values.

> *"That this organization, what it does for society and how it does it, i.e., with the values with which it does it, is in line with my personal drive"* (E10).

According to some experts, an impact-focus has the potential to become the new normal, and especially young startups can make use of this to succeed in the long run:

> *"Startups can actually say, it's not that important yet, in five years, believe me, we'll all have to do impact things, or even want to. And if you're in early, that's also an opportunity. It's also an opportunity to turn it into great business models"* (E8).

As pointed out, the arguments of why one should focus on impact are closely related to responsible actions and upfront related to the demand for a collective effort toward saving our planet and a just society. If not able to predict the actual impact, a company should act with the intent to change something for the better:

> *"We must preserve the future of the earth and of humanity. […] Is it sustainable or not? Yes, we don't know, we have to look. But that doesn't change the fact that the goal remains the same"* (E6).

According to the experts, the responsibility of entrepreneurs can be understood in two ways: towards society and the environment where regulations lack to push towards a more desired future, as well as towards their business practices. Especially for the first part, impact-driven entrepreneurs will go beyond the current "state-of-the-art" to act as pioneers:

> *"Everything you do has an impact. And you bear responsibility for that. Or should be, as I see it. And there are many areas for which you have to bear responsibility by law. However, there are some areas where this is not yet clearly regulated. This has a lot to do with negative external effects in the area of sustainability, for example. There are simply issues for which we are not held accountable or responsible. And that's where I think, or I know from all the sustainability pioneers, that responsibility is taken rather proactively, and I believe that in today's world, this is an important entrepreneurial role"* (E4).

> *"I think, responsibility is a very important attribute to anyone that wants to be a successful founder because the only way in which you can be useful to society, useful to your mission, useful to your company, is by really developing a good sense of responsibility for your employees, for your customers, and then embedding this into the way you manage. I think the more practical way of where founders are in the whole paradigm of other stakeholders is that founders have the responsibility to use their innovativeness, their openness in being a bit more kind of agile in comparison to other stakeholders, then to suggest improvements in processes, to suggest kind of things can be made more efficient and apply this within the realm of existing solutions"* (E5).

In line with the former statement, a strong sense of responsibility shapes the entrepreneur's actions internally at a company level as well as outward into the entrepreneurial ecosystem:

> *"We have a tendency for founders who set up impact companies not to be so willing to get out again quickly. They don't say, I'm going to do this for two years, work myself to death, and then sit down in the South Seas and say I've made it. It is more likely that they will say I have a purpose here, I am even interested in possibly launching new company forms, that I don't even own the company myself,*

> *but that it belongs to the employees and that is not the classic case for the VC"* (E8).

One expert further stressed the inclusion of stakeholders in the responsible action of impact-driven companies: ethical consideration should be followed by the founders and their stakeholders along the company's value chain (E1).

This is closely related to the question of the assessment of impact-driven startups. Responsible practices are an incremental part of determining an impact-driven startup due to some of the experts (E1, E6, E7). Closely related to that are the SDGs, which were mentioned as one of the most prominent frameworks in assessing the impact goals of a company (E3, E7, E9, E10); one of the experts even considers the SDG key performance indicators (KPIs) for impact measurement (E8). While these goals can function as guiding principles for the assessment, the presentation or evidence of an impact logic is of utmost importance to achieve these goals by applying a logic model. Most prominent, to be expected in the German context, is the Phineo impact staircase or the Theory of Change. Other frameworks were mentioned in the Donut Economy or Gemeinwohl-Ökonomie (Economy for the common good).

Interestingly, a significant part of the assessment is the overall necessity and scalability of the business idea:

> *"The second one is, am I creating something without which the world would continue existing in the same manner?"* (E5).

> *"And you actually have to put your own favorite convictions to the test again and again. I say we need something similar for projects. Even a project that I think makes sense and is good has to be scrutinized and measured again and again, especially if I want to roll it out on a global scale"* (E6).

This relates to a strong transformative potential that impact-driven startups have, according to some experts:

> *"Impact companies are those that not only decouple growth from resource use but also have a creative approach to solving challenges"* (E9).

> *"I think it will be really important for startups in general to integrate more impact and document this openly so that we have more opportunities to transform existing companies in the world"* (E7).
>
> *"We say that with these companies, these core-regenerative companies, the impact really has to be integrated into the product or service. In other words, they really have to try to solve real problems, really transformative, simply systemic problems, let's put it that way"* (E3).

As already identified in Chapter 4, impact assessment is usually accompanied by (aiming at) impact measurement. The experts highlighted two pathways, which are sometimes interconnected and sometimes seen as differentiated concepts: a status-quo comparison of two startup cases usually based on ESG measurement versus the application of established impact reporting standards.

Before diving deeper into this debate, the experts' perception of impact measurement is worth considering. They agree it is difficult to measure impact, especially the further away from the core business actions the intended impact:

> *"Changes at either target group level, be it knowledge change, behavior change, or actually at a larger societal level. Of course, as we have noticed ourselves, this is becoming increasingly difficult to measure and, of course, increasingly long-term, and it is also becoming increasingly difficult to delineate one's contribution. Especially when it comes to social change"* (E4).

Nevertheless, it is possible to demonstrate a degree of additionality contributed by an impact-driven startup, according to one expert:

> *"I do believe that this can be measured. If you are courageous and also use proxies, i.e. auxiliary indicators, you can build up causal chains and say: if I manage to fund school plans that meet different - or also fund educational concepts - that meet different educational requirements, then I will create a different educational landscape in Germany overall"* (E9).

The expert added the fact that impact measurement is, as financial planning, always just an educated guess:

> *"Everyone is distracted by the fact that it may not yet be completely scientifically sound, but financial mathematics is not scientifically sound either; these are all just assumptions from models. That means everyone is hiding behind them, but they don't even know it. They also have to try, experiment, try, fail, try again. It's a normal innovation process".*

Another expert supports this argument, criticizing an overly scientific approach to impact measurement instead of incorporating practicality in the process (E8). Overall, the experts agree that impact should be measured, and they utilize manifold ways to do so.

As noted, one measurement path is an ESG-based approach, and closely related to this is a status quo comparison. However, these two approaches are more concerned with avoiding negative effects than the intent to generate a positive impact:

> *"But any product can be analyzed in the context of other products and if you feel like you're creating something that is creating negative abundance then, probably, maybe you should consider building something else"* (E5).

> *"You have to do like a benchmark. For example, you have to be very clear in the context that you are managing and where you are doing some performance"* (E1).

The predominant approach concerning impact measurement is to follow established frameworks or standards, such as IRIS+, the International Finance Corporation (IFC) standard (more on the fund than the company level), the Global Reporting Initiative (GRI) rating, and the previously mentioned SDG KPIs (Costa & Pesci, 2016; cf. Chapter 4). Nevertheless, overall, there is no commonly established framework all experts rely on that is applicable right away, especially for startups at an early stage:

> *"We also want to offer IRIS+ and these more complex GRI ratings and the like at some point in the future when startups develop further" (E8).*

The data shows that especially in a startup context, frequently case-specific (E3, E5, E7, E8, E9, E10) or internal KPIs are being deployed or set up by the support organizations:

> *"This means that the impact targets are always different. Meaning that we always define up to three case-specific impact goals together with the companies, which are then measured"* (E3).

> *"We designed our tool, our NEsT tool to have a measure of impact, we have around 40 KPIs that we evaluate every quarter, every quarter we will look at the development of the company for these three months"* (E1).

After getting a better picture of a highly fragmented reality of impact measurement, we asked the experts to tell us what they consider the most important impact criteria in a startup context. The identified impact categories can be seen in Table 5. We clustered the criteria under the umbrella terms “social dimension” and “environmental dimension”.

Table 5: Results of the Inductive Category Coding - Operationalization of Impact (Own Illustration)

Social Dimension	Count	Environmental Dimension	Count
Community	8	CO2 reduction	8
Quality of life*	5	Quality of life*	5
Value chain	3	Resources used	4
Employment	2	Biodiversity	4
Gender equity	2	Waste management	2
Education	2	Circular Economy	2
Working conditions	1	Water usage	2
		Energy usage	1

*coded in both dimensions, number of total counts = 5

In total, 14 categories of the impact criteria were identified from the analysis of the expert interviews. Interestingly, the social and environmental categories are pretty balanced in the number of times the experts mention them. Not surprisingly, the most mentioned impact criterion category is "CO2 reduction", as it is a common and relatively easy indicator to calculate or predict on a startup level (Leendertse et al., 2021). More interestingly, the second category frequently mentioned is "community". A startup's impact on its local community is highly important to the experts. This may be because data on a company's (potential) impact is relatively easy to obtain, and the impact may be visible more quickly than on a broader scale.

"Quality of life" could not be assigned to only one of the two dimensions: for example, sanitary improvements and improving life circumstances of youths were coded in this category.

In the social dimension, some experts mentioned responsible practices towards stakeholders outside the company, in this case along the whole "value chain", as relevant. Further, "employment", "gender equity", and "education" were all equally mentioned as a social impact category (all n=2). Lastly, the "working conditions" category was coded and related to responsibility along the value chain and employment.

In the environmental dimension, according to the experts, a relevant impact category of a startup is "resources used" and "biodiversity", or "circular economy". Further, "waste management" and "water usage" were coded, as well as "energy used".

One could argue for subsuming some of the categories, for example, the last three categories mentioned in the environmental dimension below resources or circular practices, or the category "working conditions" with proximity to employment and responsible practices along the value chain. However, the experts did distinguish it, which is why it was decided against it to increase the information content. This specification highlights again how fragmented impact assessment and measurement is, already at a startup level. Part III will discuss why this might be an issue in more detail.

Finally, the expert opinions on the relevance of potential impact versus financial return were analyzed in line with the SLR analysis. In most cases, sound financial performance is not an either-or but an accompanying requisite for generating impact.

> *"Yes, we define social entrepreneurship in such a way that the impact is always more important than the financial return. In other words, it's a prerequisite for us that you have your impact as the primary business objective, so to speak, and that the financial return is more of a means to an end"* (E2).

For the experts, these two aspects must be balanced to succeed long-term (E1, E3, E4, E8, E9, E10).

> *"On the one hand, I would say the question between the profit imperative or the return imperative versus the impact imperative: how is this structured in the management and also in the business model and therefore also in the tower, from the top? So how do I weigh up economic paradigms against socio-ecological paradigms? If I overweight one, it is always clear that the other will tend to become the servant of the other"* (E9).

This question, whether one objective dominates the other in impact investing, was also the focus of the SLR conducted earlier to understand the underlying criteria that form the basis of an investment decision or other types of support. Therefore, in the second iteration, the interviews were coded deductively with the following topics: 1) Shared sector specialization; 2) Shared DNA or social and commercial logic; 3) Scalability of impact (the categories "potential impact" and "scalability of impact" identified through the SLR were considered as the same category); 4) Conventional criteria (this included the "authenticity of the founding team", "conventional criteria" as well as "economic credibility" categories identified in the SLR); 5) Importance of the social or ecological problem (including the "social credibility" category from the SLR); 6) SDGs; 7) Social mission; and 8) Gender. The results of the coding procedure are presented in Table 6.

Table 6: Results of the Deductive Category Coding - Underlying Assessment Criteria (Own Illustration)

Category Name	Count
Shared DNA or social and commercial logic	9
Importance of the social or ecological problem	8
Scalability of impact	8
Conventional criteria	5
SDGs	5
Social mission	5
Shared sector specialization	1
Gender	0

In line with former research, the results show that a shared DNA or social and commercial logic between the investor and the investee is the most mentioned underlying category. A successful and long-term relationship can be expected if the two parties' goals align (Bocken, 2015; Eckerle & Terzidis, 2024).

The two follow-up criteria are the "scalability of impact" and the "importance of the social or ecological problem". This underlines the importance of the impact criterion compared to conventional criteria, as they follow only in third place. Furthermore, the "SDGs" and the "social mission" rank at the same level as conventional criteria. This

indicates that impact investing is genuinely distinguishable from, e.g., green investing, where the social focus is no prerequisite for investments (Olteanu & Fichter, 2020).

The last category, "Gender", has not been mentioned by the experts. The interview guidelines did not specifically ask for this, and the level of abstraction might have been too superficial for the experts to think about such a nuanced factor. Still, as evident from the inductive coding section, gender equity has been mentioned as an impact category – hence, the overall awareness of the topic exists. Additionally, gender focus is a highly controversial topic in startup valuation (Bringmann & Veer, 2021), and there might be a certain social bias toward addressing this topic.

5.4 Discussion

In this study, the underlying decision criteria to assess an impact-driven startup have been highlighted. Most of the criteria identified in the literature could be confirmed to be relevant in the decision-making process via expert interviews. The impact criterion is rarely operationalized in the literature but is usually mentioned as equivalent to conventional criteria.

The analysis of the expert interviews tackles these findings to a certain extent. After a shared DNA or social and commercial logic, two essential criteria relate to the potential impact of the venture (i.e., scalability of impact and the importance of the social or ecological problem). Conventional criteria follow in third place. However, the SDGs and the social mission were mentioned as important criteria of the same rank. In line with related research, the SDGs once again prove to be a crucial underlying criterion for identifying impact-driven companies (Castellas et al., 2018; Paetzold et al., 2022; Santamarta et al., 2021). This highlights the importance of impact investors investing in startups that can incite a positive change with their innovation, alongside a financial return. This is backed by the understanding that impact-driven entrepreneurs take responsibility for their actions and are accountable for unintended consequences (Grinbaum & Groves, 2013).

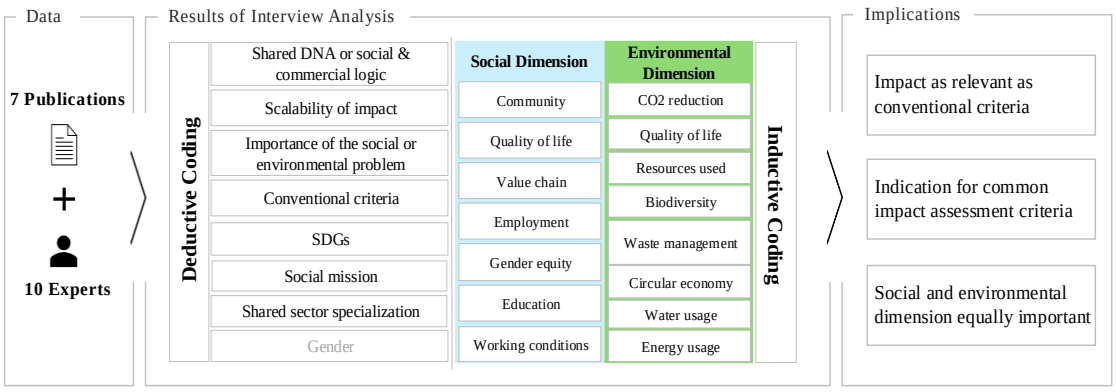
Furthermore, the analysis of the interviews made it possible to operationalize impact more concretely and identify specific categories that support organizations' emphasis on identifying impact-driven startups. Interestingly, both an ecological (CO_2 emission) and

a social impact (community engagement) were mentioned equally frequently. According to the interviewees' statements, the two dimensions, "ecological" and "social" are balanced. This points to the holistic approach of impact investors in addressing sustainable development, distinguishing them from green or social investors (cf. Holtslag et al., 2021).

5.5 Conclusion

This research aimed to improve the understanding of heuristics and criteria used in practice to assess the impact potential of a new company. For this, a two-step methodological research process was followed. First, seven relevant publications could be identified by conducting an SLR. In analyzing these publications, eight underlying criteria of impact investors in assessing potential impact-driven startups could be identified. In the second step, ten semi-structured interviews were conducted to verify the literature findings and break down the term impact to make it more tangible. A comprised overview of the main results are depicted in Figure 7.

Figure 7: Chapter 5 – Main Results (Own Illustration)



The research findings hold several implications for theory and practice. First and foremost, entrepreneurs should present their impact mission in the context of a business case to showcase the balance of impact and financial objectives, referencing the SDGs and presenting in-depth research about the severity of the societal problem they address. Utilizing a logic model, such as the theory of change, can help stakeholders assess the startup's claims transparently. Understanding the means to achieve the end will likely result in a higher monetary and non-monetary valuation by an impact investor or other support organizations (Harrer & Owen, 2022). Since the expert interviews revealed that

preferred criteria are not easy to calculate or predict, entrepreneurs should communicate their impact as tangible as possible. This can minimize a common problem in the investor-startup relationship: the prevalent information asymmetry. If the startup minimizes information asymmetry, it can reduce the adverse selection problem for investors (Eckerle & Terzidis, 2024; Reid, 1999) – in this case, investing in "impact-washing" startups and damaging the integrity of impact investing (Bengo et al., 2021).

This study adds another empirical perspective to the current limited research about impact investing and entrepreneurship (Arena et al., 2018). It implies a critical viewpoint on impact investing for sustainable development. Startups should be aware that investors' assessment depends on individual preferences, such as an investor's or support organization's DNA or sector specification. Furthermore, while impact investors emphasize the potential impact of new ventures, the findings point towards a bias for quantifiable data in assessing impact. This might hinder impact-driven entrepreneurs from essential funding if the impact cannot be presented in numbers. Initial research has already been done concerning this legitimacy issue of proving impact claims (Lall, 2019; Reeder et al., 2015), yet future research should further investigate this to confirm or reject this observation and provide solutions on how to report intangible impact rigorously.

However, the findings of this study have certain limitations. The small number of interviews conducted does not allow for generalization. Further, experts from different professional backgrounds were included in the data acquisition. A narrower viewpoint from investors could provide us with a clearer picture of 1) the debate concerning a trade-off between impact and financial return and 2) the strategic orientation for startups that strive towards impact investing as their funding source.

Finally, the methodology for deriving the underlying criteria for impact investment offers further research potential. While the primary use of entrepreneurship-related publications resulted in a highly relevant list of assessment criteria, this approach does not guarantee that additional factors are considered. Especially concerning the "impact criterion", it could be shown with the interview results that there is a highly fragmented landscape of multiple frameworks, such as IRIS+ or ESG. Hence, a large-scale survey is proposed to counter these limitations and increase insights into the impact assessment process, specifically focusing on the intended impact.

6. Patterns in Preferences of Impact Investors[4]

6.1 Introduction

Impact investors play a critical role in achieving the United Nations' SDGs with their investments (Verrinder et al., 2018). Startups are perceived as a means to this end, as the importance of sustainability in entrepreneurship has increased significantly (Filser et al., 2019; Hall et al., 2010). However, there is still no common understanding of impact (Agrawal & Hockerts, 2021; Bengo et al., 2021), and there is a lack of insight into impact investors' criteria for assessing a young venture's impact (Glänzel & Scheuerle, 2016; Hazenberg et al., 2013). For young ventures, it is essential to adjust their strategy accordingly to match the investors' preferences and position their potential impact robustly. Thus, this paper adds to GRQ1 and 2, addressing the research question:

What impact criteria do impact investors prioritize when assessing sustainable startups for investment?

To address this, a two-stage research process was conducted. Initially, a comprehensive set of impact assessment criteria was created by synthesizing information obtained through a systematic literature search. Furthermore, three prominent impact assessment frameworks [GIIN, GRI, and MSCI] were incorporated into the process. The consolidated criteria were then evaluated via a survey by 69 experienced impact investors in the European region, according to the perceived importance in the investor's assessment. The results suggest that the number of jobs provided and the amount of greenhouse gas emissions reduced by the venture are the two most important criteria. The study builds on social learning theory to interpret the underlying rationale of impact investors' preferences.

[4] This section comprises an article initially published as Eckerle, C., Finner, A.-S. and Terzidis, O. (2024), "Investor perspective on impact-driven startups – the prioritization of certainty", Social Enterprise Journal, Vol. 20 No. 4, pp. 611-631.
Note: The title has been changed, and the abstract has been removed. Further, certain parts in the introduction and theoretical background have been removed and added to Chapter 4 to avoid redundancies. Tables have been reformatted and re-referenced to conform to the overall structure of the thesis. Chapter and section numbers, the respective cross-references, and the formatting and reference style have been adjusted. The references have been included in the overall bibliography at the end of the thesis. The conclusion section adds one additional figure comprising the main results.

Theoretically, the results offer a clearer understanding of impact based on specific criteria. Empirically, it furnishes an overview of the current focal points of impact investors, which can be contextualized within social learning theory. From a practical perspective, the results create transparency for investors and startups to identify future pathways and improve communication.

The remainder of this section is organized as follows: First, a brief overview of the theoretical background is provided. Afterward, the two-step methodological approach for this research is outlined. Then the results of the systematic literature search are presented, followed by the survey results. The results are then critically discussed, and the study concludes with limitations and an outline for future research.

6.2 Theoretical Background

Impact assessments consider both product impact and operational impact (Brest & Born, 2013). According to the impact value chain framework, introduced by Clark et al. (2004), the impact of a venture reflects the portion of the total outcome achieved through its primary activities that go beyond what would have happened anyway (Grieco et al., 2015). There is growing evidence that specific impact categories exist and are utilized by impact investors to determine a company's potential impact. Studies have identified the SDGs as a distinct framework for target setting (Castellas & Ormiston, 2017; Paetzold et al., 2022; Santamarta et al., 2021). Established impact categories exist for environmental impact assessment (Dong & Hauschild, 2017) but assessing social impact is more complex and often relies on qualitative criteria (Molecke & Pinkse, 2017; Souza et al., 2018).

In this study, insights from social learning theory and social network theory are utilized to analyze the empirical findings. Social learning is the "process by which certain mechanisms in society aggregate the information of individuals" (Vives, 1996, p. 589). It underscores the significance of social interaction, imitation, and modeling in the learning process. This theory suggests that investors' behaviors influence one another through observations, attitudes, and outcomes, particularly in contexts characterized by high uncertainty, such as investment in early-stage startups (Gangopadhyay & Nilakantan, 2021). This aligns with previous research findings indicating that investors tend to lean towards well-known criteria (Kollmann & Kuckertz, 2010). The study aims to contribute

to these mechanisms through which social learning occurs within investment communities, as investors observe and emulate the behaviors of their peers.

In line with that, social network theory highlights how relationships within networks shape behaviors, attitudes, and outcomes (Sun & Tang, 2011). Previous research has identified factors such as sector specialization, geographical location, and shared social and commercial logic as influential in impact investors' decisions (Agrawal & Hockerts, 2019; Cetindamar & Ozkazanc-Pan, 2017). These findings suggest that investors may rely on their network connections to access information, learn about best practices, and collaborate with stakeholders, thereby influencing their investment decisions. It is postulated that preferences change based on the investors' characteristics. By examining the results of the study through the lenses of these theories, a deeper understanding can be gained of how impact investors learn about and adopt investment decisions within their social networks.

6.3 Methodology[5]

For this research, an SLR is combined with secondary sources to derive a comprehensive set of social and environmental impact criteria for impact investing. Multiple data sources contribute to adequate reliability and robustness of findings (Najmaei, 2016). The criteria identified form the basis for the expert survey with impact investors in the second step of the research process.

6.3.1 Developing a Set of Impact Assessment Criteria

The literature search aims to identify studies that explicitly provide criteria for assessing companies' or projects' social and environmental impact. Therefore, an SLR is conducted following Kitchenham and Charters (2007) by first defining a search string that includes "social impact" and "environmental impact" combined with the two key terms "assessment" and "criteria" and related terms (Sustainability, Life-cycle, Valuation, Evaluation; Indicators, Measures, Metrics). Thus, research is covered from both the social impact assessment (SIA) as well as the environmental impact assessment (EIA) research area. The literature search was conducted in November and December 2021 using the

[5] The data was acquired during a master thesis, supervised by the author; see Wilking (2022) (cf. Chapter 3).

literature databases EBSCO and Google Scholar and resulted in 186 publications. As the field of impact investing is evolving, the second database's broader result range was considered valuable for the overall findings. Still, to ensure an efficient search process, once all ten publications listed on a page were classified as not relevant based on their title, the search process for the respective search string was stopped.

Additional analysis of the research conducted during the preliminary review involved the exclusion of studies being too industry-specific to facilitate the formulation of a standardized set of criteria. Furthermore, only publications dating from 2000 onwards were incorporated to ensure contemporary relevance. Other inclusionary criteria comprised empirical and conceptual studies, full-text accessibility, and adherence to the English language.

After applying all inclusion and exclusion criteria, 19 publications were classified as relevant. Five additional publications could be identified via a forward and backward search, increasing the total number to 24. For each of the 24 identified primary studies, various meta-information is provided in a results protocol (see Table 7).

Table 7: Results of the Systematic Literature Review (Eckerle et al., 2024)

Author(s)	Geographic focus	Industry focus	Source(s) of assessment criteria	Impact dimension(s)
Agyekum et al. (2017)	Ghana	Bicycle frames	UNEP/SETAC guidelines	Social
Benoît et al. (2010)	No specific focus	No specific focus	UNEP/SETAC guidelines	Social
Bose and Chakrabarti (2003)	No specific focus	No specific focus	Literature Review	Social Environmental
Bribián et al. (2011)	Europe	Building Materials	CED method; IPPC 2007 methodology	Environmental
Chardine-Baumann and Botta-Genoulaz (2014)	No specific focus	No specific focus	Literature Review	Social Environmental Economic
Chen and Holden (2017)	Ireland	Dairy farms	UNEP/SETAC guidelines	Social
Dong and Hauschild (2017)	No specific focus	No specific focus	UN SDGs; Planetary Boundaries	Environmental
Du et al. (2014)	No specific focus	No specific focus	UNEP/SETAC guidelines	Social
Eslami et al. (2021)	No specific focus	Dams	Stakeholder Interviews	Social Environmental Economic

Garbie (2014)	No specific focus	Manufacturing	Literature Review	Social Environmental Economic
Goyal and Rahman (2014)	India	Oil and Gas	Literature Review; Expert Interviews	Social Environmental Economic
Hawkins et al. (2013)	No specific focus	Automotive	Own development	Environmental
Jasiński et al. (2016)	No specific focus	Automotive	Literature Review	Social Environmental Economic
Kolotzek et al. (2018)	No specific focus	No specific focus	Literature Review; Expert Interviews & Workshops	Social Environmental
Labuschagne and Brent (2008)	No specific focus	Manufacturing	Case Studies	Social Environmental
Mroueh et al. (2000)	Finland	Road Construction	Own development	Environmental
Pelletier et al. (2007)	No specific focus	Seafood	Literature Review	Environmental
Pun et al. (2003)	Hong Kong	Plastic injection molding	Expert Survey	Environmental
Rafiaani et al. (2020)	No specific focus	Carbon capture and utilization technologies	UNEP/SETAC guidelines	Social
Souza et al. (2015)	Brazil	Waste Management	Stakeholder Interviews	Social Environmental Economic
Takeda et al. (2019)	Malaysia	Renewable energy technologies	Social Hotspot Index (SHI)	Social
Umair et al. (2015)	Pakistan	Recycling	UNEP/SETAC guidelines	Social
Yıldız-Geyhan et al. (2017)	Turkey	Packaging waste management system	UNEP/SETAC guidelines	Social
Yıldızbaşı et al. (2021)	Turkey	Automotive	Literature Review	Social

The criteria aggregation was conducted along with three other sources (see Section 6.4.1). Assessment criteria provided by impact investment organizations and sustainability reporting standards were considered for the criteria, acknowledging their relevance as established reporting frameworks in extant literature as they were recognized in the literature as relevant reporting frameworks (Costa & Pesci, 2016). The included

frameworks are (1) IRIS+, the reporting system by the GIIN provides a system for measuring, managing, and optimizing impact, which allows investors to maximize the positive changes resulting from their investments (GIIN, 2019). (2) The GRI standards are the most widely used and recognized guidelines for reporting impact. The most recent version of the framework is available in the consolidated set of GRI standards 2021 (Global Sustainability Standards, 2021), which was used for this research. (3) The ESG standards are provided by MSCI (2020). The MSCI ESG ratings are designed to help investors to understand a companies' environmental, social, and governance risks and opportunities. Relevant to the criteria set of this paper are the 35 ESG key issues that form the basis of MSCI's ESG rating framework.

6.3.2 Survey-based Criteria Evaluation

In the second step, European-based impact investors evaluated and rated the impact criteria according to their relevance. Therefore, quantitative empirical research was conducted following the guidelines provided by Rowley (2014), Sing (2017), and Slattery et al. (2011). For data collection, an expert survey was conducted, a widely adopted approach known for its efficiency in yielding generalizable findings (Rowley, 2014).

To ensure that the results have a high degree of informative value, this expert survey addresses only impact investors with adequate experience investing in young sustainability-driven ventures. Specifically, a participant should have at least three years of experience in impact investing and be responsible for at least USD 1 million in assets under management related to impact investments. To verify the required participant characteristics, we included descriptive questions, for example, gender, the type of investor/investment organization, geographic focus, or the startup stage of investment.

The questionnaire was derived from the consolidated criteria outlined in Section 0. Considering the relatively high number of criteria the experts needed to evaluate, using a rating scale for the expert survey appeared most appropriate in this research (Eisele et al., 2002) for the evaluation of the individual criteria in the context of this research. Thus, a scale with a total comprising of four differentiations was defined; an approach that has demonstrated notable efficacy in previous entrepreneurship research studies (cf. Eisele et al., 2002; Macmillan et al., 1985). The rating scale's range includes the levels "irrelevant," "desirable," "important," and "essential". The assigned weighting factors used to calculate

the mean values range from zero to three and thus constitute an ordinal scale. As the criteria were derived from publications beyond the scope of finance and entrepreneurship research, their relevance in impact investing is ensured if their average rating is significantly different from zero. A random order in listing the individual criteria in the questionnaire was chosen.

The expert survey was conducted via an online data collection tool between January 17 and February 9, 2022. The sample for the survey was drawn using two different channels. First, by searching the keywords "impact investing" and filtering for individuals within the European region, 217 relevant impact investors from the social networking platform LinkedIn were identified. Secondly, another 200 investors were contacted by mail via the CyberForum e.V. network, a European-wide active entrepreneur network located in Germany. A total of 77 out of 417 investors participated in the survey, thus representing a response rate of approximately 18%. Three responders, however, had to be removed as they did not fully complete the questionnaire. Moreover, five investors needed to be excluded, as four lacked the required investment experience, and another did not primarily invest in startups. This leaves a total of 69 survey participants, which form the basis for the analysis in Section 6.4.2.

6.4 Results

6.4.1 Aggregation of the Identified Assessment Criteria

In this section, a comprehensive set of impact assessment criteria is established, which forms the basis for the expert survey in the second step of the research process. 47 different assessment criteria were derived from the data sources presented in Section 6.3.1.

In the first step, all industry-specific criteria were excluded to ensure the desired industry neutrality in the context of this study. Examples of industry-specific criteria include “vehicle interior air quality"; "drive-by noise," or "car vibration" within the automotive sector (Jasiński et al., 2016).

Secondly, to further reduce complexity, relatively similar criteria were summarized and grouped. The groupings were discussed with other researchers to ensure objectivity.

This procedure led to ten environmental and ten social criteria, which are presented with their respective references in Table 8 and Table 9.

All environmental-related assessment criteria obtained were classified into two broader categories “human health and ecosystem quality” and “natural resources”, see Table 8.

Table 8: Environmental-related Impact Assessment Criteria (Eckerle et al., 2024)

Category	Criteria	Description	References
Human health and ecosystem quality	Global warming potential	Amount of greenhouse gas emissions contributing to global warming avoided or reduced by the organization.	*Bribián et al. (2011); Dong and Hauschild (2017); Garbie (2014); Goyal and Rahman (2014); GRI; Hawkins et al. (2012); IRIS; Jasiński et al. (2016); Kolotzek et al. (2018); Mroueh et al. (2000); MSCI; Pelletier et al. (2007); Pun et al. (2003); Souza et al. (2015)*
	Pollution of air, water, or soil	Emission of pollutants with harmful effects on human health and ecosystem quality into the air, water, or soil, such as SO_x, NO_x, particulate matter, or toxic substances, avoided or reduced by the organization.	*Bose and Chakrabarti (2003); Dong and Hauschild (2017); Eslami et al. (2021); Garbie (2014); Goyal and Rahman (2014); GRI; Hawkins et al. (2012); IRIS; Jasiński et al. (2016); Kolotzek et al. (2018); Mroueh et al. (2000); MSCI; Pelletier et al. (2007); Pun et al. (2003); Souza et al. (2015)*
	Biodiversity	The company assesses the impact of locations, business activities, and products on biodiversity and seeks to minimize it.	*Chardine-Baumann and Botta-Genoulaz (2014); Bose and Chakrabarti (2003); Eslami et al. (2021); Garbie (2014); GRI; IRIS; Mroueh et al. (2000); MSCI*
	Environmental investments	Implementation of environmental improvement projects beyond the company's core business, such as reforestation.	*Chardine-Baumann and Botta-Genoulaz (2014); Garbie (2014); Goyal and Rahman (2014); IRIS*
Natural resources	Water use	Fresh and industrial water consumption is saved by the company.	*Bribián et al. (2011); Dong and Hauschild (2017); GRI; IRIS; Jasiński et al. (2016); MSCI; Kolotzek et al. (2018); Mroueh et al. (2000)*

Land use	Loss of land in the sense of being temporarily unavailable due to business activities saved by the company.	*Chardine-Baumann and Botta-Genoulaz (2014); Garbie (2014); IRIS; Jasiński et al. (2016); Mroueh et al. (2000); MSCI; Kolotzek et al. (2018); Souza et al. (2015)*
Energy use	Energy consumption saved by the company.	*Bribián et al. (2011); Goyal and Rahman (2014); GRI; IRIS; Jasiński et al. (2016); Mroueh et al. (2000); Pun et al. (2003)*
Energy mix	Use of renewable energy sources.	*Chardine-Baumann and Botta-Genoulaz (2014); Garbie (2014); Goyal and Rahman (2014); Hawkins et al. (2012); GRI; IRIS; Pelletier et al. (2007)*
Waste generation and management	Amount of waste, especially hazardous waste, avoided or reduced by the company. Furthermore, actions are implemented, such as circular measures to partially recycle generated waste.	*Chardine-Baumann and Botta-Genoulaz (2014); Garbie (2014); Goyal and Rahman (2014); GRI; IRIS; Mroueh et al. (2000); MSCI; Pun et al. (2003)*
Renewable or recyclable materials	Use of renewable or recyclable materials for production and packaging.	*Chardine-Baumann and Botta-Genoulaz (2014); Garbie (2014); Goyal and Rahman (2014); GRI; IRIS; Jasiński et al. (2016); MSCI; Pun et al. (2003)*

These categories reflect the indicators commonly considered within EIA (e.g., Souza et al., 2015). The two environmental criteria most frequently mentioned are “global warming potential” (i.e., greenhouse gas emissions) as well as "pollution of air, water, or soil." The latter combines various criteria in the context of air pollution and eco- and human toxicity; it represents any pollution with harmful emissions apart from greenhouse gases. This includes a wide range of environmental damage, such as ozone depletion, acidification, eutrophication, photochemical ozone formation, and contamination of soils and waters with toxic substances. However, we can assume that impact investors do not proceed at this level of granularity when assessing the impact of a new venture (Scholda et al., 2021).

Human health and ecosystem quality criteria was complemented with "biodiversity" and "environmental investments." The latter refers to environmental improvement projects outside the company's core business, such as reforestation (Bansal et al., 2019).

The second environmental impact assessment criteria category is related to the venture's resource consumption. It includes whether the company can reduce water, energy, and land use. Regarding the energy mix used, the company should rely on renewable energy sources rather than fossil fuels. In addition, the impact also depends on whether renewable or recycled materials are used in production and packaging. Finally, the waste generated by the company should also be considered. Of particular interest is the amount of waste that can be avoided and whether the company is acting to reuse some of the waste in the production process or to recycle it.

The identified social-related assessment criteria in Table 9 were classified in terms of the various stakeholder groups affected by a company's business activities.

Table 9: Social-related Impact Assessment Criteria (Eckerle et al., 2024)

Category	Criteria	Description	References
Employees	Diversity and inclusion	High level of diversity in terms of gender, age, and nationality. Furthermore, no discrimination against minorities or vulnerable groups, but offering equal opportunities to all people.	*Benoît et al. (2010); Chen and Holden (2017); Du et al. (2014); Garbie (2014); GRI; IRIS; Kolotzek et al. (2018); Rafiaani et al. (2009); Souza et al. (2015); Umair et al. (2015); Yıldız-Geyhan et al. (2017); Yıldızbaşı et al. (2020)*

	Gender equity	The company is committed to gender equity, especially in terms of equal salaries and development opportunities for women and men.	*GRI; IRIS; Labuschagne and Brent (2008); Takeda et al. (2019)*
	Working conditions	The company is able to improve working conditions, for example, in terms of working hours, fair salaries, labor rights, occupational health and safety, or social benefits.	*Agyekum et al. (2017); Benoît et al. (2010); Bose and Chakrabarti (2003); Chen and Holden (2017); Du et al. (2014); Goyal and Rahman (2014); GRI; IRIS; Jasiński et al. (2016); Kolotzek et al. (2018); Labuschagne and Brent (2008); MSCI; Rafiaani et al. (2009); Takeda et al. (2019); Umair et al. (2015); Yıldız-Geyhan et al. (2017); Yıldızbaşı et al. (2020)*
Community	Employment	A number of local jobs provided by the company.	*Agyekum et al. (2017); Benoît et al. (2010); Bose and Chakrabarti (2003); Chen and Holden (2017); Du et al. (2014); Eslami et al. (2021); Goyal and Rahman (2014); Garbie (2014); GRI; IRIS; Jasiński et al. (2016); Kolotzek et al. (2018); Rafiaani et al. (2009); Souza et al. (2015); Umair et al. (2015); Yıldız-Geyhan et al. (2017)*
	Education	Improving the local level of education, for example, by offering training opportunities for employees or collaborating with local schools and universities.	*Bose and Chakrabarti (2003); Chen and Holden (2017); Garbie (2014); GRI; IRIS; Labuschagne and Brent (2008); MSCI; Pun et al. (2003); Yıldızbaşı et al. (2020)*
	Community engagement	High level of local stakeholders (i.e., customers and suppliers) to contribute to the economic development of the local community.	*Benoît et al. (2010); Bose and Chakrabarti (2003); Chen and Holden (2017); Du et al. (2014); Garbie (2014); GRI; IRIS; Jasiński et al. (2016); Kolotzek et al. (2018); Labuschagne and Brent (2008); Rafiaani et al. (2009); S9; Umair et al. (2015); Yıldız-Geyhan et al. (2017); Yıldızbaşı et al. (2020)*

Value chain actors	Corporate governance structure	The company has a strong governance structure and internal control mechanisms to prevent opportunistic behavior by various stakeholder groups, such as corruption.	*Garbie (2014); GRI; Jasiński et al. (2016); Kolotzek et al. (2018); MSCI; Takeda et al. (2019); Yıldızbaşı et al. (2020)*
	Fair competition towards all stakeholders	Improving the way of competition, for example, by offering fair prices to customers and suppliers or respecting intellectual property rights.	*Benoît et al. (2010); Garbie (2014); GRI; IRIS; Kolotzek et al. (2018); MSCI; Rafiaani et al. (2009); Umair et al. (2015)*
	Consumer interaction	Improving the way of consumer interaction, for example, by demonstrating a high level of transparency.	*Benoît et al. (2010); Garbie (2014); GRI; IRIS; Kolotzek et al. (2018); MSCI; Rafiaani et al. (2009); Yıldız-Geyhan et al. (2017)*
	Promoting social responsibility	Increasing the promotion of social responsibility, for example, by setting public commitments or selecting business partners based on social assessments.	*Chen and Holden (2017); GRI; Kolotzek et al. (2018); Umair et al. (2015)*

The social impact can be differentiated on employees, the community, business partners, and customers along the value chain. The social impact on the company's employees is characterized in particular by the working conditions, which emerge as the most frequently mentioned aspect. Within the SIA literature, the working conditions for employees are typically assessed using numerous individual criteria. These include transparent employment contracts, reasonable working hours, the payment of a fair wage, social benefits, and securities such as insurance and pensions, a high level of occupational health and safety, no child or forced labor, as well as labor rights such as the right to strike, freedom of association, and collective bargaining. However, these were aggregated into a single criterion, "working conditions", to achieve the necessary reduction in complexity.

The two remaining criteria relating to the venture employees are "diversity and inclusion" and "gender equity." The latter is rarely mentioned, which could be explained by the assumption that the criterion is considered a part of diversity and inclusion.

However, for the investigation of this paper, the two criteria are treated separately, as provided in the frameworks by IRIS+ and GRI. Thus, it is possible to separately assess whether the venture has a high level of diversity in terms of age, gender, and nationality, offers equal opportunities to any minorities on the one hand, and strives for equal compensation and development opportunities between men and women on the other hand.

Regarding "employment," which is defined as the number of locally provided jobs, the most frequently mentioned social criterion belongs to the second stakeholder group, “community". Besides the product or service offered, job creation serves as a critical lever for ventures to increase the economic welfare of society. Further criteria to contribute to the development of a community are “education” and "community engagement." The venture can improve the local level of education, for instance, by offering training opportunities to employees or collaborating with universities and schools to facilitate access to job opportunities. The definition of "community engagement" is inconsistent across the identified publications. Some authors understand the criterion to mean improving living conditions in the community, such as providing essential resources like sanitation. However, the definition in the context of this research considers the share of local stakeholders of the venture as its engagement in the community. With a high share of local stakeholders, it can be ensured that the company uses local business partners and thus contributes to the local community's economic development. At the same time, the company's products should also be available to the local people rather than the location serving only low-cost production.

The third and last category of stakeholders refers to various remaining actors along the value chain, i.e., suppliers to customers. However, based on the number of mentions, these social criteria play a minor role compared to those relating to employees and the community. First, attention can be paid to whether the venture is committed to fair competition, such as paying fair prices to customers and suppliers or respecting the intellectual property rights of other companies. Regarding customers, the venture should place a high value on their well-being, for instance, through a high level of safety of the products sold or a transparent appearance towards the customer. At the same time, the venture should establish a robust governance structure and internal control mechanisms to prevent opportunistic behavior by various stakeholder groups, such as corruption.

Finally, ventures can also increase their impact by promoting social responsibility. Examples include the selection of suppliers with the consideration of social aspects or the declaration of public commitments.

This section's consolidated set of 20 criteria represents an initial valuable contribution to impact investing research. By reducing the complexity across multiple sources, it was possible to create a comprehensive overview of relevant impact assessment criteria, which form the expert survey's basis in the following section.

6.4.2 Expert Survey

First, the descriptive characteristics of the impact investors who participated in the survey are described to place the later research findings in a broader context. Among the 69 respondents, 71% are male (n = 49) versus 28% are female (n = 19). One person refused to state their gender. Together, the investors show an average industry experience of 7.9 years in impact investing (median = 7). The 69 impact investors are responsible for an average of USD 39.5 million in assets under management, with the median investor in the sample managing USD 25 million. The significant difference between the average and median investors can be explained by the presence of more prominent investors in the sample. The largest six alone are responsible for a combined impact investment portfolio of over USD 950 million. Most respondents (n = 48, 70%) represented asset managers, followed by family office investors (n = 12, 17%). The remaining participants belong to foundations (n = 6; 9%) and development finance institutions (n = 2; 3%), while one investor (1%) conducts private impact investment.

In 2021, these investors collectively invested nearly USD 650 million in 440 impact investments. Most impact investors in the sample (n = 30; 43%) focus on emerging and developed markets. At the same time, 22 respondents (32%) focus primarily on developed markets, whereas 17 (25%) concentrate their investment activities mainly on emerging markets. In addition, two-thirds of the respondents (n = 46; 67%) invest mainly in early-stage startups, while the other third (n = 23; 33%) invest in expansion and late-stage startups. The sectors in which most survey participants invest at least part of their capital are information and communications technology, healthcare, food, agriculture, and manufacturing. Eight respondents (12%) stated to be agnostic.

The results of the expert survey concerning the rating of the impact criteria are highlighted in Table 10. The first column indicates the rank of the respective criterion based on the investors' rating as "irrelevant" (0), "desirable" (1), "important" (2), and "essential" (3). To test the significance of the individual criteria, the respective p-values were calculated based on a two-tailed t-test for a reference mean value of zero (i.e., the criterion does not influence the impact assessment process).

Table 10: Results of the Expert Survey with European Impact Investors (Eckerle et al., 2024)

Rank	Dimension	Assessment criteria	Irrelevant (0)	Desirable (1)	Important (2)	Essential (3)	Mean	SD	p-value
1	Social	Employment	*3%*	*9%*	*14%*	*74%*	**2,59**	0,77	< .00001
2	Environ-mental	Global warming potential	1%	9%	22%	68%	**2,57**	0,71	< .00001
3	Environ-mental	Renewable or recyclable materials	*1%*	*6%*	*43%*	*49%*	**2,41**	0,67	< .00001
4	Environ-mental	Waste generation and management	*1%*	*4%*	*55%*	*39%*	**2,32**	0,63	< .00001
5	Environ-mental	Energy mix	*1%*	*10%*	*51%*	*38%*	**2,25**	0,69	< .00001
5	Environ-mental	Pollution of air, water, or soil	*1%*	*10%*	*51%*	*38%*	**2,25**	0,69	< .00001
7	Social	Working conditions	*1%*	*12%*	*55%*	*32%*	**2,17**	0,68	< .00001
8	Social	Corporate governance structure	*3%*	*9%*	*62%*	*26%*	**2,12**	0,67	< .00001
9	Environ-mental	Water use	*0%*	*17%*	*57%*	*26%*	**2,09**	0,65	< .00001
10	Environ-mental	Energy use	*1%*	*12%*	*71%*	*16%*	**2,01**	0,58	< .00001

(Table 10 continued)

Rank	Dimension	Assessment criteria	Irrelevant (0)	Desirable (1)	Important (2)	Essential (3)	Mean	SD	p-value
11	Social	Education	*0%*	*36%*	*39%*	*25%*	**1,88**	0,77	< .00001
12	Social	Community engagement	*7%*	*29%*	*33%*	*30%*	**1,87**	0,93	< .00001
13	Social	Consumer interaction	*3%*	*22%*	*70%*	*6%*	**1,78**	0,59	< .00001
14	Social	Fair competition	*4%*	*38%*	*49%*	*9%*	**1,62**	0,70	< .00001
15	Social	Diversity and inclusion	*6%*	*45%*	*42%*	*7%*	**1,51**	0,71	< .00001
16	Social	Gender equity	*3%*	*51%*	*42%*	*4%*	**1,48**	0,63	< .00001
17	Social	Promoting social responsibility	*13%*	*54%*	*33%*	*0%*	**1,20**	0,65	< .00001
18	Environ-mental	Biodiversity	*28%*	*55%*	*14%*	*3%*	**0,93**	0,73	< .00001
19	Environ-mental	Environmental investments	*28%*	*61%*	*9%*	*3%*	**0,87**	0,68	< .00001
20	Environ-mental	Land use	*38%*	*54%*	*6%*	*3%*	**0,74**	0,69	< .00001

Since the survey's sample size is sufficiently large, with 69 participants, a normal distribution for the sample mean can be approximated according to the central limit theorem. Assuming that the ratings of the individual participants are independent of each other, we fulfill the requirements for applying a one-sample t-test with an unknown standard deviation of the population. As the p-value for all criteria is close to zero at a significance level of 1%, indicating that their average rating is significantly different from zero, all criteria identified in Section 4.1 prove significant for the impact assessment.

First, the results are analyzed and discussed in terms of the relative importance of each criterion, based on the calculated mean value. The results show that “employment” (rank 1), as well as “global warming potential” (rank 2), were viewed as the two most important criteria by a relatively wide margin. However, the relatively high standard deviation suggests that there is no complete consensus among the respondents on the importance of the individual criteria. Concerning "employment", a possible explanation could be that the number of jobs the organization provides is a leading factor in creating economic welfare for people. At the same time, it is simple for investors to quantify. This makes the criterion well-suited for valuation purposes. The greenhouse gas emissions avoided or reduced by the organization are the leading indicator for environmental sustainability for the impact investors in the sample. Despite the rather complex and often inaccurate calculation (EEA, 2013), the criterion emerges as a key determinant for a startup's impact value.

The following most important criteria, according to the respondents' view, all relate to the environmental impact, namely “renewable or recyclable materials” (rank 3), “waste generation and management” (rank 4), “energy mix” (rank 5), as well as “pollution of air, water, or soil” (rank 5). The results suggest that the respondents place a higher weight on

environmental criteria when assessing the impact of a venture. This is further supported by Table 11, which shows the ten criteria most frequently rated as “essential” by the impact investors in the sample.

Table 11: The Ten Assessment Criteria Most Frequently Rated as Essential (Eckerle et al., 2024)

Criterion	Impact dimension	Percent
Employment	Social	73,9%
Global warming potential	Environmental	68,1%
Renewable or recyclable materials	Environmental	49,3%
Waste generation and management	Environmental	39,1%
Energy mix	Environmental	37,7%
Pollution of air, water, or soil	Environmental	37,7%
Working conditions	Social	31,9%
Community engagement	Social	30,4%
Corporate governance structure	Social	26,1%
Water use	Environmental	26,1%

Again, five out of the first six criteria relate to the startup's environmental impact, emphasizing that the respondents determine the value of the impact more significantly with environmental factors. At the same time, Table 11 highlights that both criteria with the highest average rating, "employment" and "global warming potential," represent the leading factors for the impact assessment. With around 74% and 68% of all investors, respectively, considering them to be "essential," the total value of the impact seems to be significantly determined by these two criteria.

Within the social impact dimension, besides "employment," only the two criteria, “working conditions” (rank 7) and “corporate governance structure” (rank 8), show an average rating of over two, i.e., perceived by investors as “important” to "essential".

Particularly noticeable is the high standard deviation of the two criteria, "education" (rank 11) and “community engagement” (rank 12). Although their average rating is below two (i.e., perceived between “desirable” and “important”), the high standard deviation indicates that part of the investors in the sample consider the two factors to be "essential."

Whether the company is committed to “diversity and inclusion” (rank 15) and “gender equity” (rank 16) or “promoting social responsibility” (rank 17) tends to not be considered in an investment decision within the social impact dimension. Contradicting though are

the findings that all three of them are considered by nearly 50% (diversity and inclusion) or more than 50% as “desirable”. Similarly, very few of the respondents considered the impact of the startup on “biodiversity” (rank 18), “environmental investments” outside the core business (rank 19), and the “land used” by the startup (rank 20). Yet again, all three of these criteria are ranked by more than half of the investors as “desirable”.

Considering that “biodiversity” reflects one of the most urgent challenges of the current century (Ogar et al., 2020), the dilemma between “irrelevant” but “desirable” could be because a company's total impact on biodiversity is often challenging to assess, making the criterion less tangible for investors. In addition, “biodiversity” tends to be a factor without, so far, specific parameters, which makes the criterion less suitable. This holds for the other criteria pointed out as “desirable”.

To determine if investor-specific characteristics influence the choice of impact criteria, the 22 respondents who stated to invest primarily in developed markets versus the 17 who invest primarily in emerging markets will be reviewed and compared separately. This section does not consider the 30 investors who invest in both markets.

The highest rank difference between investments in developed and emerging markets can be observed for the social criteria "community engagement" and "education." Both criteria are significantly more important for investments in emerging markets, with a relatively large ranking difference of 12 and 8, respectively. Also, “employment” and “working conditions” were considered more important by this group of investors.

The four most important assessment criteria in emerging markets relate to the venture’s social impact. These findings show that investors pay more attention to social factors when assessing the impact of a venture in an emerging market. The relatively low standard deviations of the four criteria mentioned above further indicate a high consensus among investors. Thus, the extent to which the startup can improve the lives of local people is a decisive factor in determining the value of its impact.

In contrast, respondents who primarily invest in developed markets prioritize environmental criteria to assess the value of the impact. With “renewable or recycled materials," “global warming potential," “waste generation and management," as well as the “pollution of air, water, and soil," the four most important assessment criteria for this group of investors all relate to the venture’s environmental impact.

In the third step, the respondents were devided concerning the startup stage in which they primarily invest. For this purpose, all 69 impact investors in the sample were categorized into early-stage investors (n =46) versus expansion-stage and late-stage investors (n =23). The expansion and late-stage investors are considered one group for the analysis, as differences are less significant than investments in early-stage startups. A distinction between the two types of respondents would have resulted in too small subgroups.

The differences between early-stage investors versus expansion and late-stage investors are quite small for most assessment criteria. Notably, in the case of the venture's environmental impact, a difference in the ranking numbers can only be observed for three criteria. As such, early-stage investors place slightly higher importance on the startup's "energy use," whereas expansion and late-stage investors place a higher value on the "pollution of air, water, or soil," as well as on the venture's greenhouse gas potential. On the other hand, more differences can be observed within the social impact dimension of the startup. In particular, the assessment criterion "community engagement" indicates significantly higher importance for early-stage investors.

This could be explained by the assumption that as the venture's business grows, it will eventually become inevitable to engage with business partners outside the local community. As such, late-stage startups often enter international markets to expand business activities (Eisele et al., 2002), which should accordingly interest late-stage impact investors, while the focus on the local community decreases. Furthermore, the corporate governance structure of the venture shows a higher significance for assessing its impact in the later stages. This also seems plausible when considering that the corporate structure becomes more complex as the venture grows and therefore carries a higher risk for potentially opportunistic behavior. The criterion "consumer interaction" becomes more critical at a later stage. This suggests that with a startup's increasing scale, investors expect a higher responsibility towards its customers. The same could be assumed for the venture's employees. However, the criterion "working conditions" is perceived as more important in the early stage of the startup, although the mean value's difference is relatively small. This could be explained by the startup's need to be attractive to employees at an early stage.

There are certain differences in the rating of the ten impact assessment criteria that were most frequently rated as “essential” by the 46 early-stage investors versus the 23 expansion and late-stage investors. The high significance of the criterion “global warming potential” should be noted, which is considered “essential” by almost nine out of ten investors for the impact assessment of expansion and late-stage ventures. At the same time, it can be observed that for most criteria, the share of respondents who perceived a criterion to be "essential" is significantly higher among expansion and late-stage investors than among early-stage investors. In particular, the first five criteria in the category of expansion and late-stage investors each show a share of over 50% of respondents, whereas, in the case of early-stage investors, this only applies to a total of two criteria in the list.

Overall, this result suggests that as the scale of the venture increases, so does the degree to which individual assessment criteria influence the value of the venture's impact. A closer look at all assessment criteria also supports this. As the overall mean value across all criteria, with an average importance of around 1.9 for expansion and late-stage startups, is higher than 1.8 for early-stage startups, it can be assumed that the significance of individual assessment criteria increases over time.

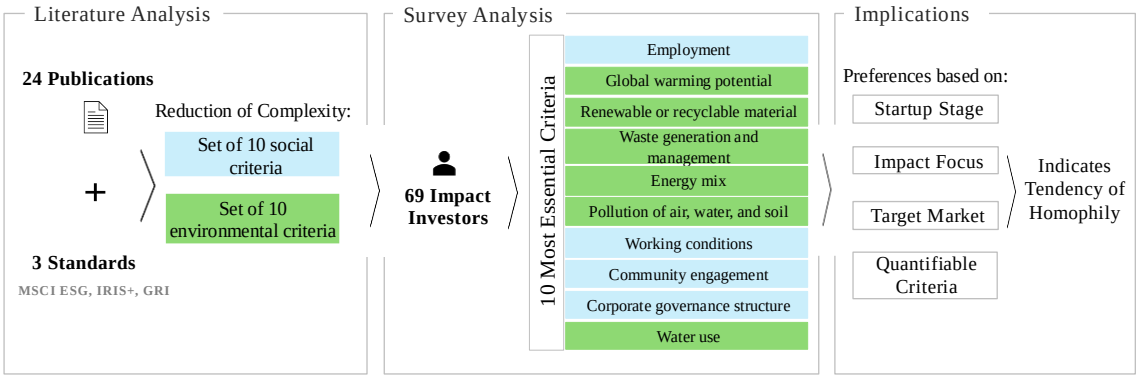
6.5 Conclusion

The objective of this research was to improve the understanding of criteria applied by impact investors for the assessment of a sustainable venture's impact. Specifically, the importance of various criteria was examined to determine the most significant impact assessment criteria as perceived by a sample of experienced impact investors in Europe. To implement the empirical investigation, a two-stage research process was conducted.

In the first step, via 24 impact assessment studies and the frameworks provided by GIIN, GRI, and MSCI, it was possible to identify assessment criteria applicable to impact investing. These were then combined into a set of ten social and ten environmental criteria to reduce complexity. Given that existing impact assessment frameworks appear inadequate for the assessment of startups due to their high complexity, the comprehensive set of criteria developed in this research represents a first contribution for investors to perform more efficient due diligence.

The evaluation of the criteria by 69 impact investors via an expert survey subsequently allowed the identification of the most important assessment criteria in the scope of the sample. A comprised overview of the results from this study can be seen in Figure 8.

Figure 8: Chapter 6 – Main Results (Own Illustration)



The results first showed that, on average, the respondents considered only a limited number of criteria to be substantial for assessing impact. In particular, the number of jobs provided and the startup's greenhouse gas emissions are key criteria. Both were considered essential by most of the investors. In addition, the analysis showed that the most significant assessment criteria were predominantly related to the environmental impact of the startup.

The findings offer several implications: As derived from social learning theory, the tendency to elevate the aforementioned criteria is in line with the assumption that investors demonstrate preferences for certain over uncertain criteria (Kollmann & Kuckertz, 2010). This is per se not bad, as the urgent need to address the SDGs demands any kind of action related to positive impact. Nevertheless, all synthesized impact criteria matter, and none should be neglected. It can be suggested that improved transparency about investors' preferences can help in social learning and might increase the focus on desirable criteria. Additionally, investments based on the target market or startup stage suggest a tendency for homophily, as stated in social network theory (Knockaert et al., 2010; Sun & Tang, 2011). Dividing the respondents according to their investments in developed and emerging markets indicated that the latter placed a stronger focus on the startup's social impact, while a higher importance on the corporate governance structure and the interaction with customers when the venture enters the expansion and late stage can be observed. In contrast, the importance of a high share of local stakeholders (i.e.,

community engagement) significantly decreases compared to the early stage of the startup.

For entrepreneurship theory, the findings add to the ongoing debate about the conflicting goals of social and environmental entrepreneurship. As postulated with the definition of impact-driven entrepreneurship, the two concepts should be understood as synergistic rather than opposing (Schäfer et al., 2015). The findings of this study support the notion that the different goals are not conflicting but rather sequential in their reconciliation (Knockaert et al., 2010). Based on our findings, impact investors foster this with their impact focus at different startup stages.

Despite these implications, several limitations must be acknowledged. Firstly, while the study adheres to scientific research standards in data collection and analysis, the limited number of participants and the survey's European focus may not fully represent the entire population of impact investors. A larger-scale survey could validate and expand upon the findings.

Another limitation arises from the use of rating scales in the expert survey. These scales, while suitable for assessing the relative importance of numerous criteria, come with inherent drawbacks. Cognitive biases may affect investors' assessments, potentially leading to discrepancies between their intentions and responses (MacMillan et al., 1985).

To address these biases and limitations, employing a conjoint analysis is recommended. This approach would allow for a more nuanced understanding of criterion importance (Knockaert et al., 2010). A conjoint analysis with the ten most significant criteria from the expert survey would be appropriate.

Furthermore, while the approach to derive impact criteria is based on existing frameworks and publications from scientific literature, it may not capture impact investors' specific perspectives. Exploring case studies of investor-investee relationships could identify additional influencing criteria.

Lastly, conducting a comprehensive network analysis could test the assumption of homophily within the impact investing network, enhancing the understanding of social learning in criterion preferences. This could open new avenues for impact assessment, such as enhancing the acceptability of qualitative assessment strategies, via the utilization of established frameworks such as the theory of change (Castellas et al., 2018).

7. Homophily in Impact Investing? A Network Analysis of Germany

7.1 Introduction

Due to increasing socio-ecological challenges, the growing demand for impact-oriented investments driving transformative and sustainable innovations, especially concerning the SDGs, is evident (Barber et al., 2021; Burckart et al., 2018). However, research suggests that impact investors often prioritize financial return over impact (cf. Chapter 4) and prefer certain and quantifiable impact categories over uncertain ones when investing in young ventures (Eckerle et al., 2024).

Up to date, though, studies about the characterization and investment behavior of impact investors have mostly been qualitative (Nachyla & Justo, 2024) or conceptual (Hockerts et al., 2022) in nature, quantitative research concerning their impact targets or startup support is scarce, limiting generalization. Initial research indicated that impact investors seem to be organized in networks, including companies, banks, public institutions, or private investors who participate directly or through crowdfunding platforms (Spiess-Knafl & Scheck, 2017). Via these networks, the investors can shape the impact investing landscape while potentially being influenced in reverse. To analyze this interconnectedness, the research builds on social network theory (Sun & Tang, 2011). Sung and Tang (2011) emphasize that networks serve as critical channels for resource allocation (i.e., financial capital), knowledge exchange, and strategic alliances, which are vital for the growth and success of startups. Therefore, understanding the dynamics of social networks in the context of impact investing provides valuable insights into the mechanisms driving investment patterns and the broader ecosystem of impact-driven startup financing. Hence, this research aims to answer the following question:

What structural characteristics define the organization of networks among impact investors, and how do these structures influence impact investing decisions?

By conducting a social network analysis of the German impact investment network, this study seeks to uncover the specific organizational patterns and structures prevalent within impact investing networks, thereby untangling the roles and interactions among various types of impact investors. Understanding these structural characteristics

determines how these network structures facilitate or hinder collective efforts to achieve impactful investments into innovative young ventures, particularly in alignment with the SDGs.

The results show that cluster formation and homophily are evident in the German impact investing network based on the actors' type, impact focus, and startup focus. The findings further suggest that many impact investors are more inclined to invest in companies at later growth stages than early-stage startups, potentially hindering significant positive transformation and sustainable development.

The remainder of this chapter is organized as follows: Section 7.2 briefly dives into the theoretical background. Section 7.3 outlines the methodological approach for this research. Section 7.4 presents the network analysis results, and the implications of the tendency for homophily are outlined. The study concludes in Section 7.6 after discussing limitations and an outline for future research.

7.2 Theoretical Background

Social networks generally exhibit typical recurring structures. In their work, Liang and Yuan (2016) investigated the influence of social networks of investors and companies on investment decisions. They found a correlation in this context, suggesting that investment decisions can be predicted based on network structure (Liang & Yuan, 2016). This finding suggests that similar network structures may emerge in the impact investor network, potentially revealing patterns in investor behavior.

The most common social network structures and patterns include 1) hubs, 2) transivity, 3) homophily, and 4) clusters. Hubs are actors within networks who have an above-average number of connections to other actors. This phenomenon is described as popularity, as these actors can easily form new connections, thereby enhancing their role and significance (Klärner et al., 2019).

Clusters in social networks are regions with a higher density of connections within or among themselves than with entities outside the region. Actors connected to a specific actor are also likely to be connected. Cluster formation is often explained by transitivity and homophily, helping to understand the structural formation within networks (Handcock et al., 2007).

Transitivity in networks means that two actors connected to a common third actor are more likely to connect. This effect leads to the formation of social groups or clusters, where connections among actors increase due to shared relationships (Handcock et al., 2007). Proof of transitivity is not possible through this work. The network, particularly the connectivity behavior, would need to be observed over a longer period to demonstrate transitivity. The current study analyses data based on a snapshot but could be used in future data collection to predict likely future connections.

Homophily is a fundamental characteristic of social networks, indicating that actors tend to be similar to their connected neighbors. This can be due to social influence, selection, and other factors, resulting in greater similarities among friends than in random samples (Sun & Tang, 2011). Social influence involves people adopting the behaviors of their friends, while selection refers to forming relationships with similar individuals, and other unknown variables may also play a role.

As previous research has shown (cf. Chapter 5), impact investors tend to focus on specific aspects of their investment decisions for startups, such as a shared DNA or social and commercial logic between the investor and the investee (Bocken, 2015; Centindamar & Okzacan-Pan), the SDGs and the social mission (Peatzold et al., 2022; Roundy et al., 2017), or a specific sector or geographic focus (Agrawal & Hockerts, 2019).

However, defining and operationalizing an impact investor is demanding; multiple studies are trying to untangle the broad dichotomy of finance first to impact first investors (Hockert et al., 2022). This study tries to shed at least some light on certain attributes of impact investors.

Based on these theoretical foundations, the following research will explore whether the impact investor network exhibits a structure similar to those of previously analyzed social networks. Consequently, clustering might be observed, following the principle of homophily. If this is confirmed, dividing the network into subnetworks could be possible. Subnetworks would consist of actors with similar attributes or pursuing similar objectives.

Therefore, an exploratory network analysis will test the following hypothesis:

H1: The structure of the impact investor network can be partially explained by the concept of homophily.

As stated in the introduction, the main goal of impact investing is to invest in transformative and sustainable innovations, especially concerning the SDGs (Barber et al., 2021). If the hypothesis is confirmed, this could indicate an imbalance of allocated funding in relation to social or environmental-focused projects based on in-group behavior. Further, certain attributes could emerge as prevalent for startup support. Similar effects might be observable for the actors' geographical focus.

7.3 Methodology[6]

The hypothesis was tested using an exploratory-empirical approach by conducting a social network analysis. The networks' data acquisition, creation, and analysis proceeded based on the methodology of Mayring and Fenzl (2014) and Kuckartz and Rädiker (2022).

7.3.1 Research Background

Germany presents a compelling case for analysis due to its burgeoning impact investment sector and the rapid growth of impact-driven startups. In 2022, the Federal Initiative Impact Investing, comprising impact investors, intermediaries, and foundations, reported that impactful investments in Germany amounted to 9.23 billion euros (Then & Schmidt, 2020). Additionally, the number of impact-driven startups in Germany has surged, with over 700 such startups reported in 2019, a 40% increase from the previous year (Kollmann, 2019). These figures underscore the demand for and the presence of a robust impact investor network.

A comprehensive inventory and detailed network analysis are essential to determine whether the increasing number of impact-driven startups in Germany are receiving adequate support. Such an analysis can also identify potential avenues for future research and strategies to bolster impact investing for these startups.

7.3.2 Selection of Considered Actors

To identify the German impact investor network, the initial sample of actors was obtained through a manual search following the recommendations of Kuckartz and Rädiker (2022).

[6] The data was acquired during a master thesis, supervised by the author; see Rogulsky (2023) (cf. Chapter 3).

The search started with the impact investors and intermediaries listed in the 2020 German Impact Investing Initiative market study, including 20 actors fit for the study's overall goal (Then & Schmidt, 2020).

The next step involved applying so-called snowball sampling. Building on Goodman's (1961) work, this approach is suitable for identifying new actors based on those previously identified. It revealed the connections and relationships that illustrate the interconnections and organizational structure of the German impact investors' network.

The data collection was conducted iteratively, and all connections between pre-identified actors were documented. This process continued until 150 actors and their respective connections were exceeded. This limit was set because the number of new actors per cycle had continuously decreased. Data collection took place between January and May 2023.

The coding of potential actors to be included in the network generation was based on a semantic examination of the information on individual entity websites. It can be divided into two parts: The first part required a reference to investing, while the second focused on impact.

- Exemplified coding for “Investing” is funding, support, investor, investing, return, turnover, money, and consulting.
- Exemplified coding for “Impact” is the claim of a positive impact on the SDGs, change, transformation, the most urgent problems of our times, and social engagement.

The coding consists of text fragments that can appear in different constellations. As each actor describes its impact and investments differently, synonyms or semantically identical statements may have been sufficient for classification.

Additionally, as this study aims to understand the existing support structures for impact-driven startups, an explicit reference to startups or entrepreneurship was coded. The actors were coded as "yes" if they showcased keywords such as startup, entrepreneur, or related synonyms. The key criterion was a direct connection to startups or entrepreneurship. Actors that target or indirectly support groups of startups were coded as "maybe". Impact funds are an example here, as they provide support to organizations

supporting startups. Actors with no evident connection to startups or entrepreneurship were coded as "no".

The coding was done in German and English, based on the website language.

Graphical representations of the main network and sub-networks were created using the MS Excel extension NodeXL. Additionally, the Gephi program was used for further analytical enhancements. Section 7.4.1 initially introduces the fundamental network attributes and metrics. Subsequently, detailed subgraph results and individual observations are presented in Section 7.4.2.

7.4 Results

Based on the 150 initial actors, the analysis of their connections resulted in a final database of 891 actors. A total of 1,270 connections were identified between them, with 1,059 (83%) of these connections being unique.

Of those 891 acotrs, 166 actors can be attributed directly or indirectly as impact investors and impact investing support organizations.The identified impact investors include 83 asset managers or asset owners (A), 16 banks (B), two family offices (FO), and two funds (F). Further, intermediaries were identified that support impact investing via consultation or other resources. They include 30 consultants (C) and 33 institutionalized networks (IN). In addition to impact investors and intermediaries, there are connections to 182 actors outside of Germany and 28 conventional business angels.

The remaining 515 are unspecified actors. These include educational institutions, magazines, journals, impact startups or companies, religious institutions, civic associations and clubs, non-profit organizations, certification bodies, or foundations. These actors were excluded from further analysis, as this study focuses on the direct interconnection between impact investors, their intermediary organizations, and their network structure.

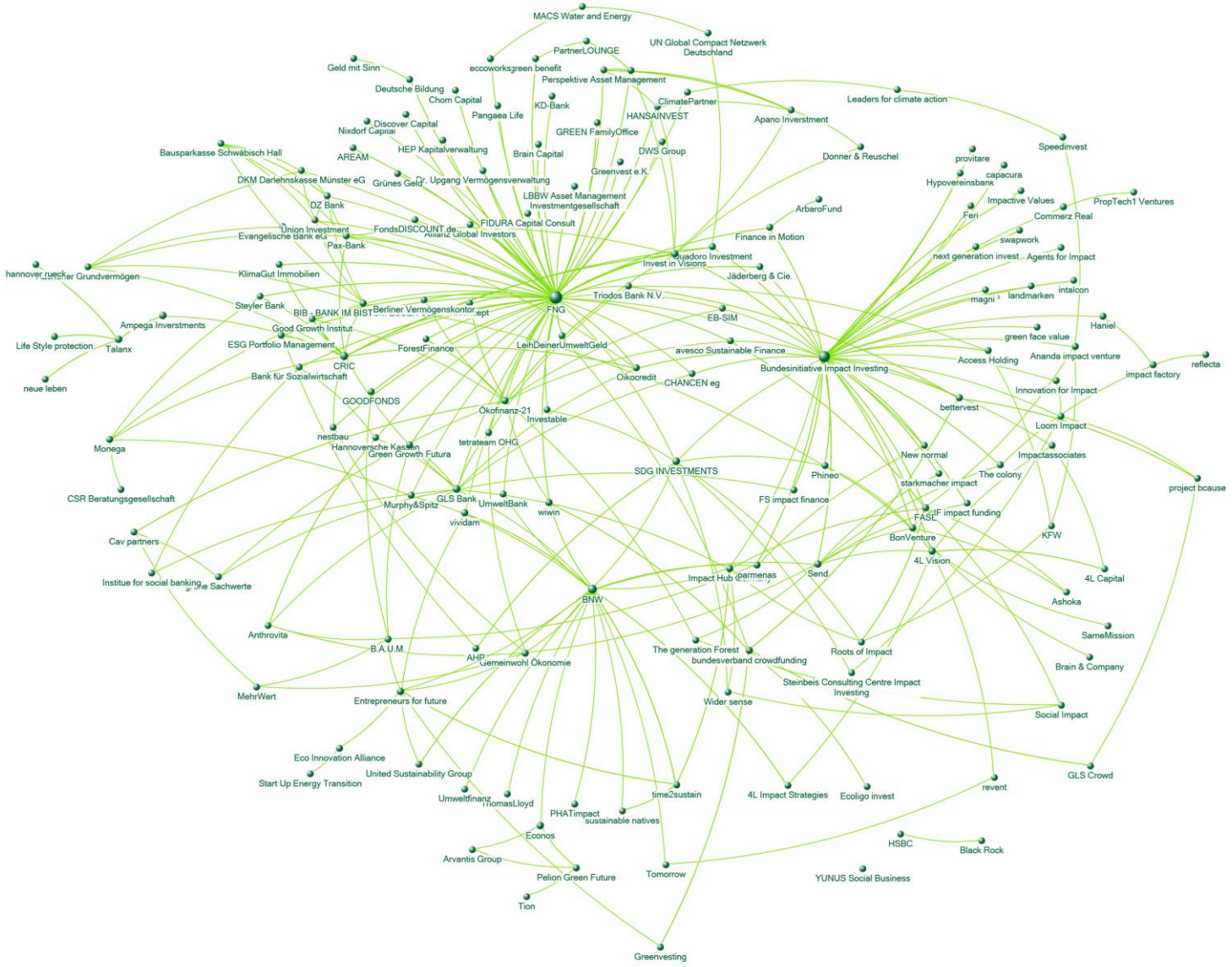
7.4.1 The Main Network

The initial findings of the 166 actors of the German impact investor network (see Figure 9) divide 413 edges into 207 unique and 206 edges that occur multiple times. This suggests multiple connections between some nodes, indicating strong or multifaceted relationships between those actors. The maximum geodesic distance is 8, with an average

of 3.176 nodes, indicating that most nodes can be reached from any other node in just a few steps, implying a well-connected network.

The entire network consists of three subnetworks. One primary network connects 163 out of 166 nodes. The other two consist of one and two impact investors without connections to the rest (lower right corner). These results show that the network is mainly cohesive, with almost all participants being part of the primary network.

Figure 9: German Impact Investor Network (Own Illustration)



A closer look at the primary network shows a modularity value of 0.527 and a density of 0.0226. The modularity value indicates that the network consists of individual modules and helps identify groups of nodes that are more densely connected than those outside the group.

To better understand the networks´ structures and primarily the most important actors (i.e., to identify the existence of hubs), the network was analyzed using the metrics of betweenness centrality, closeness centrality, and degree centrality.

Exemplary, the results of the betweenness centrality are shortly presented. A high betweenness centrality value indicates that this node plays a crucial role throughout the network. The maximum betweenness centrality of a node is 6627.5, with a median of 15.94. Six networks, one bank, and one asset manager/owner are among the ten nodes with the highest values. In descending order, these are Forum Nachhaltige Geldanlagen (FNG) (IN), Bundesinitiative Impact Investing (BII) (IN), Bundesverband Nachhaltige Wirtschaft (BNW) (IN), Send (IN), Corporate Responsibility Interface Center (CRIC) (IN), GLS Bank (B), SDG Investments (IN), Ampega Investments (A), Talanx (A), and Econos (A).

Only slightly different pictures emerge when looking at closeness centrality or considering the ten actors with the highest degree centrality, revealing how many direct links or edges they have.

The combination of betweenness, closeness, and degree centrality analyses enabled the identification of actors occupying particularly central positions within the entire network. The actors that belong to the highest ranks according to all three metrics are as follows: FNG (IN), BII (IN), SDG Investments (IN), Social Entrepreneurship Netzwerk Deutschland (SEND) (IN), GLS Bank (B). Based on the data, it can be postulated that some INs act as hubs within the overall network, which can be explained by their overall goals.

The FNG has been the professional association for sustainable investments in German-speaking countries (Germany, Austria, Switzerland) since 2001. FNG members include banks, investment companies, rating agencies, financial advisors, scientific institutions, insurance companies, non-governmental organizations (NGOs), and private individuals.

Their vision is to promote a financial system that drives the socio-ecological transformation of the economy within planetary boundaries (FNG, 2024).

BII is a non-profit association based in Berlin. It pursues the vision of regenerative investing and economic activity that respects both ecological limits and social standards. It pursues the purposes of education, science, and research in impact investing (BII, 2024).

SDG Investments supports institutional investors in identifying fitting finance products based on ESG and impact criteria (SDGInvestment, 2024).

SEND is a German-wide non-profit association network of regional associations active in social entrepreneurship. The overarching goal is to connect and communicate social innovation (SEND, 2024). SEND is the only actor within this group with a concrete focus on entrepreneurship.

Lastly, GLS Bank calls itself a pioneer in sustainable banking and is the biggest sustainability bank in Germany. Their main pillars are sustainable crediting, community-based banking, and social actions (GLS, 2024).

7.4.2 Clusters within the Network

Once the most central hubs within the network had been identified, clustering algorithms were applied to the data to ascertain whether the identified actors had significant roles in the network and to gain further insight into its nature. The objective was to examine the actors' networking behavior based on their characteristics, link them to the results of the network metrics, and identify potential subnetworks in the form of clusters. These analyses serve to validate the hypothesis that there are similarities within specific clusters.

Three standard clustering algorithms, Clauset-Newman-Moore (CNM), Wakita-Tsurumi (WT), and Girvan-Newman (GN), were utilized to identify clusters in the data based on the documented connections between actors (Clauset et al., 2004; Girvan & Newman, 2002; Wakita & Tsurumi, 2007). Furthermore, clustering results were analyzed and visualized, considering the entity type of the actors, the focus on startups, and the impact focus (environmental, social, or both).

The CNM algorithm forms 12 clusters, the WT algorithm 16 clusters, and the GN algorithm 14 clusters. Due to the extent of graphical representations and little

differentiation, only the clusters according to the CNM algorithm are depicted in the following. For clarity, only the names of actors categorized as "institutionalized network" (IN) are displayed, and connections between the clusters are hidden. Figure 10 and Figure 11 depict the two main clusters of the German impact investor network after applying the CNM algorithm (the illustrations of clusters 3-12 can be found in Appendix B).

Figure 10: Network Structures Applying CNM, Cluster 1 (Own Illustration)

Vertex Properties: dark blue: IN, light blue: B, dark green: A, light green: F, red: C, orange: FO

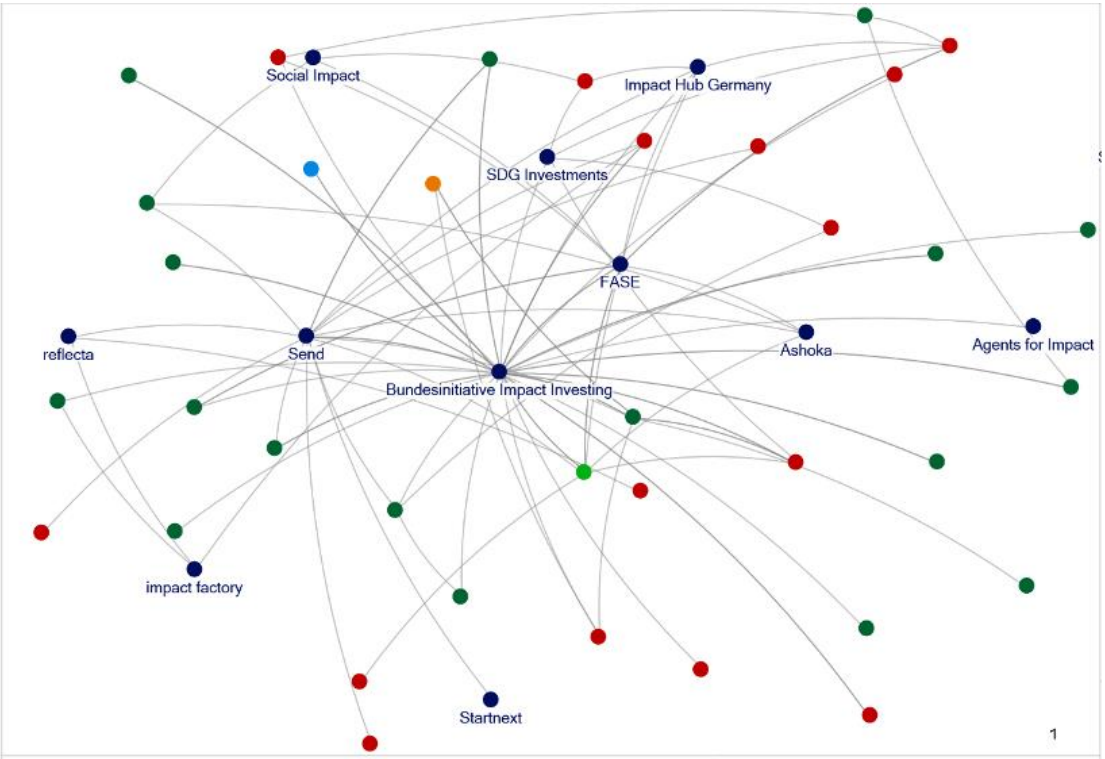
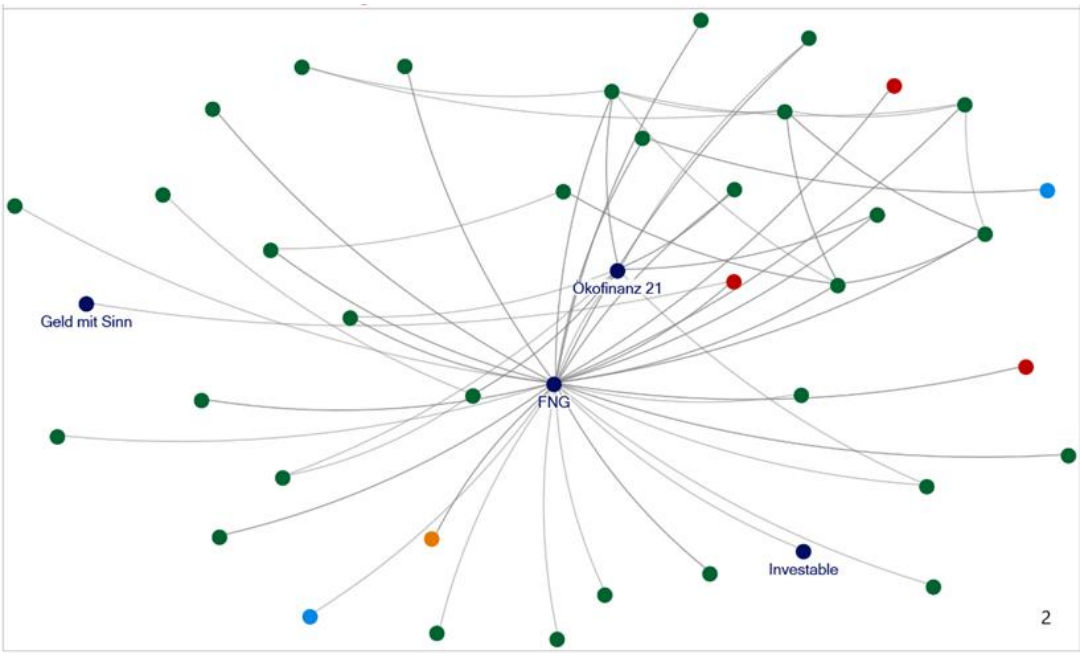


Figure 11: Network Structures Applying CNM, Cluster 2 (Own Illustration)

Vertex Properties: dark blue: IN, light blue: B, dark green: A, light green: F, red: C, orange: FO



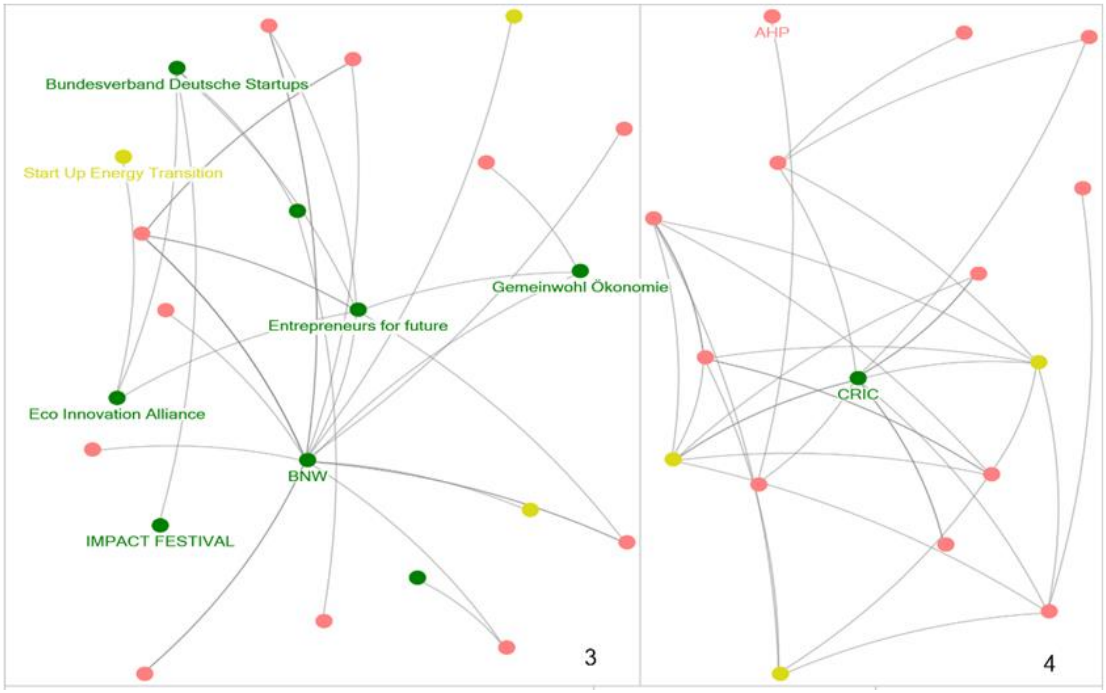
An initial observation is that the clusters vary in size, ranging from only two actors to over 30 nodes. Clusters with a high number of nodes usually have one or more IN-type intermediaries at their centers. It suggests that IN-type intermediaries are pivotal in forming larger network structures, acting as hubs that connect various actors and facilitate larger cluster formations.

Specific patterns emerge when examining each cluster's overall distribution of actor types. For the CNM algorithm, no cluster exhibits a balanced distribution of all actor types. Only cluster number five is roughly balanced, with family offices (FO) missing. Intermediaries are overrepresented in clusters one, three, six, nine, and ten. There is an overrepresentation of institutionalized networks (IN), particularly in cluster six, and consulting firms (C) in cluster nine. Clusters two, seven, eight, eleven, and twelve have an increased number of asset managers/owners (A). Banks (B) dominate in cluster four. These findings showcase that the network has specialized clusters with different actor types dominating each. This indicates a lack of uniform distribution and suggests that clusters might serve specific functions or sectors within the network.

Based on this observation, the clusters were analyzed in terms of startup support and impact focus. The previously described patterns (actor dominance and actor imbalance) are again visible in the clusters concerning startup support; see Figure 12 for an exemplary depiction. Green dots or text colors indicate actors support startups directly, yellow indicates potential support in specific cases, and red suggests no apparent connection. Notably, out of a total distribution of 52 green, 22 yellow, and 93 red actors, a significant portion of actors seems unsuitable for startups.

Figure 12: Comparison of Cluster 3 and 4 based on Startup Focus (Own Illustration)

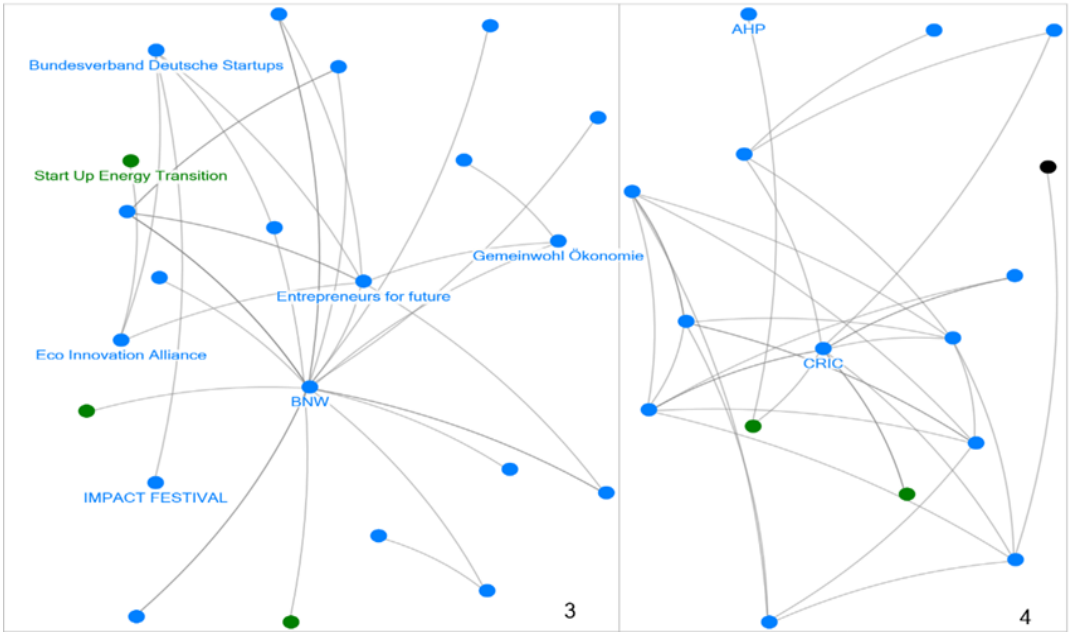
Vertex Properties: green: startup focus, yellow: potential focus, red: no focus



A similar analysis was conducted for the impact focus (see Figure 13 for an exemplary depiction).

Figure 13: Comparison of Cluster 3 and 4 based on Impact Focus (Own Illustration)

Vertex Properties: green: environmental, blue: environmental and social; black: indiscernible



An impact focus could not be determined for two nodes, resulting in 164 for analysis. Green represents the environmental category, yellow represents the social category (not depicted in Figure 13), and blue represents both. Black-marked actors indicate an indiscernible focus. Over the total network, the distribution among the three categories significantly leans towards the "both" impact focus, with 75.6%.

After looking at the clusters separately, Table 12 includes a breakdown of distribution for each actor type based on startup suitability and impact focus.

Table 12: Results for Investor Type, Startup, and Impact Focus (Own Illustration)

Actor Type	**Quantity**	**Startup Focus**			**Impact Focus**		
		Yes	**No**	**Maybe**	**Environ-ment**	**Social**	**Both**
Asset Manager	83	17	7	59	25	1	56
Bank	16	2	7	7	0	0	15
Family Office	2	0	0	2	0	0	2
Fund	2	1	1	0	0	2	0
Consulting	30	10	4	16	4	4	22
Institut. Networks	33	22	3	8	2	2	29
Sum	166	52	22	92	31	9	124

Multiple assumptions can be drawn from this table:

(1) Asset managers/owners mostly lack a direct connection to startups and frequently pursue an environmentally oriented impact focus.
(2) Consulting firms have an evenly distributed startup focus, with a strong tendency towards both types of impact.
(3) Institutionalized Networks are generally well-suited for startups and any impact focus. Notably, both funds are associated with a focus on social impact.

Regardless of the algorithm employed, the institutionalized networks FNG, BII, and BNW consistently appear in distinct clusters. They consistently demonstrate high levels of activity within the four largest clusters. In two out of three algorithms, the CRIC network is included in one of the four largest clusters separately from the others. A considerable number of banks are present whenever the CRIC network is an actor in a cluster. Similarly, the GLS Bank also appears in a distinct cluster. The cluster in which it is situated is either the fifth or sixth largest in terms of size.

FNG, CRIC, and the GLS Bank tend to establish connections primarily with actors who do not explicitly support startups. Conversely, institutionalized networks such as the BII, BNW, Bundesverband Crowdfunding, and particularly SEND demonstrate the opposite tendency. Furthermore, there is a discernible increase in the presence of environmental-focused actors in clusters where SEND is an actor. This is an intriguing and somewhat contradictory finding, as SEND has a strong focus on social entrepreneurship (SEND, 2024).

Across all clustering methods, the subnet around the Bundesverband Crowdfunding exhibits some peculiarities. Other networks are situated in proximity to it and are more likely to be conducive to the growth of startups. The actors in question are predominantly crowd investment platforms.

To conclude the cluster analysis, a review of the data from all three attributes (type, startup focus, impact focus) reveals that only a few clusters exhibit a uniform distribution. The actors within the specific clusters tend to share similarities with their neighbors.

7.5 Discussion

In summary, several observations and interpretations about the German impact investor network highlight impact investors' investment behaviors. This study provides an initial overview of the German impact investor network but acknowledges limitations due to the volatility of impact investors and intermediaries, making full coverage difficult (Islam, 2021).

The network is characterized by very low absolute density, high modularity, and a highly differentiated networking degree. Some actors do not publicly disclose their partnerships, reducing documented connections and overall network density. This contributes to high modularity and uneven networking, with a few actors playing dominant roles, as reflected in their high betweenness, closeness, and degree centrality values. These results align with social network theory, particularly the principle of homophily (Sun & Tang, 2011).

Clusters formed by different algorithms are unevenly distributed, with different network parts becoming relevant based on actor type. For example, banks are notably often connected to the CRIC network, indicating a conservative approach to impact-driven innovation, as shown by startup support offerings. However, intermediaries like BII and BNW facilitate connections between diverse impact investors and startups, serving as valuable gateways for funding.

In addressing the SDGs, clusters such as BII, FNG, and GLS Bank focus on specific impact areas: social, environmental, and both, respectively. However, the impact focus analysis shows that most actors do not limit themselves to specific forms of impact, suggesting openness to supporting various positive impacts. Many asset managers and banks invest in diverse positive impacts through funds.

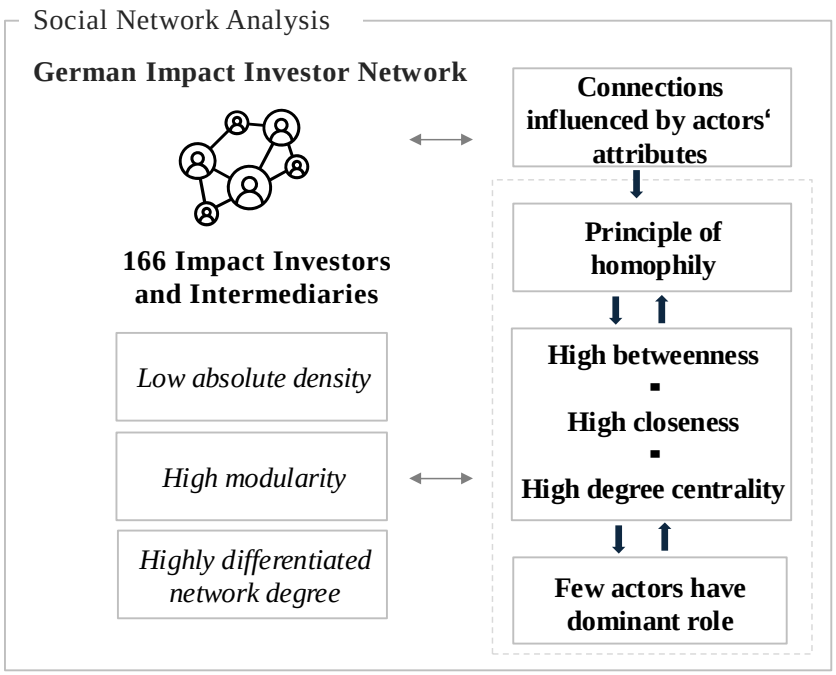
To conclude the cluster analysis, these findings support the hypothesis that homophily plays a role in the network formation of impact investors. It seems reasonable to posit that the connections between actors are not entirely random but influenced by their attributes.

7.6 Conclusion

This study aimed to define the structural characteristics of networks among impact investors and how these structures might influence investment strategies. Using snowball sampling and semantic coding, the study identified and analyzed the German impact investor network, comprising 166 impact investors and intermediaries consisting of 83 asset managers/owners, 16 banks, two explicit funds, two family offices, 33 institutionalized networks, and 30 consulting companies.

The exploratory analysis revealed that the network is well-connected and compact, with strong relationships among its members and only a few small subnetworks, indicating high community integration. Cluster analysis showed that actors with similar properties tend to be interconnected, reflecting the principle of homophily. See Figure 14 for a comprised representation of the main results.

Figure 14: Chapter 7 – Main Results (Own Illustration)



Contrary to expectations based on literature (Block et al., 2021; Cetindamar & Ozkazanc-Pan, 2017; Roundy et al., 2017), the data revealed that many investors do not focus on startups, aligning with findings that companies become attractive to impact investors at a later growth stage (Arena et al., 2018; Gidron et al., 2021). This could hinder significant positive transformation and sustainable development.

Defining an impact investor is complex, as indicated by the literature (Hockert et al., 2022). This study faced similar challenges, complicated by the difficulty of operationalizing socio-environmental impacts. Despite this, a consolidated view of the German impact investor network was achieved, though an in-depth qualitative analysis of investments and services was not conducted. Network properties could change with the addition or removal of actors (Islam, 2021).

Future research could expand the network to provide a more comprehensive view and conduct detailed analyses of actor profiles and investment strategies. Examining the network at a European or global level could reveal similar patterns internationally. Additionally, evaluating impact measurement methods for these actors would be valuable. Time-delayed network analysis could project and verify future networking behavior, testing the principle of transitivity.

This study offers an overview of the German impact investor network, highlighting diverse actors committed to positive socio-environmental impacts. The insights support earlier studies of impact investor tendencies and can assist impact-driven startups in navigating this investor landscape.

Part III – Impact-driven Startups

So far, the startup perspective has been a rather neglected focus of analysis in research about impact investing. In the following chapter, their point of view takes center stage. With all acquired knowledge about investors' difficulties in identifying suitable investments and their preferences in choosing their investment cases, it is crucial to understand startups' main challenges and barriers in measuring and reporting their potential impact to communicate it transparently and thoroughly to their stakeholders.

The findings show four main trade-offs evident in the reality of impact measurement practices of startups. Further, the results support earlier findings that startups utilize no established framework (Fichter et al., 2023). Even the more commonly known frameworks within the impact investing community, such as IRIS+, are not part of the daily business of young companies, which shows the demand for tailored frameworks fit to their capabilities for impact measurement and assessment.

8. The Reality of Startup Impact Measurement

8.1 Introduction

Impact measurement has gained attention in practice and research over the past years alongside the growth of impact investing. As more and more startups want to exert a social or sustainable impact with their business model (Türck, 2022), measuring a startup's sustainable impact is becoming increasingly important (Schutselaars et al., 2023). From the investors' demand, it is important to quantify their impact to track their progress and to adjust their sustainable business strategies accordingly (cf. Chapter 4, 5, 6). Despite numerous impact assessment tools and frameworks that are supposed to help in this regard, none have been established as a standard so far (Eckerle et al., 2022). This leaves investors unable to assess and properly value the impact of an investment (Grabenwarter & Liechtenstein, 2011).

Research indicates that startup-specific challenges of resource constraints, limited data availability, and uncertainty make measuring their impact particularly difficult (Trautwein, 2021). This study aims to add to this observation to understand the underlying challenges and barriers better and identify points for improvement in existing impact measurement practices.

Therefore, this analysis' guiding research question is:

GRQ3: What are startup-specific challenges and barriers for impact measurement?

To address this, an empirical investigation is conducted via 25 expert interviews. First, an overview of existing methods for measuring the impact of startups is provided to synthesize the basis for the interview guideline. Afterward, qualitative content analysis is utilized to identify iteratively overarching topics and concrete challenges and barriers based on the experts` insights concerning impact measurement practices.

8.2 Theoretical Background

Many startups aim for economic goals such as rapid, exponential growth and significant market shares. Such startups, which rapidly increase the company's value and attract the interest of investors and venture capitalists, are called Unicorns (Kollmann et al., 2020).

Contrary to this startup type, impact-driven startups pursue ecological and social goals in addition to economic ones (Schäfer et al., 2015). Raising capital is a much greater challenge for such startups, as mentioned in Chapter 4, especially in direct comparison to their growth-driven peers. Therefore, impact investing is an attractive funding source for these types of startups, as impact investors emphasize the impact goal alongside a (reduced) financial return (Hockerts et al., 2022). However, as shown in the previous chapters, impact investors demand measurable evidence of the potential impact the startup intends to achieve (Bocken, 2015; Grieco et al., 2015).

Multiple ongoing efforts are being made to develop and standardize measurement tools for impact-driven companies. Prominent organizations that lead this endeavor are the formerly called “Impact Management Project”, now Impact Frontiers (ImpactFrontiers, 2024), the GIIN with their established IRIS+ Metric (GIIN, 2019), or in the German context, the IMV-Lab to streamline impact measurement processes (IMV-Lab, 2024). Specifically for startups, the absence of concrete measurement indicators is notable on the one hand by their absence in the frameworks of the organizations mentioned above. On the other hand, initiatives such as the newly introduced IMMPACT Project in Germany aim to support young companies in their impact journey and to support them with their measurement – their goal is to develop assessment standards within the German impact investing ecosystem (IMMPACT.Guide, 2024).

Research has identified the demand in practice to develop sound measurement and reporting tools for the non-financial sustainable performance of companies (Crucke & Decramer, 2016). Having originated in social science and aid programs (Roth, 2021), several impact measurement tools have been developed in recent years that focus on the application in a business context (Rainock et al., 2018). However, there is a lack of appropriate measurement for startups, as they have different needs and potentially face different challenges than established companies (Fichter et al., 2023; Horne, 2019). The need to measure the potential impact of a startup is evident. Nevertheless, there is a lack of research that explains what challenges and barriers hinder startups from using established measurement tools.

Impact measurement approaches can be subdivided into three groups: process-based, scorecard-based, and synthetic indicators[7] (Arena et al., 2016; Horne, 2019).

First, the process-based approach attempts to establish a causal relationship between the actions of the startup and the resulting change or impact. Evidence in the academic literature shows that process-based approaches are suitable for qualitatively reporting the intended impact (Roth, 2021). Prominent examples next to the "Theory of Change" (Grieco, 2015; Wendt, 2021) are the "Social Return on Investment" (Nicholls et al., 2012), or the "Social Balanced Scorecard" (Grieco et al., 2015).

Second, the scorecard approach aims to evaluate the sustainable impact of the startup based on different dimensions. The sustainability performance or potential of the startup in the different dimensions is rated on a predefined scale (e.g., 1-5 points). The scores for each dimension are then added up, multiplied, and combined to produce a final score. This final score allows for comparison with other start-ups, previous scores, or the high score. Examples of such dimensions are, for example, environment, value to society, scalability, or efficacy (Malhotra et al., n.d.). They provide a simple interpretation that is useful in accountability processes (O'Flynn & Barnett, 2017). Two well-known and established scorecard-based models are the "Impact Compass" (Malhotra et al., n.d.) and the "B Impact Assessment" by BLab (Barman, 2015).

[7] For an in-depth description of the frameworks, please see Appendix A.1-2.

Third, synthetic indicators compare the impact of different organizations (Grabenwarter & Liechtenstein, 2011; Horne, 2019). While the scorecard approach aims at an internal assessment of the sustainability impact of the startup, synthetic indicators aim to compare the impact between different organizations (Horne, 2019). Therefore, it is an approach suitable for investors but not on a company level. Here, a single indicator is calculated that combines several aspects of a company's impact. Such indicators attempt to combine the different aspects of impact into a comprehensive indicator that is easier to communicate and understand. Therefore, KPIs are often used that can be adapted to the needs and characteristics of a particular impact investment (Grabenwarter & Liechtenstein, 2011). Here, one noteworthy framework to compare different companies is the "Global Impact Investing Rating System" (GIIRS). GIIRS is an IRIS+-based rating approach for investors. It is used to rate companies on different dimensions (e.g., employees, operations, and environment) using the IRIS+ metrics (Barman, 2015). The aim is to make it easier to measure impact and to make the results comparable. However, this approach has also been criticized for being too superficial in terms of metrics and therefore does not allow for adequate impact measurement (Brest & Born, 2013).

In summary, all the instruments used in these three approaches (process-based, scorecard, or synthetic indicators) have different problems that are very versatile and multilateral. They include high resource requirements, lack of standardization and normalization, and poor comparability (Arena et al., 2016; Horne, 2019). This seems to make the entry barrier to impact measurement difficult, especially from a startup perspective. To verify this viewpoint, 25 semi-structured interviews were conducted with impact-driven startups, sustainability consultants, and impact investors to identify challenges and barriers for an impact measurement by startups and to distill the main points for adjusting current impact measurement practices towards startup-tailored frameworks.

8.3 Methodology

To answer the research question, the expert interviews are analyzed using qualitative content analysis (Mayring, 2014). This method is suitable for extracting and interpreting unknown variables from a small sample of textual data (Leedy & Ormrod, 2015). In addition, there has been little research on the challenges and barriers faced by startups in

the pursuit of impact measurement. For this reason, the analysis of the interviews is based on inductive category development, in which the categories to be analyzed emerge from the material itself (Gläser & Laudel, 2010; Mayring & Fenzl, 2014).

The inductive analysis of the qualitative contextual data is carried out, according to Kuckartz (2019). In the first step, the data is collected and prepared. After that, the data is coded inductively by identifying key topics. Therefore, the data is read repeatedly to check and adjust the codes continuously, increasing the accuracy of the analysis. The codes are subsequently grouped into categories and subcategories based on common topics. In the next step, the categories and codes are related to each other to derive the corresponding concepts. The final step is to interpret and summarize the results at the category level.

For data collection, 25 semi-structured interviews with experts were conducted. To ensure a comprehensive overview of the subject of impact-driven startups, not only founders and employees of startups but also investors, investment managers, and consultants in this field were interviewed. Furthermore, a systematic sampling process was used to increase the sample's representativeness (Fahrmeir et al., 2023).

Thus, for the startup interviews, experts were interviewed whose new ventures were characterized by the following at the time of the data gathering: 1) They are not older than ten years; 2) they have between 3 and 250 employees; 3) they are aiming for a significant increase in turnover (EuropeanCommission, 2003); 4) they claim that they want to generate a positive ecological or social effect on the environment with their product or service. These criteria were designed to ensure that the startups are impact-driven early-stage startups. The interviewed experts who do not work for startups were characterized by the fact that they all have in-depth knowledge about sustainable startups, e.g., by consulting them or investing in them.

Accordingly, a list of suitable impact-driven startups, impact investors, and sustainability consultants was compiled by screening the social network platform LinkedIn. The experts were contacted via LinkedIn, informed about the research background, and asked to participate in the interview. Via two Master Theses supervised

by the author[8], 20 interviews were conducted by the students and five by the author herself. Once the experts agreed to be interviewed, a Microsoft Teams or Zoom meeting was arranged and audio recorded. An overview of the interviewed experts can be found in Section 8.3.1.

To ensure data consistency, a semi-structured interview guideline was used (Gläser & Laudel, 2010). The guideline is divided into five parts. The first part is focused on the tools and frameworks used to develop a business model with impact. The second part aims to investigate how impact startups currently measure their impact. Furthermore, the importance of the measurement for external and internal stakeholders is asked. The third part is about the two main approaches for impact measurement relevant to startups: the scorecard and the process-based approach, and their strengths and weaknesses. The fourth part focuses on the comparison between the two approaches and which approach is preferred for impact measurement by startups. Furthermore, special features for the measurement, such as benchmarking, forecasting, and monetization of impact, are investigated. The last part covers the challenges of startups in terms of impact measurement and analyzes the requirements for an impact measurement tool or framework.

After recording the interviews, the 25 interviews were transcribed. Standard orthography was followed for transcription, and non-verbal expressions were omitted. Furthermore, incomprehensible passages were marked (Gläser & Laudel, 2010). Most of the interviews were conducted in German. Important passages from the interviews quoted in this work have been translated into English.

8.3.1 Overview of Interview Experts

For a better understanding of the content analysis and the perspectives of the different experts, an overview of the interviewees is given below. 18 of the 25 experts worked directly for a startup, and seven had a broader perspective on impact measurement of startups either as investors or as consultants. An overview of the interviewed experts can be found in Table 13.

[8] Parts of the data was acquired during two master theses, supervised by the author; see Edelmann (2021), Bernhardt (2023) (cf. Chapter 3).

Table 13: Overview of the 25 Interview Partners (Own Illustration)

ID	Organization	Type	Position	Industry	Impact Measurement Frameworks/KPIs
A	Avocadostore	Startup	Sustainability Manager	Consumer goods	Self-developed
B	BackBone Ventures	Investor	Partner	ICT, FoodTech	SDGs, Carbon Footprint
C	sigo	Startup	Co-Founder	Mobility	Kilometers traveled by bicycle
D	Spoontainable	Startup	Co-Founder	Consumer goods	Saved CO_2-eq. kg; saved cocoa shells in kg
E	SDG Investments	Investor	Investment Manager	Agnostic	SDG rating from imug
F	Magnotherm	Startup	Co-Founder	Energy	Saved CO_2-eq. kg
G	Onomotion	Startup	Co-Founder	Mobility	Saved CO_2-eq. kg
H	Sustainble Thinking	Consulting	Consultant	Agnostic	Saved CO_2-eq. kg; KPI set from CSRD
I	WETell	Startup	Co-Founder	Telecommu-nication	GWÖ
J	MGH	Investor	Business Angel	Agnostic	Saved CO_2-eq. kg; amount of planted trees
K	Regionique	Startup	Managing Director	Consumer goods	Transport kilometers; water usage
L	Querfeld: Bio	Startup	Managing Director	Consumer goods	Saved food in kg
M	Numbat Energy	Startup	Managing Director	Energy	Saved CO_2-eq. kg
N	4L Impact Strategies	Consulting	Managing Director	Agnostic	GRI; ESTS; DNK
O	Easer	Startup	Co-Founder	Energy	SDGs
P	4L Capital	Investor	Impact Analyst	Agnostic	Impact Management Project
Q	Vytal	Startup	Co-Founder	Consumer goods; Packaging	Material input per service unit; saved CO_2-eq. kg; water usage
R	The Nu Company	Startup	Sustainability Manager	Consumer goods	Amount of planted trees; saved CO_2-eq. kg; water usage; LCA
S	Soulbottles	Startup	Impact Manager	Consumer goods; Packaging	Amount of donated money in Euro; Saved CO_2-eq. kg
T	Junglück	Startup	CSR Manager	Consumer goods	Amount of planted trees; Saved CO_2-eq. kg; SDGs
U	Hopper Mobility	Startup	Co-Founder	Mobility	Saved CO_2-eq. kg
V	Einhundert	Startup	Co-Founder	Energy	Saved CO_2-eq. kg
W	Citcar	Startup	Managing Director	Mobility	Saved CO_2-eq. kg
X	Africa GreenTec	Startup	Co-founder	Energy	IRIS+; GWÖ; saved CO_2-eq. kg

Y	Ananda Impact VC	Investor	Associate	Agnostic	SDGs; self-developed

8.4 Results

In the following, the results of the interview analysis will be presented. First, a closer look is taken at the current impact measurement practice of startups; afterward, challenges and barriers are presented.

8.4.1 Current Impact Measurement Practices

The interviews confirmed the observation from the scientific literature that there seems to be no common framework for impact measurement utilized by startups. Instead, startups try to measure individual indicators that fit their business models (see Table 13). Overall, the most common indicator to measure the potential impact is saved CO2 emissions. Next to this indicator, self-developed and highly specialized indicators are the norm. These findings are also supported by the investor and consulting perspective, although they more often propagated the use of standardized sets of indicators. Especially from a synthesizing viewpoint, the SDGs prove once more to be a renowned framework for target setting.

Regarding the debate about process- vs. scorecard-based models to measure impact, the findings suggest aiming at a unified model of both approaches. Experts who are more in favor of the process-based approach particularly appreciate the clear causal chain that this approach provides, which makes it more applicable to startups (T; V; X; H; I; B) (see Section 8.4.2).

The scorecard approach, on the other hand, holds the advantage over the process-based approach because the attributes can be conveyed well with a scope that is quite easy to understand and can be used in the external presentation to stakeholders (U; A; L). In addition, this has a positive side-effect because a simple understanding of the company's impact can be used to sharpen the image of the sustainable company, leading to self-selection within the workforce and, above all, to the employment of committed employees (V). The difficulties of applying both approaches, as well as the desire to unify them, can be summarised in four main challenges and three overarching barriers distilled from the expert interviews, which are presented in the following subsections.

8.4.2 Challenges

The inductive coding of the data yielded four main challenges for startups concerning the measurement of their intended impact, as shown in Table 14.

Table 14: Identified Challenges for Startup Impact Measurement (Own Illustration)

Challenge Category	Description
Data Availability	Difficulties in obtaining the necessary data to measure the impact.
Restricted Resources	Availability of financial and human resources to carry out the impact measurement.
Complexity of Implementation	Complexity to implement and integrate impact measurement into business practices.
Comprehension and Comparability	Translation of impact goals and activities into understandable and comparable measures.

The Challenge of Data Availability

The most common challenge is "data availability", mentioned by 22 out of the 25 experts. This is a multi-faceted obstacle, with some conflicting views among the experts. However, most experts (19 of the 25) believe that it is already difficult for startups to obtain the appropriate data needed to measure their impact. For example, one founder describes the main problem of why impact is not measured in their start-up as follows:

> *"[...] simply missing data or information in the supply chain"* (D).

There are several reasons for the difficulty in collecting data. One is that it is fundamentally challenging for startups to get data, *"especially if the data is located outside the company"* (S). As one startup points out, suppliers are reluctant to share their data because it is a valuable corporate asset that they want to protect. This is a major barrier in measuring impact (see Section 8.4.3). Concretely, the startup had the problem that a supplier did not want to disclose the energy data of a machine because it was *"internal company data"* (S). This problem is reflected by another startup, which states that it is not possible to obtain concrete data upstream in the value chain:

> *"For example, with batteries or things like that, where you just can't get good data, or you don't even know where substances like lithium are actually being mined. [...] but we also wouldn't know what kind of electricity is used, for example, by the factories that we get the parts from"* (U).

On the other hand, startups are also unable to collect data on the downstream processes of their business activities or can only do so with great effort (B; S). For example, one startup only makes recommendations within the framework of their business model that have the potential to generate impact, but they can't check to what extent the recommendations are implemented.

> *"So, the biggest challenge for us is that we only make recommendations, and the real impact is when the recommendations are implemented. That is when the impact is created. The biggest challenge for us is to quantify how big the gap is, are we talking about 5% that are not realized or 95% that are not realized"* (O).

It is also not possible to track what happens in the downstream processes that add value to the product from a sustainability perspective.

> *"The biggest challenge is probably to track where the products are actually used or then resold, because we have a B2B business model and sell to retailers [...]. And if you now look at CO2, then of course the question is, what are the downstream distribution or logistics processes that we can't even calculate or take into account now, which perhaps also generate CO2?"* (D).

In addition, startups in particular operate in an environment of great uncertainty. In some cases, their product is not even on the market yet. As a result, their actual performance and market forecasts are difficult to predict (U; F; Y).

> *"Yes, I think the biggest uncertainties are in predicting the future. I mean, quantifying something today is very, very easy because you have all the data, but the problem with a startup is to forecast its status in three years. It is difficult in many ways. You never know how the market is going to develop, you never know how the business is going to develop and you never know how the environment of the business is going to develop [...]"* (F).

Therefore, startups often must work with *"assumptions through surveys or hypotheses*" (U) to be able to carry out adequate measurements. Another startup agrees with that opinion:

> *"But this is still a weak data situation, so we can only argue in very general terms, with very large numbers or with averages"* (L).

On the other hand, two experts said that data collection, especially for startups, can be carried out well under certain conditions (X; U). However, it is important to mention here that the interviewees explicitly referred to internal company data or self-collected data. One startup even sees an advantage in data collection for a startup compared to a corporation, because they can optimally align their data strategy as they are still very agile in this early company phase (V).

> *"When it comes to data collection, I think a start-up has more of an advantage than a corporation, because sometimes a startup is still chaotic, but at the same time there is not such a large amount of data and everyone is accessible [...]"* (V).

Finally, it should be mentioned that the data collection and processing itself requires resources such as time and money. These are already scarce resources in startups (Q; S; D). The resource issue was also often mentioned as an obstacle to impact measurement in general, which is the next challenge category.

The Challenge of Restricted Resources

"Restricted Resources" are usually an obstacle in any startup reality, nevertheless, especially in measuring impact, (non-)available resources play an important role. This is consistent with the general trade-off in impact investing, where there is always tension between profit and impact (Hockerts et al., 2022). Startups often face the problem that they lack the human and financial resources to carry out adequate impact measurement (C; E; J; R; W).

> *"When you are a startup, you always have to weigh the time and money factor against everything else. You always have to look at how you prioritize, and time and money are often scarce in a start-up"* (R).

In addition, new ventures also lack the necessary knowledge to measure the impact of their business activities, which is one of the main barriers identified (see Section 8.4.3). Consequently, the limited financial resources lead to limited access to experts and outside knowledge. The lack of financial and human resources can lead to a vicious circle with the lack of knowledge about impact measurement, as these two aspects reinforce each other.

> *"I mean, I'm also noticing now that I'm not yet very familiar with this topic and sometimes I don't know what's already on the market, so a lot of time goes into the search for it, into the selection. Of course, you could get external advice, but then it's also a question of financial resources, which are limited. It's a bit of a vicious circle"* (T).

In this context, the lack of a compatible tool for impact-driven startups that meets the resource efficiency requirements to assess their impact adds to the resource restriction in addition to the financial, human, and technical challenges (T; R; D; Q).

> *"...there are a lot of big challenges in quantifying impact, and the characteristics of startups are also a big problem. It's all about money and human resources. Everything you want to measure in terms of impact has to be done somehow with software, and that software is very expensive. And then you need people to learn that software, to operate that software, to do certain measurements and calculations for you. And that takes money for training, for human resources, for personnel costs. […] And then sometimes you have to say, okay, there are things that are sometimes not important to measure because we just need the resources elsewhere"* (R).

> *"If you want to be very precise, you would have to have a huge database and then track it exactly. What we could do, we could actually ask every partner what you have used so far and what you will use in the future [...]. But nobody does that, it's very time-consuming […]" (Q).*

The Challenge of the Complexity of Implementation

As aforementioned, the "complexity of implementation" of current impact measurement practices is another challenge. The interviewees require an impact assessment tool to be clear and easy to use to ensure that startups can measure their impact with minimal effort (B; C; J; Q; M).

> *"So, the best approaches are actually those that are highly practicable and, yes, also have a certain simplicity. If it is over-engineered, then it will be rejected by the people who have to do it..."* (J).

In this regard, a process model is preferred over the scorecard-based model (R; V; Y):

> *"Also, the stringency, that you have a clear chain that you can go along and say: 'How does it actually come to the impact that I generate?'. You can map that out very well"* (R).

The process-based models can further help to find potential for improvement regarding impact:

> *"And so for me, it is an approach that, if you follow it properly, is more objective and also helps to make clearer decisions about how to optimize the whole thing or maximize the impact. And I don't see that with the other approach, because if I'm doing a broad range of activities, then I don't have that in my understanding. Then, in my understanding, I have not examined it at that level and I have not created a chain that allows me to think concretely about how I can improve my impact and in what way"* (V).

Besides simplicity in terms of implementation, it is also important that the tool remains easy to maintain and update.

> *"It should be simple. The barrier to entry should be low so that companies can do it and don't have to dedicate a full-time employee to it for a year or keep it up to date. That is actually necessary: Simplicity to keep it up to date"* (I).

Yet, some experts mention the advantages of implementing an impact measurement practice for startups. This is because startups are more agile, and their business processes are still easily adaptable due to their lean structure (B; E).

> *"When you are pre-seed, before you even have customers, there is not much to measure, I would say. But once there is something to measure, it's actually easier, because it's much easier to implement in a start-up like this than it is in a company with a process that's been completely ingrained for 20 years"* (B).

> *"Our experience is that it is much, much easier to evaluate a startup in terms of sustainability because as a startup you are usually a mono-liner. That means that you have one topic that you are dealing with and that is very easy to outline and describe"* (E).

The Challenge of Comprehension and Comparability

Related to the challenge of implementation is the next one: "comprehension and comparability" of impact measurement results. As discussed in Section 8.2, current impact measurement frameworks and tools are very diverse. Accordingly, the results of these frameworks are also very versatile. They range from qualitative impact reports to various indicator systems to specific scorecard systems. Therefore, in principle, experts Q, U, and P wish that the result of an impact measurement should be easy to interpret and understand, which is currently not the case. One expert who has evaluated various impact-driven startups also finds that it is difficult to understand the impact of a startup because the business models are highly diverse and range from purely ecological impact to purely social impact.

> *"The sectors are also very broad. So, somehow, I have to keep track of so many different topics that I cannot claim to understand everything perfectly, especially the business models. I didn't study medicine, to stay with the example. I can't judge it down to the last detail"* (P).

Clear guidance (X) and standardized procedures (W) would yield comparability of impact measurement results. On the one hand, comparability should be possible between companies in the same sector (M; T). On the other hand, comparability should also be possible between different sectors with different sustainability goals, such as environmental or social ones (H; P). However, experts agree that it is very difficult to make comparisons between different sectors (R; J; B; F; M).

> *"And then you will see how difficult it is to compare different sectors. So, if you take one in the energy sector and one in adult education. I think it is very difficult to get a comparable result afterwards, so that you can say: 'Hey, I'm investing in A because A has a much better impact'"* (M).

To meet this requirement of comparing companies from different sectors with different sustainability goals, one startup suggests comparing indicators within the individual sustainability dimensions (X). In addition, some of the experts recommend monetarization, i.e., the conversion of impact into monetary units, to satisfy the needs of simple communication, clear understanding, and comparability (Q; J; R). According to one investor, monetarization also has a positive side effect, as the impact is dependent on

business volume and turnover, which also makes it possible to forecast the impact efficiently. After all, a startup only has a sustainable impact if the business model works (J). On the other hand, both information loss and ethical considerations are arguments against monetarization (X; Y).

> *"Overall, the indicators and impacts are most meaningful to me with the unit I am measuring them with"* (X).
>
> *"...for us, it's the lack of standards and questions about how ethical this approach is. For some environmental startups, you can also measure the impact in terms of future generations. Then, how do you account for the value of future life versus the present life?"* (Y).

While challenges can be overcome at some point, barriers pose a significant hurdle to the implementation of impact measurement within a startup company. Barriers are obstacles that prevent or block progress, which can be external to the impact-driven startup or internal. The findings suggest three overarching barriers, which will be illustrated in the following section.

8.4.3 Barriers

During the inductive coding process, three distinct barriers were identified that have a direct consequence on how impact-driven startups operate and, ultimately, on the challenges they face in measuring impact, see Table 15.

Table 15: Identified Barriers for Startup Impact Measurement (Own Illustration)

Barrier Category	Description
Stakeholder Demand	Different stakeholders, such as investors, customers, and employees, expect different aspects of a startup's sustainable business model to be the focus of its activities.
Power	Due to their smallness and newness, new ventures are usually in a weaker bargaining position than other established actors and therefore cannot demand specific information from them to minimise their impact intransparency.
Knowledge	The lack of specific knowledge on how to measure impact can prevent startups from obtaining impact investments.

The Barrier of Stakeholder Demands

Startups now have to offer a product or service that not only meets customer needs in terms of product or service design but also at a broader level, such as considering environmental impact. This is further relevant to their investors, but also their (future) employees. This external barrier requires startups to effectively report their impact and thus require impact measurement tools to do so.

> *"The stakeholders who are interested in this area, of course, investors, because they are increasingly saying, okay, what can I actually do to make the world a better place in the long term, including with the portfolio of companies I invest in. Of course, you also have customers who are asking themselves, what's the point of what you're doing, so I would also include them. Suppliers less so today. What I also see is, yes, actually a bit internal, the employees really"* (W).

From the interviews, it became evident that stakeholders especially requested the measurement of (saved) CO2 emissions (R, X, V, W).

> *"And that also applies to the employees as well as the investors. So, the decisive factor for people coming to us, working with us and, above all, staying with us for a long time is the CO2 impact and that they believe that we really do have an impact"* (V).

This is accompanied by a simple communication of the result to satisfy customers who explicitly choose a sustainable company and consequently demand it (R; S; J, Y).

> *"And to be transparent and show how much positive and negative impact you are generating through your sales and through that consumption. And also, to be able to track whether your tree is really growing, whether it is healthy, whether it will survive, and so on. This is of great interest to our customers, and we think that this transparency will become even more important"* (R).

According to one expert, for this purpose, it would be beneficial to communicate the impact through the product so that the consumer can quickly and easily see and evaluate the impact on the label (J).

At the same time, while some stakeholders aim for impact measurement, others do not see it as desirable to invest a lot of resources in impact measurement, as it is precisely at

such an early stage that it should be shown whether the impact-oriented business model can survive on the market. Accordingly, for some investors, accurate impact measurement at a very early stage is not feasible and not per se necessary (J; Y).

> *"I wouldn't like it if you spent a lot of time measuring or analyzing the impact in detail, but it's just: the impact is there for now, I need to make sure that I build a model from my impact-driven business model that works in the market. [...] as an investor I would ask the question: 'Yes, are you thinking about your operational business in the same way?'"* (J).

This leaves startups in a dilemma situation between very different demands from different impact investor types (Hockerts et al., 2022) and other stakeholders.

The Barrier of Power

Another disadvantage is that new ventures are usually in a worse negotiating position than their suppliers and, therefore, cannot demand data or any kind of information about practices emphatically.

> *"But what I see as the biggest problem is getting sufficient data, because especially as a start-up you simply don't have that much power and influence. We startups also notice that when ordering our raw materials, for example, we don't get enough data about the raw materials themselves. And then a wholesaler just says: 'And if you don't order from me anymore because of that, I don't care, I have enough others.' We just don't have the power on the market yet to really extort this information"* (T).

The poor negotiating power of the startups results from the fact that they purchase smaller volumes. In addition, they usually do not have a strong market position, as they have not yet been able to establish themselves in the market (S, T, U).

> *"Of course, as start-ups, it is only possible to buy in small quantities at the beginning and therefore approach the suppliers with little power. And sometimes you're more of a supplicant and say it's worth working with us. In any case, your hands are tied to a certain extent in terms of making big demands, what data is released, how the production processes are implemented, and the like"* (U).

The Barrier of Knowledge

The lack of specific knowledge on impact measurement is another major problem for impact-driven startups. The experts see this as the biggest problem, which is accelerated by the lack of capacity or resources (Q; W; T; X).

> *"The capacity is one thing, but if you don't have anyone who is also doing a PhD on the topic, as we do, and then a few working students who are hired for this because they have prior knowledge. I don't think it's feasible for the average start-up to work through all the different frameworks"* (X).
>
> *"Even if you have the resources and have good intentions, you don't know how to do it"* (Q).

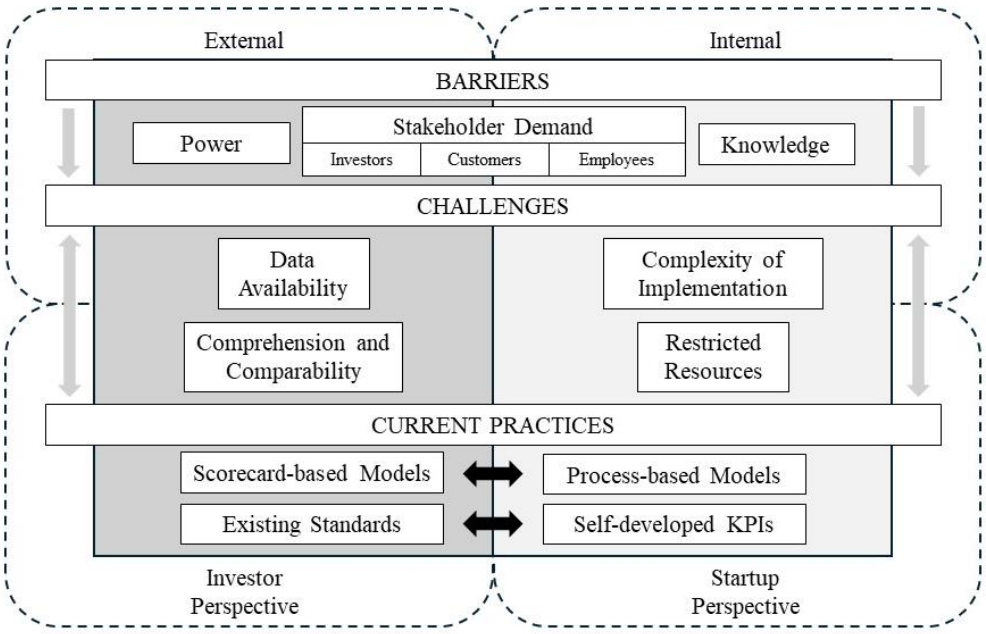
In the end, the lack of knowledge hinders the startups from carrying out a trustworthy impact assessment (W). Yet, even investors often lack the necessary expertise to adequately assess and classify impact:

> *"So, the aim will not be that only those with a PhD can do this analysis, but we also see that we have a lot of venture capital funds... but there are also very weak people working there, they have a lot of money, but they are also not able to do a good analysis"* (M).

8.5 Discussion

Overall, several noteworthy overlaps and interconnections emerge between the dimensions of impact measurement in practice, as well as the barriers and challenges of startups. Figure 15 offers an abstract view, exhibiting directly observable connections. It can be distinguished between internal and external boundary conditions. While internal conditions predominantly depend on the startup's characteristics, external conditions are shaped predominantly by stakeholder perspectives. Nevertheless, as the interview findings suggest, there is an overlap between both spheres.

Figure 15: Interconnectedness of Barriers, Challenges, and Current Practices of Impact Measurement of Startups (Own Illustration)



While barriers are not easily overcome, they directly pose challenges to startups. The barriers "power", "knowledge", and "stakeholder demand" are the main obstacles to a sound impact measurement by startups.

Power struggles with market actors are nothing new in entrepreneurship research (Santos & Eisenhardt, 2009). However, acquiring third-party data to measure a startup´s potential impact poses a major barrier. This could, for example, be a central issue if an impact investor demands a startup to report its Scope 3 CO2 emissions. Also, reporting working conditions along the value chain may pose a difficulty for young companies due to their limited resources or the lack of access to the facilities, which increases their dependence on the goodwill of the suppliers. Regulatory frameworks such as the newly resolved Act on Corporate Due Diligence Obligations in Supply Chains (CSDDD) could help to make this data more transparently available (EuropeanCommission, 2022). This is supported by a study by (Lucas et al., 2022), who show that already weak legislation towards sustainable practices shapes a more value-driven economy. This may lower the barrier for a sound and transparent impact measurement.

A barrier a startup faces externally and internally is how to interact with stakeholders (Dew & Sarasvathy, 2007; Mitchell et al., 2006). In this context, firstly, investors emphasize certain pathways concerning impact measurement: in extremes, they either

request pre-defined KPIs or do not wish the startup to "waste" resources on impact measurement. Secondly, customers request companies to be transparent about their ecological impact, independent of their company size, and neglect the effort that comes with it. From the interviews, this has been mentioned mainly concerning CO2 compensation. This seems to be the best-known indicator, which its ease of understanding and measurability can explain. Thirdly, (potential) employees expect their employers to be transparent and active concerning sustainability – again, oftentimes, about their CO2 emissions. Even if the startup may not have the resources or means to prioritize the measurement of CO2 emission, it may pose a barrier due to competition with other companies for the best talents. Especially in Germany, with its pressing "Fachkräftemangel" (FAZ, 2023), transparent reporting and communication of their (ecological) impact could be a decisive incentive in the run for potential employees.

The last barrier identified is "knowledge". Closely related to the other two barriers, missing knowledge about impact measurement poses a threat to the startup's ability to meet stakeholder demands or work around missing data from external partners. Again, missing knowledge has been identified in other studies in the field of entrepreneurship (Townsend et al., 2018). Yet, while support for traditional business topics is widely available, e.g., via accelerator programs (Cohen, 2013), knowledge provision about impact measurement is still lacking (Fichter et al., 2021). Of course, this is understandable as there is no set standard yet for impact measurement. However, this poses a barrier that might increase the threat of mission-drift – the focus from impact-driven towards profit-driven activities (Santos et al., 2015).

Four challenges could be identified in the qualitative data analysis, of which two are more related to the external dimension, and the other two are more related to the internal dimension. Internally, the startup can face the challenges of data availability and the complexity of implementing impact measurement within the company processes. So far, the existing measurement tools are not easy to implement due to their incomprehensibility, which requires a startup time and effort to learn and implement.

As this is often due to external factors and demand, the challenges of restricted resources and comprehension and comparability depend not only on the company's internal structure. Stakeholders such as investors and customers need to understand the

measured indicators and be able to relate them to other startup contexts to assess the impact.

As pointed out before, current practices are – in part – reasons for the four challenges. Investors more often try to work with established standards and want to utilize scorecard-based models for impact measurement. Startups, on the other hand, usually prefer self-developed KPIs to measure their potential impact and prefer process-based models to justify and explain their efforts. Overall, though, both groups recognize a mix of both approaches as the best option to enable a startup-specific impact measurement practice that addresses the challenges optimally.

8.5.1 Implications for Startup-specific Impact Measurement Practices

Within this interconnectedness of current practices, challenges, and barriers, four trade-offs are proposed to be immanent to impact measurement of startups: (1) Standardization versus Flexibility, (2) Accuracy versus Usability, (3) High-Resource Input versus Low-Resource Input (4) Holistic Sustainability versus Specialized Focus on Sustainability.

Standardization versus Flexibility: Via the interviews, it could be confirmed that existing frameworks and tools seem too complex for startups (Phillips & Johnson, 2021). Yet, current practices exhibit promising starting points for impact measurement tools for startups. A combination of process- and scorecard-based models would address certain barriers, minimizing the associated challenges.

While existing standards can guide the startup and investors in target setting, clearly defined impact indicators on the company level could help to reduce the knowledge barrier. Utilizing and perfecting the evaluation of internal data can be the starting point for advanced measurements at a later stage of the company. This is supported by former research, which proposes a purely output- and outcome-based measurement at the company level (Ebrahim & Rangan, 2014). This is further related to the power barrier, where data availability of suppliers would not be a prerequisite for impact measurement.

Further, self-developed indicators were a good starting point for the pioneers of impact measurement. Yet, a certain standardization of a set of impact indicators would address stakeholder demands and might lead to easier comparability, which could be beneficial both for the stakeholders and the startup in terms of outside communication.

Likewise, aiming to address overarching goals would help to understand the claims and aims of the startup. Here, former research points towards the SDGs for target setting (Schutselaars et al., 2023). The process-based model can support explaining the connection of the addressed SDG to the business model of the startup. At the same time, the process-based model leaves room for activities that may be unrelated to the standardized set of indicators.

Accuracy versus Usability: Related to the former trade-off, impact measurement practices of startups need to allow for a certain degree of inaccuracy. Especially if there are standardized indicators that need to be reported, the measurement of these should not demand the highest standards of accuracy. It is common practice in the financial projection of traditional startups to work with estimates and assumptions (Macclure, 2023). This should be likewise the case to estimate the potential impact of a startup.

Consequently, the issues of missing data and knowledge could be minimized if estimates and aggregated data sources could be utilized. At the same time, focusing on usability would allow the startup to adapt their measurement more easily at different growth stages or changing business model conditions. Concretely, usability can be enhanced if (1) internal data is prioritized over external data, (2) aggregated market data or user testing is prioritized over field experiments and sophisticated survey designs, or (3) the monetization of impact is not mandatory for impact indicators that are overall hard to quantify in terms of their non-monetary value (van Bommel et al., 2023).

High-Resource Input versus Low-Resource Input: A seamless integration of impact measurement into the company's business practices could tackle the question of how resource-intensive impact measurement is for a startup. Again, it is argued that the prioritization of set and already widely accepted indicators can minimize resource input. Startups are part of entrepreneurial ecosystems, where learning from peers and stakeholders is accelerated the more something is common knowledge (Theodoraki et al., 2018; Vives, 1996). This could minimize the knowledge barrier. Consequently, a low number of impact indicators should be accepted as the initial measurement practice, especially at the early stages of company formation. Reporting on an extensive list may neither be helpful nor meaningful in capturing the potential for positive impact if data is scarce and resources are low. Likewise, the process-based model should be designed as

low-resource demanding, focusing on the main impact targets of the startups and their means to the intended end. As mentioned above, this could be achieved if a certain inaccuracy of reported data is accounted for.

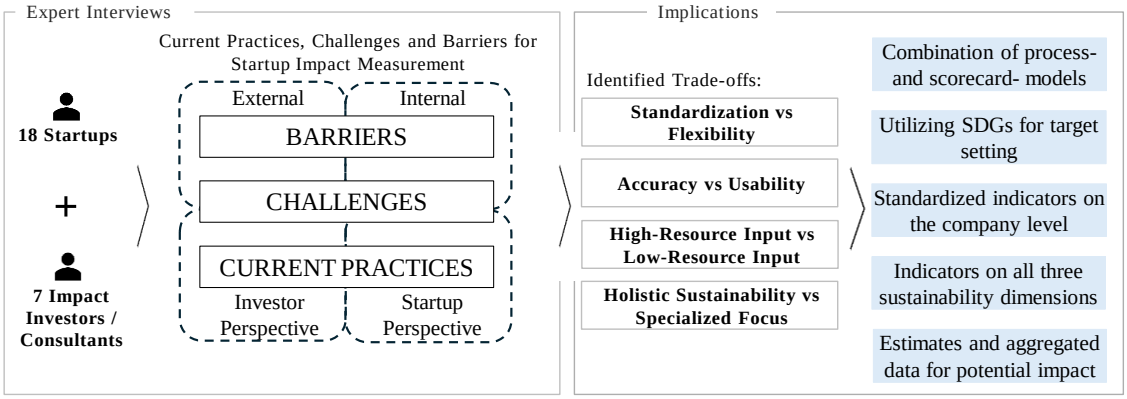
Holistic Sustainability versus Specialized Focus on Sustainability: Currently, due to the high complexity of impact measurement practices and the associated barriers and challenges, startups seem to prioritize one aspect of sustainability over the others (ecological versus social versus economic). The aforementioned propositions to address the other trade-offs could enable the startup to shift towards a more holistic approach to sustainable impact measurement. As much as a focus on the main contribution is necessary and sensible, from a sustainable development point of view, a positive impact cannot be achieved if only one of the triple-bottom-line dimensions is addressed (Elkington, 1997). To measure impact should, therefore, mean to transparently report on all aspects of sustainability – regardless of positive or negative outcomes of activities. While it is proposed to clearly state one main SDG for target setting to solve a societal problem, it is therefore suggested to include indicators on all three sustainability dimensions in an initial impact measurement of startups (Schutselaars et al., 2023). This is in line with the established standard of the European Union, where the EU Taxonomy follows the notion of "do no significant harm" in those dimensions that are not the main focus of a business's activities (EU_SustFinance, 2020).

8.6 Conclusion

Until now, the reality of startup approaches to measuring their potential impact has been neglected in academic literature. At the same time, the underlying barriers and challenges have not been analyzed extensively. This study aimed to shed some light on these aspects.

The results support previous findings that startups are currently using no established framework. Three main barriers and four related challenges for impact-driven startups were identified through 25 expert interviews. Considering the four main trade-offs that emerged from the analysis, implications were derived to adapt current impact measurement practices to the reality of startups, see Figure 16.

Figure 16: Chapter 8 – Main Results (Own Illustration)



Firstly, a combination of scorecard- and process-based impact measurement models is proposed as a potential solution to address these. Further, setting a clear goal via the utilization of the SDGs for target setting captures the startup's unique goal. At the same time, clearly defined impact indicators on the company level can enable certain comparability, ensure holistic sustainability, and reduce resource constraints. Estimates and aggregated data should be considered to depict the potential impact.

The results enhance the ongoing debate in practice and theory concerning impact measurement with empirical evidence. Nevertheless, the study faces limitations. Due to the small number of interviewed startups, the findings are not generalizable. Furthermore, despite including diverse perspectives in the sample, this leads to a small sample size, raising the possibility of bias due to limited sample representation. While qualitative research provides valuable insights, it may not capture quantitative or statistical patterns, which limits the ability to make broader empirical claims. At the same time, the results mirror recent findings by the German Social Entrepreneurship Monitor (GSEM) 2024: 62% of the 329 participating startups claim to measure their impact. However, the main challenges for impact measurement are lack of knowledge (35%), high complexity (32%), and unreliable data (31%) (Kiefl et al., 2024). This strengthens the findings of the qualitative study and highlights the necessity to address these challenges. A large-scale survey with more startups in different countries could build on the findings of the qualitative study and enhance the findings of the GSEM 2024.

Part IV – Design Support for Impact Assessment of Startups

In the aforementioned studies, two theoretical concepts have emerged as crucial in the relationship between impact investors and startups: the tendency of homophily attributed to the investor side and the liability of impact intransparency to the startup side. The two hallmarks must be accounted for to assess a legitimate investment case and ensure alignment for impact by both actors (Eckerle & Terzidis, 2024). Therefore, this thesis finally addresses the following guiding research question:

GRQ4: How to design new methodological artifacts to provide support for the impact assessment of impact-driven startups?

A DSR project is pursued for that purpose. DSR is a paradigm that allows us to translate knowledge into artifacts (Hevner et al., 2004). The complexity of the present endeavor lies in translating the former research results into design requirements and deriving design principles to build the baseline for artifacts aimed at the overarching goal. Its goal is to incorporate both the startup's need to easily navigate such assessment artifacts and the investor´s need for the artifact to be comprehensive enough to genuinely measure the potential impact, enabling investors to make informed decisions – while still holding the promise to unlock the full potential of a sustainable future.

9. Design Principles for Startup Impact Assessment[9]

9.1 Problem Domain

From the former studies it became evident that measuring startups' social and environmental impact is central to their assessment as legitimate investment cases by impact investors. Only with reliable measurement can an impact due diligence be performed (Eckerle & Terzidis, 2024). However, there is a debate on whether impact-driven startups should measure outcomes and impact, as the causal link between outputs and outcomes is unclear and often goes beyond the company's control (Crucke & Decramer, 2016). Ebrahim and Rangan (2014) argue that measuring impacts and outcomes might be counterproductive for a single company, suggesting that these should be measured at an aggregated level over multiple companies or at country level. This is supported by research suggesting that the utilization of ESG criteria (output level) is

[9] A slightly adapted version of this study has been submitted and is under review in the *Small Business Economics* Journal.

useful, as evidence shows that companies with prior ESG experience and high ESG ratings are more likely to comply with engagement requests, leading to higher impact at later stages (Kölbel et al., 2020).

Reporting on sustainability at the output level might further be beneficial for startups to receive investments. The study by Truong and Nagy (2021) shows that potential investors may be more inclined to invest in new venture opportunities when they perceive sustainability initiatives as a source of long-term competitive advantages for the nascent ventures they are interested in. While research highlights that measuring sustainability increases their legitimacy as an investment case (Lall, 2019; Scherer et al., 2013), startups constantly struggle with resource restrictions that constrain them to activities essential to their organizations' emergence and viability (Truong & Nagy, 2021, cf. Section 8.4.2).

This showcases the struggle of impact-driven startups with hybrid goals (Battilana, 2018; Santos et al., 2015). Impact-driven entrepreneurs often grapple with goal conflicts and try to find ways on how to manage them (Pieniazek et al., 2024; Vedula et al., 2022). However, if impact measurement is perceived as too complex or too resource-intense, mission drift might be the outcome of these goal conflicts, and there might be less and less alignment of business activities for impact (Eckerle & Terzidis, 2024; Santos et al., 2015).

Current impact measurement tools exhibit high complexity. Many of them are not tailored to the startup context (Horne, 2019). For example, they require data as evidence, posing a challenge for startups with limited capacity and resources (Fichter et al., 2023; Singhania & Swami, 2024). Additionally, the chosen impact indicators must be robust enough to prove the startup’s impactfulness (cf. Chapter 8).

This study aims to synthesize the existing body of knowledge to provide design support for new methodological artifacts with the objective of fostering startups' impact assessments addressing the aforementioned constraints of startups. Therefore, a DSR approach is followed (Romme & Reymen, 2018; Romme & Dimov, 2021; Terzidis et al., 2023). Based on derived design requirements and design principles, an impact assessment artifact has been developed in three design cycles for impact-driven startups aiming to measure and report their potential impact in addressing societal problems, facilitating a transparent assessment by impact investors.

The proposed solution advocates adopting common measurement models and indicators to foster transparency and comparability. The artifact incorporates essential startup needs, facilitating the measurement and reporting of impact in a resource-adequate manner while accounting for the overarching goal of impact investors to generate positive societal impact. Empowering startups to provide a transparent report of their potential impact aims to increase their legitimacy; the artifact is designed to streamline decision-making for impact investors, accounting for entrepreneurial capacities.

9.2 Methodology

A DSR approach is followed to investigate design knowledge to design impact assessment artifacts that enable impact investors to assess and compare liable impact-driven startups. This research approach has been proven in entrepreneurship research to be fitting in addressing complex challenges and bridging the gap between theory and practice (Terzidis et al., 2023).

In this respect, the recommendations by Kuechler and Vaishnavi (2008) are utilized to iteratively develop an artifact that allows testing, refining, and evaluating the developed design requirements and derived design principles from the studies mentioned above in this thesis. This study's research is structured according to the phases of awareness of the problem, suggestion, development, evaluation, and conclusion in three design cycles (see Figure 17).

Figure 17: Overview of the Iterative Design Cycles (Own Illustration)

Design Science Cycle	Design Cycle 1	Design Cycle 2	Design Cycle 3
Awareness	Synthesis of DRs	Findings from DC 1	Findings from DC 2
Suggestion	Derived DPs	Refinement of DPs	Refinement of DPs
Development	Instantiation of artifact	Instantiation of improved artifact	Instantiation of improved artifact
Evaluation	Interviews with experts	Interviews with users	Expert feedback, focus group
Conclusion	Interview analysis	Interview analysis	Evaluation analysis, final artifact

The basis of an instantiation of a design solution is the derivation of design requirements and related design principles resulting from research synthesis of the former studies (Denyer et al., 2008). The formulation and validation of design principles that encompass generic capabilities of designed artifacts help to build a cumulative body of design knowledge (Baskerville & Pries-Heje, 2010). Following the framework by Gregor

et al. (2020), with a specified context (C), aim (A), mechanism (M), and rationale (R), this logic is applied to present the defined design principles adequately, ensuring structured design support for future design projects concerning the impact assessment of startups. This logic has been applied before in the development of design principles for, e.g., sustainability assessment in business model innovation (Bhatnagar et al., 2022). While former research has formulated design principles for the overarching impact due diligence of startups (Eckerle & Terzidis, 2024, cf. Chapter 4), the goal of this study is to destill design knowledge specifically for impact measurement by startups to enable an initial assessment of multiple startup cases. The former research guides this endevour.

A key evaluation proposed by Venable et al. (2012) is to determine a design instantiation´s utility for the intended purpose. While evaluation studies usually test an artifact if there is already a known means-ends relationship, they can also evaluate more abstract design principles (Seckler et al., 2021). Therefore, an exemplary design instantiation was evaluated three times at the end of the design cycles to validate the derived design principles for the impact assessment of startups. The three design cycles with their respective evaluation strategies are presented in short.

The **first design cycle** aimed to translate the acquired knowledge in the former studies of this thesis into a tangible prototype for impact assessment of early-stage startups. The defined design requirements and derived set of theory-grounded design principles (cf. Section 9.3.1) guided the process and described the generic functions and capabilities of the artifact. In particular, the design knowledge builds on social learning theory with its inherent tendency of homophily (Gangopadhyay & Nilakantan, 2021; Sun & Tang, 2011), the principle-agent theory with the problem of information asymmetry (Eckerle & Terzidis, 2024; Reid, 1999), and the conflicting goal theory of impact-driven entrepreneurs (Pieniazek et al., 2024; Vedula et al., 2022).

The design principles are instantiated in a first artifact, a paper prototype (V0), showcasing the generic composition and central elements, see Figure 22 (cf. Section 9.3.6). This prototype version was evaluated via 20 semi-structured interviews with investors, consultants, startups, and established companies experienced in impact investing or sustainable innovation and financing (see Table 16).

Table 16: List of the 20 Interview Partners for Evaluation of Prototype (Own Illustration)

Interview	Position	Organizational Type	Area / Sector
A	Managing Partner	Impact VC	Climate Tech
B	Consultant	Consultancy	Sustainable Finance
C	Investment Analyst	VC	Enterprise Tech
D	Founder	Startup	Climate Tech
E	Finance Director	Consultancy	ESG
F	Consultant	Consultancy	Sustainable Finance
G	Founder	Startup	Social
H	Founder	Startup	Climate Tech
I	Impact Private Equity	Impact Investor	Agnostic
J	Managing Director	Impact Investor	Agnostic
K	Senior Sales Manager	Consultancy	Healthcare
L	Investment Director	Consultancy	Sustainable Finance
M	Chief Operation Officer	Established Company	Agriculture
N	Founder	Startup	Animal Care
O	Chief Technology Officer	Startup	Healthcare
P	Director of Sustainable Banking	Bank	Sustainable Finance
Q	Sustainability Manager	Established Company	Sustainability
R	Project Manager Sustainability	Startup	Sustainability
S	Impact Analyst	Consultancy	Impact
T	Founder	Startup	Consumer Goods

The evaluation focused on the overall set-up of the instantiation with its main elements and the proposed impact criteria included. The interviews were semi-structured and lasted, on average, 45 minutes, asking first about the understanding and experience of the experts concerning impact measurement, followed by feedback on the different elements and criteria of the prototype. The expert interviews were recorded, transcribed, and deductively, according to the building blocks of the artifact, as well as inductively coded, following the recommendations of Mayring (2014). The results confirmed the combination of a process- and scorecard-based model and revealed possibilities for further improvements, especially regarding the impact categories.

The **second design cycle** aimed to enable the overall usability of the design solution from the startups' perspective. Based on the results from the first cycle and in line with former research on impact measurement and ESG criteria, the overall goal shifted to a more output-level perspective on reporting indicators. Hence, the impact criteria were adapted to fit better the possibilities of startups in measuring their potential impact. The prototype was then transferred to the first version of the artifact (V1). It was built on an Excel sheet with the artifact's description and a template the startup could fill out. In this way, it was possible to create a situation similar to reality to test the artifact's usability. As V1 only differs slightly from the final version (V3), see Figure 20 for the main set-up (cf. Section 9.3.2). The evaluation in this cycle was conducted via in-depth interviews with three startups, which were already interviewed in the previous cycle.

One startup is active in the healthcare sector, one in climate tech, and one provides support for companies that want to include sustainability processes into their existing business activities. The startup's data is anonymized due to confidentiality reasons. The startups worked with the impact measurement template (Figure 20), and researchers recorded their verbal feedback. Again, the recorded interviews were transcribed and deductively coded, following the recommendations of Mayring (2014). The results confirmed the validity of the proposed artifact. They only suggested minor changes to the instantiation, such as a change in the CO2 equivalent indicator to be measured in tons per euro instead of kilograms.

The **third design cycle** focused on the assessment and comparability of multiple startups by investors (V2). Prompted by the results of the previous startup user testing, the final qualitative feedback on the usefulness and applicability of the artifact was retrieved from four impact investors, two impact accelerators, and one impact investing consultant. For the feedback, an Excel sheet was prepared, containing 1) a worksheet with an overview of the evaluation goal, a step-by-step instruction for using the evaluation sheet, and the assessment artifact. 2) A description of all the elements of the startup measurement tool[10]. 3) Three fictive startup cases showcasing a filled-out impact measurement template. 4) A benchmarking of the three fictive startup cases for comparison. 5) An evaluation worksheet for feedback. Again, this approach was chosen

[10] See Appendix A.3 for the final impact measurement template.

to be suitable as it simulates a real situation, enabling the applicants to imagine using the artifact in daily situations, evaluating impact-driven startups, and comparing them with other impact-driven startups. The acquisition of interview partners was based on the initial expert panel from cycle one, followed by a screening of the German impact investor network (cf. Chapter 7). The written feedback was deductively coded, according to Mayring (2014). Overall, the experts confirmed the applicability of the artifact.

Lastly, a focus group workshop (Morgan, 1997) with six researchers in the field of sustainability and impact investing was conducted at a scientific conference to confirm the scientific robustness of the artifact. The participants were briefly introduced to all the elements of the artifact, including the measurement part of the startups and the benchmarking part for the investors. By collectively reflecting on the artifact, new thoughts were inspired and triggered (Szopinski et al., 2019). On a virtual whiteboard, the author of this thesis collected feedback concerning strengths, weaknesses, and points for improvement while a second researcher moderated the open discussion. These categories also informed the subsequent coding of the data. Only minor suggestions lead to the refinement of the artifact, resulting in the final version of the exemplary instantiation of the design principles (V3). As the results of the third evaluation cycle did not prompt any significant changes to the content of the instantiation, this concluded the process.

The iterative design process's overall results with the evaluations' main findings are described below.

9.3 Results

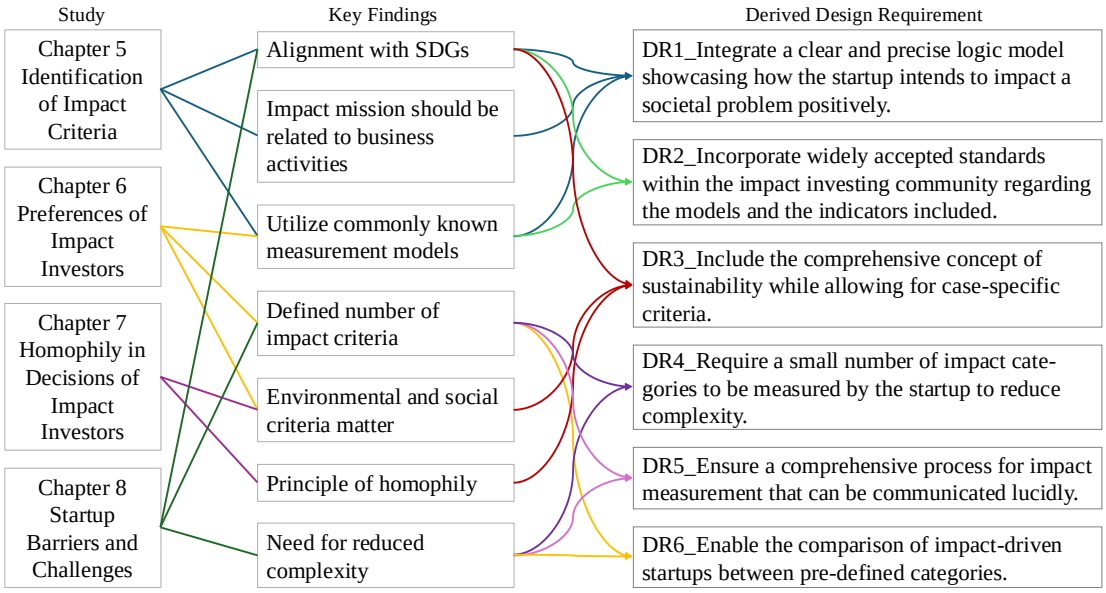
The first part of this section summarizes and describes the requirements derived from the former studies in this thesis for a startup impact assessment artifact and the proposed design principles. The final instantiation with its main components is presented in the second part. The third part introduces the results of the evaluations.

9.3.1 Design Requirements and Proposed Design Principles

The overarching goal of the impact assessment artifact concerning impact-driven startups is how the liability of impact intransparency can be minimized to be perceived as a legitimate investment case for impact investors (Lall, 2019).

In three design cycles, based on insights from theory, prior research, and three evaluation episodes, four design principles are proposed that describe how to design impact assessment artifacts to support impact investors in assessing a legitimate startup case. The design principles are derived from seven design requirements, informed by the former studies in this thesis, see Figure 18. Their reasoning will be elaborated in the following.

Figure 18: Synthesis of Findings to Derive Design Requirements (Own Illustration)



Chapter 5 focused on the underlying criteria for identifying and assessing an impact-driven startup. The findings offer several implications for the design support for impact assessment artifacts. First and foremost, entrepreneurs should articulate their impact mission in the context of a business case, aligning it with the SDGs and providing comprehensive research on the severity of the societal problem they are addressing. Using commonly known models, such as a logic model (e.g., a theory of change), allows stakeholders to evaluate the startup's claims more easily and enhances legitimacy (DR1, DR2). Clarifying the activities to achieve desired outcomes will likely improve monetary and nonmonetary valuation by impacting investors and other supporting organizations (Harrer & Owen, 2022). Since expert interviews indicated that the preferred criteria are difficult to quantify or predict, entrepreneurs should strive to present their impact as concretely as possible. This can minimize information asymmetry between investors and startups (cf. Eckerle & Terzidis, 2024)

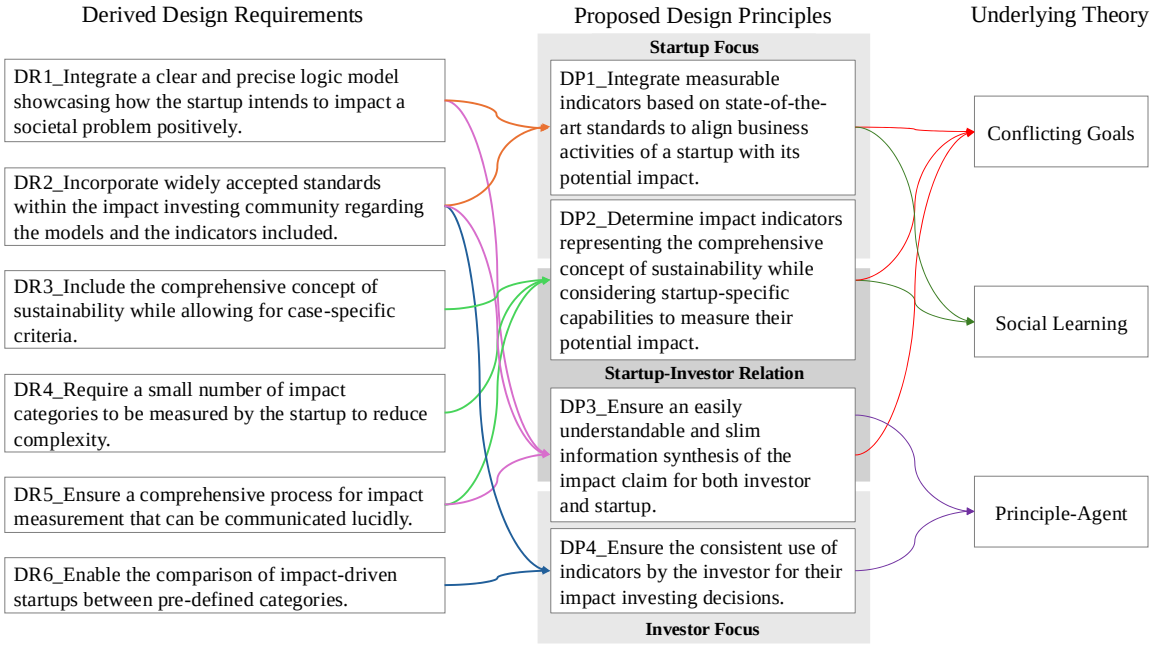
As discussed in Chapter 6, it was possible to identify a consolidated and validated set of assessment criteria applicable to impact investing. The results suggest a few criteria to consider when assessing legitimate investment cases (DR6). Nevertheless, all synthesized impact criteria from Chapter 6 are essential for sustainable development and should not be neglected. A positive impact and the avoidance of negative externalities should be ensured (Schutselaars et al., 2023, cf. Chapter 5), advocating a holistic measurement of sustainability activities. This may minimize the likelihood of impact-washing (Azmat et al., 2022). However, the third study about the German impact investor network (see Chapter 7) showed that actors with similar properties tend to be interconnected, reflecting the principle of homophily, which could hinder significant positive transformation and sustainable development because similar peers invest in similar startups based on similar indicators (DR3). To make a holistic contribution to the SDGs, investors need to consider all consequences, social, environmental, and economic (Elkington, 1997) (DR3), which could minimize the risk of mission drift of investors (Cetindamar & Ozkazanc-Pan, 2017).

Startups face specific challenges and barriers in measuring and reporting their potential impact to external stakeholders, as presented in Chapter 8. The findings highlight the need to reduce the complexity of the impact measurement process (DR4) while ensuring easy communication of the impact (DR5). Further, setting a clear goal via the utilization of the SDGs for target setting captures the startup's unique goal, allowing for case specification (DR3). At the same time, clearly defined and a low number of impact indicators on the company level can enable certain comparability within and between startups (DR6), ensure holistic sustainability (DR3), and reduce resource constraints (DR4).

The six design requirements inform four design principles as design knowledge for developing an impact assessment artifact. Further, three underlying theories inform their rationale: conflicting goals, social learning with the underlying tendency of homophily, and principle agent theory with the problem of information asymmetry.

Figure 19 presents the connection between the developed design requirements and the final set of design principles, represented by their mechanisms, their relation to the target groups, and the underlying theories.

Figure 19: Final Design Principles with their Underlying Theories (Own Illustration)



Over the three design cycles, the design principles were constantly refined. The final set of the four design principles presented based on their aim (A), context (C), mechanism (M), and rationale (R) can be seen in Table 17.

Table 17: Design Principles for Startup Impact Assessment Artifacts (Own Illustration)

Number	Aim (A)	Context (C)	Mechanism (M)	Rationale (R)
DP1	To minimize the liability of impact intransparency and enhance the legitimacy of an impact-driven startup	for impact investment in startups	integrate measurable indicators based on state-of-the-art standards to align business activities of a startup with its potential impact	as it helps to manage conflicting goals within the impact-driven startup.
DP2	To minimize the liability of impact intransparency and enhance the legitimacy of startups	for impact investment in startups	determine impact indicators representing the comprehensive concept of sustainability while considering startup-specific capabilities to measure their potential impact	because this reduces the tendency of social learning based on homophily by impact investors while accounting for conflicting goals of impact-driven entrepreneurs.
DP3	To minimize the liability of impact intransparency and	for impact investment in startups	ensure an easily understandable and slim information	because this accounts for conflicting goals of impact-driven

	enhance the legitimacy of startups		synthesis of the impact claim for both investor and startup	entrepreneurs and reduces information asymmetry.
DP4	To enable an impact investor to compare potential investment cases	for impact investment in startups	ensure the consistent use of indicators by the investor for their impact investing decisions	because this reduces the information asymmetry.

All four design principles have the same context: they present design knowledge for impact assessment artifacts in the context of *impact investing in startups*.

DP1, DP2, and DP3 aim to minimize the liability of impact intransparency and enhance the legitimacy of impact-driven startups, while DP4 aims to enable an impact investor to compare potential investment cases. The first three design principles address the aforementioned problem of conflicting goals (Pieniazek et al., 2024), which could lead to a startup's mission drift. This informs the mechanism of DP1, which proposes to *integrate measurable indicators based on state-of-the-art standards to align a startup's business activities with its potential impact*. DP2 adds to this by proposing a mechanism for *determining impact indicators representing the comprehensive concept of sustainability while considering startup-specific capabilities to measure their potential impact*. The latter part highlights impact-driven startups' conflicting goals. In contrast, the first part of this DP acknowledges the tendency of homophily, ultimately informing social learning (Murnieks et al., 2011), which is evident in the investment behavior of impact investors (cf. Chapter 7).

Lastly, the third principle proclaims a mechanism for *ensuring an easily understandable and slim information synthesis of the impact claim for investors and startups*. Again, this accounts for the conflicting goals of impact-driven startups and reduces information asymmetry between the investor and the startup, which is a crucial aspect of principle-agent theory and is evident in investor-investee relationships (Reid, 1999). This reduction of information asymmetry is substantiated by the mechanism of DP4, which suggests *ensuring the consistent use of indicators by the investor for their impact investing decisions.*

Given these requirements and principles and the three evaluation cycles, an exemplary instantiation (V3), outlined in the next section, was developed. Overarching is the startup's intended contribution to the SDGs. The impact assessment artifact incorporates a scorecard and a process model to bolster this claim. Only a restricted number of impact criteria are required, and the measurement indicators are focused on the output level. However, they include all three dimensions of sustainability: social, environmental, and ecological, to ensure a comprehensive assessment of the startups.

9.3.2 Exemplary Instantiation of Design Principles

The exemplary instantiation of the developed design principles consists of two components: the startup's measurement and reporting side and the investor's assessment and comparison side. For the startup to fill out the tool, the exemplary instantiation (V3) starts with the scorecard-based model, as the data later can be utilized to understand claims made in the logic model (Jackson, 2013; Nachyla & Justo, 2024), see Figure 20. In addition to the filled-out tool, the investor will receive a cumulated table of all potential investment cases, with a benchmarking chart to visually present the differences between the cases (Figure 21). In the following, the main components of the exemplary instantiation will be introduced in more detail, as well as the main findings of the evaluation cycles.

Figure 20: Exemplary Instantiation of Design Principles (V3) – Startup Case Example (Own Illustration)

Input

Revenue from current year	1.000.000,00 €
Revenue from year before	400.000,00 €

Scope 1 / Scope 2 Greenhouse Gas Emissions in CO2-equiv. (current year)	200	in tons
Scope 1 / Scope 2 Greenhouse Gas Emissions in CO2-equiv. (year before)	170	in tons

CAGR Revenue Development	**Values**
Number of Periods	2
Initial Value	400.000,00 €
Final Value	1.000.000,00 €

Rate of Impact Investments	**Values**
Amount of Impact Investments	2.250.000,00 €
Amount of Invested Capital	3.000.000,00 €

Diversity (in %)	**Values**
Number of people within the organization who feel that they belong to minority groups	3
Number of women within the organization	4
Number of employees	13

Affected SDGs & related target(s)	**Description**
Description of how the activities of the Startup contribute to the targeted SDG(s). Provide a logic model of your intended process.	* see space below output table

Output

Dimension	**Score**
Scope 1 Greenhouse Gas Emissions in CO_2-equiv.	200
Revenue in Relation to Scope 1 Greenhouse Gas Emissions in CO_2-equiv.	5000
Difference in Greenhouse Gas Emissions in CO2-equiv. between current year and year before	30
CAGR Revenue Development (in %)	58,11%
Rate of Impact Investments (in %)	75,00%
Diversity I: Percentage of people within the organization who feel that they belong to minority groups (in %)	23,08%
Diversity II: Percentage of women within the company (in %)	30,77%

Logic Model	Affected SDG(s)
For a CO2 neutral economy in the DACH region **who/which currently face** the problem of how to compensate their CO2 emissions **we intend to** provide knowledge transfer and offer technological innovation to capture CO2 **by** cosulting companies and providing a hydrothermal carbonising process.	SDG 13.2: C02 negative Emissions

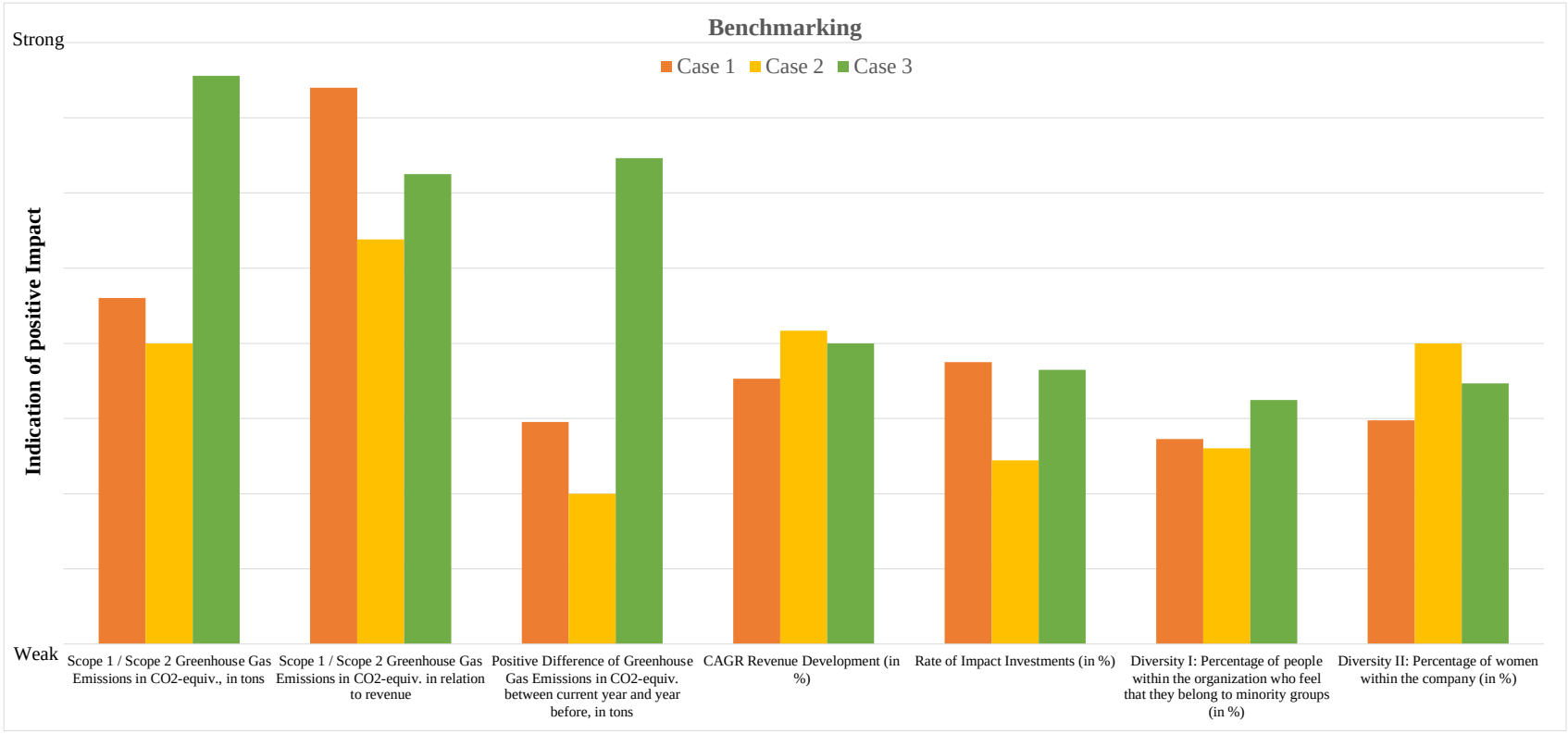
Instantiation Development

Based on the four design principles, the exemplary instantiation proposes 12 indicators as scorecard measurement. A logic model accompanies the scorecard-based measurement and links the startup's activities to the SDGs. The benchmarking for the impact investor provides a bar chart of the scorecard-based indicators for different startup cases (see Fig. 15). The exemplary instantiation was iteratively refined based on 20 expert interviews, three user tests, written feedback by seven experts, and one focus group workshop with researchers. The presented case example emerged from the user testing.

Figure 21: Exemplary Instantiation of Design Principles (V3) – Investor Benchmarking (Own Illustration)

Output				**Output - normalized Data**		
Dimension	**Score Case 1**	**Score Case 2**	**Score Case 3**	**Case 1**	**Case 2**	**Case 3**
Scope 1 / Scope 2 Greenhouse Gas Emissions in CO_2-equiv., in tons	200,0	100,0	6000,0	2,3	2,0	3,8
Scope 1 / Scope 2 Greenhouse Gas Emissions in CO2-equiv. in relation to revenue	5000,0	490,0	1333,3	3,7	2,7	3,1
Positive Difference of Greenhouse Gas Emissions in CO2-equiv. between current year and year before, in tons	30,0	10,0	1700,0	1,5	1,0	3,2
CAGR Revenue Development (in %)	58,1	121,4	100,0	1,8	2,1	2,0
Rate of Impact Investments (in %)	75,0	16,7	66,7	1,9	1,2	1,8
Diversity I: Percentage of people within the organization who feel that they belong to minority groups (in %)	23,1	20,0	42,0	1,4	1,3	1,6
Diversity II: Percentage of women within the company (in %)	30,8	100,0	54,0	1,5	2,0	1,7
SDGs Adressed	13	12	10; 12	13	12	10; 12

(Fig. 15 continued)



9.3.3 Measuring Scorecard-based Indicators

The startup-related reporting (cf. Figure 20) starts with measuring scorecard-based indicators. To account for startups' resource constraints, three criteria reflecting the triple-bottom-line of sustainability are proposed to be measured via twelve indicators. Overall, these indicators are similar to standard ESG criteria, which are proven to contribute to the SDGs (Betti et al., 2018) and account for the overall sustainability efforts of the young company. This enhances legitimacy, as these criteria are commonly known and further outline potential weak impacts if a startup is less active or produces negative externalities in one of the dimensions (cf. Schutselaars et al., 2023).

For the scorecard-based measurement, the startup's revenue from the current year provides the basis for the subsequent impact-related indicators. The revenue from the period before highlights the growth potential.

For the potential environmental impact, the startup reports on its Scope 1 (or Scope 2, if data is available) CO2-equivalent emissions (measured in tons) from the previous year to the current year.

Economic sustainability is reported via compound annual growth rate (CAGR), which is a method of visualizing a company's average annual growth rate over a given period. CAGR can be applied to a wide range of economic indicators and is, therefore, characterized by a high degree of flexibility (Gartner, n.d.n.d.):

$$CAGR = \left(\frac{Final\ value}{Starting\ value}\right)^{\frac{1}{N}} - 1$$

The number N of years to be analyzed is determined by the year change. The quotient of the final value and the initial value describes the total growth over the period under review. This is distributed over the years using the compound interest effect (Nth root). Investors are particularly interested in the long-term trajectory of economic development. Parameters often considered here are turnover, profit, loss reduction, and customer base development. In the exemplary instantiation, the revenue is considered for this calculation. The prerequisite for this calculation is market entry or initial sales profits. Still, this is relatively easy to calculate for startups as they generally generate sales earlier than profit.

To connect the business growth potential to the scalability of impact, the proportion of the company's value invested to generate impact represents the startup's management of the conflicting goals: Impact investments refer both to the amount of investment already received and to the company value if a startup has not yet received any investment. The aim is to obtain a percentage figure that indicates how much money flows into projects or activities that generate impact. Projects or activities can also be the product itself. In general, these activities are based on the SDGs (see Section 9.3.4). In the calculation, the amount of money spent is divided by the amount of money received. This allows the investor to compare how much of the invested capital is ultimately invested in impact.

To measure a startup's social sustainability, the diversity of its employees is evaluated. Three indicators are utilized to measure diversity: based on the total number of employees, the percentage of women in a company is measured, as gender equality is essential, e.g., for funding projects by the EU or distinct female-oriented venture capitalists (Yang et al., 2020). The second indicator focuses on the "Percentage of people within the organization who feel that they belong to minority groups". Minority groups in this regard are, for example, socio-economic background, immigration, language barrier, disability, sexual orientation, or gender (other than female / male). Here, either anonymized surveys can be used to measure this.

9.3.4 Reporting the Logic Model

While the former output-level indicators represent the inside view of the activities of a startup towards a potential positive impact, the tool incorporates an outside view via the connection to the SDGs with a logic model that explains how the activities of the startups are intended to aim at the respective SDG. As previous research has pointed out, the SDGs are a widely accepted and preferred reference framework for understanding a startup's impact claim (Burckart et al., 2018; Schutselaars et al., 2023). At the same time, the description of the startup's process, including its activities and intended outcomes/impact, acknowledges the case specifications of each startup.

The respective column in the tool is called "Affected SDG(s) and related target(s)," which describes how the activities of the startup contribute to its targeted SDG(s). To account for resource constraints, for easy communication, and to still achieve certain comparability between startup cases, the logic model is divided into the following parts:

> "For (who or what is the beneficiary) who/which currently face (state the problem), we intend to (state potential positive impact) by (how do you plan to do this)".

This comprises the well known theory of change into the most important facts: The beneficiary and the state of the problem showcase the direct relation to the addressed SDG. At the same time, the potential positive impact and the plan for achieving it represent the impact/outcomes with its related inputs/activities. The structure of this condensed logic model builds on earlier entrepreneurship research concerning the value proposition for impact measurement (Schutselaars et al., 2023), which is a one-sentence formulation emphasizing the importance of conciseness in translating the core value of a startup (Manthey, 2024). The value proposition statement is commonly used in practice making it easy to use and understand for both the impact-driven startup and the impact investor.

9.3.5 Benchmarking

Lastly, the artifact provides investors with a table and a chart visualization to help them quickly and easily understand how the different startups perform concerning their potential for positive impact. This becomes visual and thereby interpretable due to the depiction of multiple startup cases (see Figure 21). On the y-axis, the potential for positive impact ranges from weak to strong. On the x-axis, the different dimensions from the startup measurement tool are presented and listed based on the environmental, economic, and social groups. Thereby, the visual representation ensures the investor's attention to a holistic picture concerning the impact potential, which counters the tendency of homophily (cf. Chapter 7). The artifact's aim is not to represent the different sectors of the startups nor to represent the stage of development of the start-ups, recognizing the limitations of this comparison. Still, to a certain extent, comparison is possible by normalizing the available data. Overall, the benchmarking chart helps assess each startup's potential to have a positive impact compared to other investment cases.

9.3.6 Evaluation

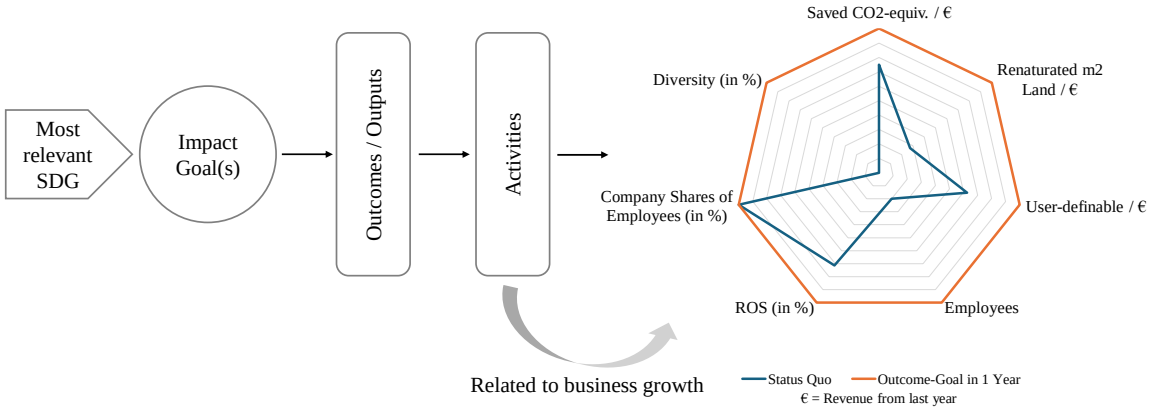
The artifact and its earlier versions were tested and validated using various evaluation methods. The artifact's initial prototype (V0) was reviewed via 20 expert interviews. This

evaluation led to refining and developing the first applicable artifact (V1). For the user-testing of the V1, three startups were invited to apply the tool, and researchers were present to protocol the startups' opinions and suggestions. Based on their feedback, V2 was developed, adding a benchmarking tool for investors to compare different startup cases. The third evaluation cycle consisted of 1) qualitative expert feedback and 2) a focus group workshop with researchers in management, sustainable finance, and entrepreneurship. Based on this, the final version (V3) has been developed. All data is anonymized due to confidentiality reasons.

The first evaluation episode's results revealed that the artifact's initial prototype (see Figure 22), which consisted of a combination of a process and scorecard model, was perceived as reasonable. The findings in the former studies of this thesis concerning impact investor assessment and the findings from Chapter 8 about the four trade-offs for startup impact measurement laid the ground for designing prototype V0.

Therefore, the prototype elements consist of the most relevant SDG a startup aims to address, matched with the impact goal(s), followed by a theory of change to showcase the activities of the startup aiming towards the impact goal(s). Secondly, to ensure comparability between startups while accounting for individual startup specifics, a web-cobb depicts the scorecard-measurement of impact categories with set indicators the startup has to measure. Here, based on the findings from the survey with impact investors (cf. Chapter 6), the prototype includes impact criteria for the environmental (saved CO2-equivalent, biodiversity via renatured land), social (diversity, employee engagement), and economic (return on sales, number of employees) dimension of sustainability, as well as one user-definable criterion which is aligned with the main impact goal of the startup. If possible, the criteria are matched to the startup's revenue to ensure the alignment of business growth and impact potential.

Figure 22: Prototype of the Impact Assessment Artifact for Startups (Own Illustration)



While the experts deemed a logic model, such as the theory of change, in combination with the SDGs, fitting to justify and explain the startup's overall impact goal, the major points for improvement emerged for the scorecard-based indicators. This proved to be the red threat in all evaluation cycles: which indicators are relevant, essential, or measurable for startups.

In this first evaluation round, the experts proposed a reduction of impact criteria from initially five to three. Especially noteworthy is the discarding of the “user-definable” impact criterion, as it seems to hinder comparability. According to the experts, allowing startups too much freedom in defining KPIs might lead to irrelevant or less meaningful metrics, which could undermine the integrity and comparability of the assessment. The same fate befell the “biodiversity” criterion, as it was disregarded as too complex to measure and too case-specific. Here, experts highlighted that obtaining accurate data for biodiversity-related metrics is challenging, as companies often lack precise land usage and restoration information. Further, biodiversity as a KPI may be too niche and not universally relevant, particularly for sectors with limited direct environmental impact, such as software startups. Lastly, the criterion “return on sales” was rejected, as the experts questioned its necessity in analyzing the potential impact. In the economic dimension, is was proposed that the money spent by the startup directly related to impact would be much more interesting. This led to the “rate of impact investment” criterion. The aim is to obtain a percentage figure that indicates how much money flows into projects or activities by the startup that generates impact. Only minor suggestions for improvements were made for the other impact criteria; overall, experts accepted them.

The suggestions from this evaluation led to the development of the first applicable artifact (V1). The focus of this iteration was on the usability for startups. The user testing of V1 supported the overall setup to be easy to understand. Further, the indicators of the three impact criteria were discussed thoroughly and once more refined. No essential changes were made regarding replacing, adding, or renaming the criteria; however, various weaknesses were identified to facilitate the startup application. The insights the startups gave helped adapt the criteria better to their capabilities, leading to the necessity of adjusting primarily the units. For example, for the CAGR criterion and the match between CO2 equivalent and saved tons per Euro, startups need to have generated a certain revenue to make sense. The startups themselves suggested that making a speculative forecast could negatively impact investors' comparability of startup cases. Therefore, the focus of the assessment artifact should be on startups that have already generated revenue for at least one year.

Overall, the connection to the SDG was highlighted as a significant benefit of acknowledging startups' individual goals. To account for a comprehensible representation of the logic model, a refinement of the in-depth presentation of the theory of change was proposed. A deep dive into the entrepreneurship education literature guides this refinement (Manthey, 2024), see Section 9.3.4. Concluding the second evaluation phase, the artifact was deemed appropriate for measuring and assessing the startups' impact at a lifecycle stage of at least one year of revenue.

The last refinements were translated into the second version of the artifact (V2), and based on the finalized output table from the startup measurement tool, a benchmark representation was designed, as the third design cycle focused on the assessment and comparability of multiple startup cases by impact investors. This version was evaluated with two target groups: impact investors/consultants or accelerators and researchers.

The qualitative feedback by the impact investors/consultants or accelerators suggests that the artifact is a good starting point to assess and compare the potential impact of startups. A main critique focused on the output level of the data measured by the startup. It became evident that the experts perceive the artifact only partially allowing one to assess the impact of a startup; rather, it showcases the potential for impact. One suggestion to include outcome level data was to include Scope 2 CO2-emissions

measurement for startups. However, some startups might be unable to retrieve the data for Scope 2, as they depend on third-party data (cf. Chapter 8, barrier of power). Therefore, the final version offers this as an optional indicator.

Another point for questioning was mentioned regarding the diversity measure, as some experts perceived this as very vague, and each company might understand and report differently (if at all). However, no concrete solution for improvement was given, resulting in no changes to this dimension.

Positively highlighted was that the artifact provides a useful, brief overview of the potential for positive impact of a startup and that all dimensions of sustainability are included. It was acknowledged that the artifact is easy to use and understand. The clarity of the artifact was highlighted, and it was pointed out that the artifact strikes a good balance between informative value and time expenditure. Further, the benchmarking approach was positively perceived by some experts, as it offers substantial value, especially if it could be applied across portfolios or funds. However, again, the internal benchmarking lacks an objective comparison of impact, as the data is provided at the output level.

The results of the focus group workshop with the six researchers highlight that the artifact simplifies a complex reality, which is a strength and a weakness simultaneously. Due to the experts, it fosters the opportunity for startups and investors to learn and think about impact. At the same time, the output level of impact measurement limits the informative value. Building on these remarks, the results can be clustered into strengths, weaknesses, and suggestions for further improvements.

Positively seen was the holistic consideration of impact, as some startups might only be aware of specific impacts. Further, the small number of indicators was considered positive, which can be seen as a starting point for impact measurement. These make it easy to use and simplify the complex endeavor of impact measurement. As mentioned, a weakness is the lack of consideration of the impact a startup might generate outside the company, which would be the outcome- or even impact level of measurement; for example, Scope 1 CO2 emissions vs Scope 2, which represents the outcome level of activities by a startup. Overall, though, the researchers acknowledged the difficulty between impact measurement and startup capabilities, which led to the output-based

design of the artifact. To strengthen the comparability for impact investors, it was suggested that the assessment artifact be used only between similar types of startups, e.g., with a specific impact focus, active in the same sector, or at similar startup stages. Furthermore, it might be difficult for young startups to report on the indicators, implying that the impact measurement tool could only be applicable after two or three years of foundation. For this, the researchers suggested qualitative reporting on the indicators to support the numbers with written explanations, which can be combined with the theory of change.

In conclusion, the last evaluation indicates that the artifact is complete and useful for measuring the output level of sustainability activities of a startup, indicating the potential for impact. Moreover, the artifact appears to support impact investors to a certain extent in assessing and comparing multiple startups. The combination of indicators and qualitative reporting on activities proved to be a valuable combination, highlighting how the startup aims to contribute to the SDGs. In terms of the requirements defined in Section 9.3.1, it thus can be concluded that the artifact fulfills all requirements formulated, which in turn supports the derived design principles.

9.4 Discussion

The exemplary instantiation provides one solution of a possible artifact for the impact assessment of startups by impact investors. The design solution has been meticulously constructed, drawing upon a multitude of scholarly works and interviews, aiming for comprehensive incorporation without compromising on fulfilling the design principles. What must be highlighted about the evaluations is the persistent debate about the measurement of output level versus outcome or impact level – an ongoing debate in theory and practice (Singhania & Swami, 2024). This highlights the struggle to acknowledge startups' resource restrictions while demanding sound and transparent proof of impact.

Nevertheless, new initiatives in practice confirm the proposed solution by choosing similar approaches. One example is the initiative “Score4Impact”, a combined project by research institutions, public impact initiatives, and investment companies, now a gGmbH (BMWK, n.d.; score4impact, n.d.). They propose the following approach, which is very much in line with the proposed design principles: Their initial step for startups involves

an ESG measurement focusing on five environmental, five social, and five governance criteria, supplemented with educational components and implementation aids. This includes scoring based on the current implementation status and improvement potential, categorized by sector, resulting in a strengths-weaknesses profile of the ESG measures and evaluation of basic disclosure principles. The second step, the “Impact Estimator”, defines impact goals, estimates greenhouse gas reduction potentials, aligns with SDGs, and compares the solution’s emission savings to established alternatives (Score4Impact, 2024).

This showcases the feasibility of ESG-related measurement, which can strengthen startups' legitimacy of their impact claim. This is likewise evident in the alignment with the SDGs. Further, a reduced number of indicators acknowledges the adjustment of impact assessment artifacts toward startup resource constraints. The exemplary instantiation further incorporates the connection to the startup's revenue. Thereby, the impact investors' goal of aligning a startup's business activities with its intent to generate a positive impact is accounted for. This interconnection and direct relation between impact and revenue can minimize the risk of mission drift and help manage conflicting goals (Pieniazek et al., 2024; Santos et al., 2015).

The connection to revenue depicts the restriction of the artifact: only startups with revenue of at least one year can use the measurement tool. It is suggested that less mature startups start with the reporting of the logic model. If revenue is given, both aspects, the output-level measurement connected to the revenue and the alignment to the SDGs, ensure certain comparability while acknowledging individual cases. The comparison can be increased if two startups address the same SDG or operate in similar sectors. Lastly, the chosen indicators and design ensure attention to potential weak aspects of the startup and provide a holistic sustainability picture (Kaufmann & Botha, 2024).

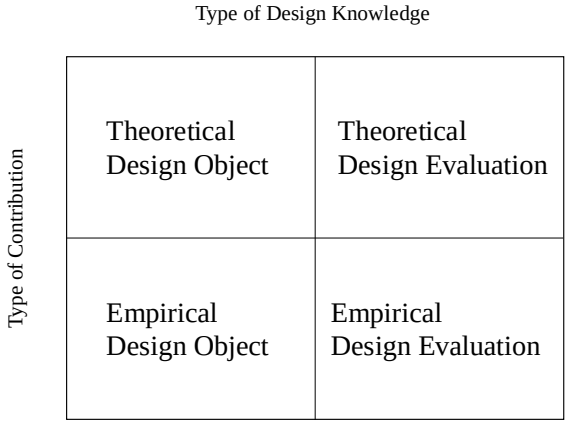
9.5 Conclusion

The existence and relevance of assessment artifacts for impact are commonly acknowledged. However, there seems to be a lack of application especially in the context of impact investing for startups. Therefore, the study focused on identifying overarching principles to design rigorous and relevant artifacts that provide support for the impact assessment of impact-driven startups. One possible solution was iteratively designed to

test and validate the design principles applicable to startups while ensuring comparability for impact investors. The DSR approach by Kuechler and Vaishnavi (2008) was used as a guideline for the scientific advancement of the design instantiation.

Specific to design science, the main contribution of this study is theoretical. Based on the framework by Seckler et al. (2021), this research has added to the theoretical design object knowledge of impact assessment for startups (see Figure 23).

Figure 23: Types of Design Knowledge Contributions (adapted from Seckler et al., 2021)



Seckler et al. (2021) define theoretical design object contribution as, for example, design science studies on a high level of abstraction that contributed to developing design principles. This study derived and iteratively validated four principles, presented once more here in a comprised form:

*DP1*_Integrate measurable indicators based on state-of-the-art standards to align business activities of a startup with its potential impact. *DP2*_Determine impact indicators representing the comprehensive concept of sustainability while considering startup-specific capabilities to measure their potential impact. *DP3*_Ensure an easily understandable and slim information synthesis of the impact claim for both investor and startup. *DP4*_Ensure the consistent use of indicators by the investor for their impact investing decisions.

The design principles make a significant contribution to design knowledge that can guide the future development of such artifacts for impact assessment of startups. They cover all necessary perspectives of the target groups: the startup capabilities (DP1), the startup-investor relation (DP2,3), and the investor side (DP4).

The evaluation focus informs parts of the study's limitations. First, only a few user tests were conducted for the application of the impact measurement tool by startups. Therefore, testing the impact measurement tool with more startups would be beneficial. Hereby, the selection of startups should pay attention to include startups of different sizes, in different life cycle stages, and from different industries, to evaluated if the artifact can be applied to all kinds of startups or is more suitable for specific industries.

Second, the instantiation was only evaluated in artificial settings (Venable et al., 2016). This was partly due to the difficulties in acquiring suitable interview and user testing partners. Impact investors, in particular, proved once more to be a challenging target group to reach, which is why other stakeholders, such as impact investing consultants or impact accelerator program managers, were included in the development of the exemplary instantiation. However, not all stakeholders have a say or are involved in selecting possible ventures for investments. As a result, the final design solution should be again evaluated by impact investors. This aligns with suggestions from DSR for follow-up research by testing the proposed design solution concerning its effectiveness empirically (Seckler et al., 2021; Venable et al., 2016).

Part V – Finale

10. Summary

The quote at the beginning of this thesis from the famous Stoic Seneca asserts that sometimes, all you need to do is take a leap and start. The impact assessment process is a critical part of initiating a potential partnership between an impact investor and an impact-driven startup. However, in order to take the leap and make an investment decision, impact investors must work with the liability of newness, the liability of smallness, and the liability of impact intransparency of a young and emerging company. Therefore, startups need to establish the legitimacy of their claim to positively impact societal problems with their business ideas. However, up to date, not much is known about how impact investors assess startups and what criteria matter to them, as former research has mostly focused on impact investing in established companies. There is also a lack of research on the impact of startups and if or how they should prove their impact claim. Therefore, the overarching research question of this thesis was:

How can startups minimize the liability of impact intransparency to be assessed as a legitimate investment case for impact investors?

To answer this, four subsequent guiding research questions were formulated. The thesis started with a theoretical foundation and provides a deeper understanding of impact and how it relates to startup investments. The first guiding question (GRQ1) examined how impact-driven startups are identified according to conceptually grounded and empirically validated criteria and in what relation impact stands compared to conventional investment criteria. The second question (GRQ2) then analyzed in detail what impact implies for impact investors in relation to startup investment and how different preferences change the investors' impact focus. GRQ3 emphasized the startup perspective concerning impact measurement and identified how current practices could be adjusted to address startup-specific challenges and barriers. Lastly, the fourth question (GRQ4) aimed to provide design support for impact assessment by synthesizing the previous findings of this thesis to develop design principles.

To answer GRQ1, two studies were conducted (cf. Chapter 5, 6). First, an initial study had a closer look at the current state of impact investing in startups. Specifically, an SLR concerning criteria of impact investors to assess suitable investment cases highlights a

phenomenon that has been scarcely investigated: not much is known about specific criteria or impact assessment of startups in general. In the literature, "impact" is not operationalized, and conventional criteria, such as team authenticity, are equally important in assessing impact-driven startups. These findings could be confirmed via ten semi-structured interviews with experts in the field of impact investing – investors, consultants, and startups. Still, the study helped to identify initial impact-related criteria for assessing impact-driven startups, emphasizing the scalability of impact and the significance of social or ecological issues, with the SDGs and social mission being crucial to operationalize it (cf. Castellas & Ormiston, 2017; Paetzold et al., 2022; Santamarta et al., 2021). The expert interviews highlighted the equal importance of ecological (CO2 emissions) and social impact (community engagement), showcasing the holistic approach of impact investors as identified in former research (cf. Holtslag et al., 2021). Impact-driven entrepreneurs are considered highly relevant for a sustainable future and should be held accountable for their actions, including unintended consequences (cf. Grinbaum & Groves, 2013).

The initial study identified the need to dive deeper into specific impact criteria that impact investors consider when investing in a startup. Therefore, a quantitative study added to these findings and addressed the second GRQ. A survey with 69 impact investors was conducted based on a set of impact criteria previously derived systematically from the literature. From these findings, it became evident that certain preferences exist in impact investors' investment decisions. The results revealed that investors prioritized a few key criteria for assessing the impact of startups, notably job creation and greenhouse gas emissions, with environmental impact being paramount. This aligns with social learning theory, suggesting investors prefer certain over uncertain criteria (Kollmann & Kuckertz, 2010), and highlights the importance of addressing the SDGs through any positive impact action. Additionally, preferences varied by market and startup stage, with emerging markets emphasizing social impact and later stages focusing more on corporate governance and customer interaction, indicating a synergy between social and environmental goals rather than a conflict (Schäfer et al., 2015; Vedula et al., 2022).

The third study built on these findings (cf. Chapter 7). An extensive social network analysis of the German impact investor network supports the formerly deducted

assumption of a tendency of homophily. Investor type, startup focus and impact focus reveal impact investors' underlying preferences, which influence the current practice of impact assessment of startups. Using snowball sampling and semantic coding, the study analyzed the German impact investor network, identifying 166 impact investors and intermediaries. The network was found to be well-connected and compact, with high community integration and a tendency for homophily. Contrary to expectations, many investors do not focus on startups, preferring companies at a later growth stage, which may impede significant positive transformation and sustainable development (Arena et al., 2018; Gidron et al., 2021).

The third research question shifted the focus from the investor's to the startup's point of view. For a startup, the measurement of impact holds multiple obstacles, yet to date, they have been neglected in impact investing research. The specific barriers and challenges young companies face in measuring their impact were the focus of the analysis in Chapter 8. A qualitative interview study with impact-driven startups and investors/investor consultants was used to understand these obstacles in-depth. From the analysis, recommendations could be deducted to support impact measurement and, in turn, impact assessment of startups. Three main barriers – power, knowledge, and stakeholder demand – and four related challenges could be identified through 25 expert interviews. The analysis suggests adapting impact measurement practices to better fit startups' realities and capabilities, highlighting the need to simplify the process. Furthermore, the findings showed that established frameworks in impact investing, such as IRIS+, are not known or used by startups. The proposed solutions include combining scorecard- and process-based models for measurement, setting clear goals using the SDGs, and defining company-level impact indicators to enhance comparability, ensure holistic sustainability, and reduce resource constraints.

Lastly, a DSR was conducted to provide design support for impact assessment of startups (cf. Chapter 9). In the relationship between investor and investee, a set of artifacts is available, which supports either target group methodologically. Still, overarching guiding principles for designing an appropriate methodological artifact to enhance the impact assessment's efficiency and effectiveness and mitigate the liability of impact intransparency of young companies are rare. To address this gap, this thesis aimed to

establish prescriptive guidelines for (impact) investors to craft appropriate future methodological artifact assistance for their (potential) portfolio companies. First, six design requirements and four design principles were deducted from the former studies presented in this thesis and iteratively validated over three design cycles via a design instantiation. The results of the evaluations highlight the ongoing debate about measuring startup impact and the question of output versus outcome level measurements (cf. Ebrahim & Rangan, 2014). The developed artifact proposes output-based measurement, which accounts for the practical feasibility and is tailored to startups' resource constraints. The developed artifact not only strengthens the startup's legitimacy of the impact claim but also mitigates the risks of mission drift or impact risk, the possibility that the impact will be different than expected (Kaufmann & Botha, 2024).

10.1 Contribution

This thesis has both significant scientific and practical relevance. Chapter 4 critically reviewed the state of the art and identified several research gaps that this thesis aimed to address and provide valuable contributions. Accordingly, this thesis adds an empirical perspective to the limited research in impact investing and entrepreneurship (Arena et al., 2018; Eckerle et al., 2022).

10.1.1 Theoretical Contribution

Mainly, the thesis contributes to a better understanding of impact in relation to startup assessment. To minimize the liability of impact intransparency, it highlights the necessity to translate impact goals into tangible criteria that can be measured at the output level. This supports earlier research questioning the feasibility of outcome or impact-level measurements (Ebrahim & Rangan, 2014). It further adds to former studies to connect the impact claim to the outputs via the contribution to the SDGs as the most prominent framework (Schutselaars et al., 2023; Tabares, 2021).

For entrepreneurship theory, the context of impact-driven entrepreneurship bolsters earlier findings of distinct challenges and barriers to startups. The barriers of power (Santos & Eisenhardt, 2009), stakeholder demand (Dew & Sarasvathy, 2007), and knowledge (Townsend et al., 2018) could be identified to be immanent in the impact measurement of startups, highlighting their prevalence for startups in multiple contexts.

Likewise, the thesis identified challenges and barriers that support the two notions of the liability of newness and smallness (Freeman et al., 1983).

Further, the findings contribute to the debate on social versus environmental entrepreneurship, supporting the view that these goals, not only financial goals versus impact goals, should be understood as synergistic rather than conflicting (Schäfer et al., 2015; Vedula et al., 2022). Impact investors reinforce this synergy by emphasizing social and environmental impact as relevant to their investment decisions in all startup stages (Eckerle et al., 2024).

Additionally, this thesis contributes to the ongoing debate about the legitimacy of investment cases in relation to sustainability (Lall, 2019; Scherer et al., 2013). Traditional investment criteria, such as team authenticity and a proven track record, remain significant alongside a startup's potential impact, supporting the findings of earlier studies (Block et al., 2021). Still, the studies highlight the influence of individual investor preferences on assessments, suggesting preference toward quantifiable data. This preference might disadvantage impact-driven entrepreneurs if their impact cannot be numerically presented. The findings align with social learning theory, indicating that investors prefer certain criteria over uncertain ones (Kollmann & Kuckertz, 2010). Further, the thesis verified a tendency for homophily within the network structures of impact investors, supporting the conceptual model by Hockerts et al. (2022) about different impact investor types. This emphasizes the need for impact assessments to ensure investments in truly sustainable and transformative startups while accounting for different goals by impact investors.

Combining the findings of the different studies, the thesis translates the theoretical foundation and empirical findings into new design knowledge to support the development of artifacts for the impact assessment of startups. It thereby offers new pathways to address the identified issues, offering three main contributions to practice.

10.1.2 Practical Contribution

First, entrepreneurs should present their impact mission aligned to their business activities, referencing SDGs and utilizing logic models such as the theory of change to report their impact claims transparently. This can minimize a common problem in the

investor-startup relationship: the prevalent information asymmetry. If the startup minimizes information asymmetry, it can reduce the adverse selection problem for investors (Eckerle & Terzidis, 2024; Reid, 1999) – in this case, investing in "impact-washing" startups. This approach may eventually lead to higher valuations by impact investors and support organizations (cf. Harrer & Owen, 2022).

Second, impact investors should acknowledge their underlying preferences by assessing startups' potential impact through a holistic lens of sustainability: How does the startup perform regarding social, environmental, and economic aspects? Further, they should account for the startup-specific constraints, focusing on measurement indicators at the output level and allowing for qualitative reporting through a theory of change.

Third, as the findings about impact-driven startup barriers and challenges show, policy regulations can have a significant influence on both investors and startups. In this context, even low regulatory changes can significantly influence investments in more sustainable startups (Lucas et al., 2022). At the same time, they can minimize the external barriers for startups, resulting in a minimized liability of impact intransparency. Therefore, it is recommended that policy regulations at the transnational level should be understood and further promoted as a supportive measure in the empowerment of sustainable startups.

10.2 Limitations and Future Studies

The limitations specific to the individual studies have been outlined in their respective chapters. Nevertheless, evaluating the overall study design's primary limitations is beneficial and can lay the groundwork for future research activities.

The studies in this thesis have identified impact investor behavior. Yet, a clear distinction of impact investor archetypes, such as those conceptualized by Hockerts et al. (2022), was not possible within the study designs. Future research could build on the identified criteria of impact investors, such as the DNA, or the SDG, geographic, and sector focus, as well as the focus on specific impact criteria or different startup stages. Here, signaling theory might be an interesting point to dive deeper into the distinguishing aspects of investing in impact-driven startups versus other startup types. Previous studies have looked at signals in relation to traditional venture financing (Svetek, 2022) and investigated specific signals of social startups (Yang et al., 2020).

Yang et al. (2020) and other studies focus on the cognitive aspects of impact investor behavior, adding to the findings about social learning and the tendency of homophily. The study by Lee et al. (2020) about categorial cognition and outcome efficiency in impact investing decisions, for example, shows a tendency to assess investments with a focus on the business aspects rather than the actual outcomes they produce, i.e., social aspects. The implications regarding the initial screening of potential investment cases could be further investigated.

The limitation of the design science approach results from the focus on current practices (cf. Chapter 8) that were used to lay the ground for the overall design instantiation. These current practices have their own limitations, which might hinder identifying the best possible solution. To critically reflect on the design recommendations, further research could consider utilizing a backcasting approach (Gebker et al., 2024). This is a strategic planning method that is used to envision a desirable future and then to work backward to identify the steps that are necessary to achieve that future (Quist & Vergragt, 2006). Former research has shown that backcasting can facilitate sustainable development by aligning current actions with long-term goals (Dreborg, 1996).

This informs another limitation: the meso-level analysis of the direct relation between the investor and the startup. Especially in the context of achieving a sustainable future, external factors should be considered to understand the full potential of an innovation or threats thereof (Varco & Marcandalli, 2020). How geopolitics, conjunctures, and public trends at the macro level shape the potential for innovation has to be managed proactively and monitored continuously by firms and investors alike (Betti et al., 2018). How this can be integrated into the current impact measurement practice for startups was beyond the scope of this thesis but should be addressed in future research. Likewise, how political regulations should be shaped in order to address the influence of these factors could be another pathway for future research.

Lastly, the scientific debate about mission-drift in impact investing has gained momentum (Cetindamar & Ozkazanc-Pan, 2017; Santos et al., 2015). While this thesis has built on the scientific foundation about conflicting goals within impact-driven startups (Vedula et al., 2022) and adds valuable insights to the debate, current research goes

beyond the dilemma of financial returns and impact focus to address a possible "impact-drift" – a mismatch between the impact aspirations and the expectations of stakeholders, defined by Argiolas et al. (2024) as "the disconnection of [pro-social] actions from long-term [social] impact outcomes" (p. 106342). Here, the ongoing issue of output versus outcome measurement once again appears as a hot topic in the impact assessment of startups and should be further explored.

10.3 Concluding Remarks

The first steps of an investment, mainly assessing whether one is a suitable partner, are the most crucial yet the most uncertain ones – both for the startup and the investor. In the context of sustainability, their shared goal of making a positive impact on society and the planet can bring them together, but caution can also keep them apart. The reluctance on both sides is often due to the fear of impact washing or divergence of impact understanding, thus not achieving the intended effect. As a result, impact investing in startups has been rather scarce to date. This thesis contributes new knowledge to this relevant and complex interplay of impact-driven startups and impact investors. It paves the way for more transparency for both sides to achieve more investments in visionary startup ideas that have the potential to shape the future and redefine our very existence sustainably.

References

Abatecola, G., Cafferata, R., & Poggesi, S. (2012). Arthur Stinchcombe's "liability of newness": Contribution and impact of the construct. *Journal of Management History*, *18*(4), 402-418. https://doi.org/10.1108/17511341211258747

Agrawal, A., & Hockerts, K. (2019). Impact Investing Strategy: Managing Conflicts between Impact Investor and Investee Social Enterprise. *Sustainability*, *11*(15), 4117. https://doi.org/10.3390/su11154117

Agrawal, A., & Hockerts, K. (2021). Impact investing: review and research agenda. *Journal of Small Business & Entrepreneurship*, *33*(2), 153-181. https://doi.org/10.1080/08276331.2018.1551457

Agyekum, E. O., Fortuin, K., & Harst, E. (2017). Environmental and social life cycle assessment of bamboo bicycle frames made in Ghana. *Journal of Cleaner Production*, *143*, 1069-1080. https://doi.org/https://doi.org/10.1016/j.jclepro.2016.12.012

Arena, M., Azzone, G., Bengo, I., & Calderini, M. (2016). Indicators and metrics for social business: a review of current approaches. *Journal of Social Entrepreneurship*, *7*(1), 1-24. https://doi.org/10.1080/19420676.2015.1049286

Arena, M., Bengo, I., Calderini, M., & Chiodo, V. (2018). Unlocking finance for social tech start-ups: Is there a new opportunity space? *Technological Forecasting and Social Change*, *127*, 154-165. https://doi.org/10.1016/j.techfore.2017.05.035

Argiolas, A., Rawhouser, H., & Sydow, A. (2024). Social entrepreneurs concerned about Impact Drift. Evidence from contexts of persistent and pervasive need. *Journal of Business Venturing*, *39*(1), 106342. https://doi.org/10.1016/j.jbusvent.2023.106342

Aschari-Lincoln, J., & Jacobs, D. C. (2018). Enabling Effective Social Impact: Towards a Model for Impact Scaling Agreements. *Sustainability*, *10*(12), 4669. https://doi.org/https://doi.org/10.3390/su10124669

Azmat, F., Jain, A., & Michaux, F. (2022). Strengthening impact integrity in investment decision-making for sustainable development. *Sustainability Accounting, Management and Policy Journal*, *13*(1), 55-87. https://doi.org/10.1108/SAMPJ-10-2020-0368

Bachmann, K., Meyer, J., & Krauss, A. (2024). Investment motives and performance expectations of impact investors. *Journal of Behavioral and Experimental Finance*, *42*, 100911-100911. https://doi.org/10.1016/j.jbef.2024.100911

Bai, X., Hasan, S., Andersen, L. S., Bjørn, A., Kilkiş, Ş., Ospina, D., Liu, J., Cornell, S. E., Sabag Muñoz, O., Broadgate, W., Lade, S. J., Rocha, J., Rockström, J., Stewart-Koster, B., Van Vuuren, D., & Zimm, C. (2024). Translating earth system boundaries for cities and businesses. *Nature Sustainability*, *12*. https://doi.org/10.1038/s41893-023-01255-w

Bansal, S., Garg, I., & Sharma, G. D. (2019). Social Entrepreneurship as a Path for Social Change and Driver of Sustainable Development: A Systematic Review and Research Agenda. *Sustainability*, *11*(4), 1091-1091. https://doi.org/10.3390/su11041091

Barber, B. M., Morse, A., & Yasuda, A. (2021). Impact investing. *Journal of Financial Economics*, *139*(1), 162-185. https://doi.org/10.1016/j.jfineco.2020.07.008

Barman, E. (2015). Of Principle and Principal: Value Plurality in the Market of Impact Investing. *Valuation Studies*, *3*(1), 9-44. https://doi.org/10.3384/vs.2001-5592.15319

Baskerville, R., & Pries-Heje, J. (2010). Explanatory Design Theory. *Business & Information Systems Engineering*, *2*(5), 271-282. https://doi.org/10.1007/s12599-010-0118-4

Battilana, J. (2018). Cracking the organizational challenge of pursuing joint social and financial goals: Social enterprise as a laboratory to understand hybrid organizing. *M@n@gement*, *21*(4), 1278-1305.

Bengo, I., Borrello, A., & Chiodo, V. (2021). Preserving the Integrity of Social Impact Investing: Towards a Distinctive Implementation Strategy. *Sustainability*, *13*(5), 2852-2852. https://doi.org/10.3390/SU13052852

Benoît, C., Norris, G., Valdivia, S., Ciroth, A., Moberg, A., Bos, U., Prakash, S., Ugaya, C., & Beck, T. (2010). The guidelines for social life cycle assessment of products: just in time! *Int. J. Life Cycle Assess*, *15*(2), 156-163. https://doi.org/https://doi.org/10.1007/s11367-009-0147-8

Bergset, L., & Fichter, K. (2015). Green start-ups – a new typology for sustainable entrepreneurship and innovation research. *Journal of Innovation Management*, *3*(3), 118-144. https://doi.org/https://doi.org/10.24840/2183-0606_003.003_0009

Betti, G., Consolandi, C., & Eccles, G. R. (2018). The Relationship between Investor Materiality and the Sustainable Development Goals: A Methodological Framework. *Sustainability*, *10*(7), 2248. https://doi.org/10.3390/su10072248

Bhatnagar, R., Keskin, D., Kirkels, A., Romme, L. G. A., & Huijben, J. C. C. M. (2022). Design principles for sustainability assessments in the business model innovation process. *Journal of Cleaner Production*, *377*, 134313. https://doi.org/10.1016/j.jclepro.2022.134313

BII. (2024). *Über die Initiative*. https://bundesinitiative-impact-investing.org/initiative/

Block, J. H., Hirschmann, M., & Fisch, C. (2021). Which criteria matter when impact investors screen social enterprises ? *Journal of Corporate Finance*, *66*, 101813-101813. https://doi.org/10.1016/j.jcorpfin.2020.101813

BMWK. (n.d.). Score4Impact - Klimaschutz bei Start-ups investierbar machen. In *Nationale Klimaschutzinitiative*: Bundesministerium für Wirtschaft und Klimaschutz.

Bocken, N. M. P. (2015). Sustainable venture capital - catalyst for sustainable start-up success? *Journal of Cleaner Production*, *108*, 647-658. https://doi.org/10.1016/j.jclepro.2015.05.079

Bose, P., & Chakrabarti, R. (2003). Application of optimized multi-criteria decision-making in an environmental impact assessment study. *Civil Engineering and Environmental Systems*, *20*(1), 31-48. https://doi.org/10.1080/10286600302230

Bose, S., Dong, G., & Simpson, A. (2019). Sustainable Investing and Asset Allocation at Global Scale. In *The Financial Ecosystem.* (pp. 225-251). Palgrave Studies in Impact Finance. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-05624-7_10

Boulongne, R., Durand, R., & Flammer, C. (2024). Impact investing in disadvantaged urban areas. *Strategic Management Journal*, *45*(2), 238-271. https://doi.org/10.1002/smj.3544

Brandstetter, L., & Lehner, M. O. (2015). Opening the Market for Impact Investments: The Need for Adapted Portfolio Tools. *Entrepreneurship Research Journal*, *5*(2), 87-107. https://doi.org/10.1515/erj-2015-0003

Brest, P., & Born, K. (2013). *When Can Impact Investing Create Real Impact?* www.ssireview.org

Bribián, I. Z., Capilla, A. V., & Usón, A. A. (2011). Life cycle assessment of building materials: comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential. *Building and Environment*, *46*(5), 1133-1140. https://doi.org/https://doi.org/10.1016/j.buildenv.2010.12.002

Bringmann, K., & Veer, T. H. (2021). Everything is (not) negotiable: The gender startup valuation gap. *Academy of Management Proceedings*, *1*, 11404-11404.

Brock, P., & Knorz, J. (2020). Growth of impact investing (in Germany/and the European Union) generally and as a consequence of the Covid-19 pandemic. *The International Family Offices Journal*, *5*(1), 6-14.

Burand, D. (2015). Resolving impact investment disputes: When doing good goes bad. *Washington University Journal Of Law And Policy*, *48*(1), 55-87. https://openscholarship.wustl.edu/cgi/viewcontent.cgi?article=1878&context=law_journal_law_policy

Burckart, W., Lydenberg, S., & Ziegler, J. (2018). *Measuring Effectiveness: Roadmap to assessing System-level and SDG Investment*. https://sdg-investments.com/fileadmin/user_upload/Measuring-Effectiveness-Report_Final_March-2018.pdf

Calderini, M., Chiodo, V., & Michelucci, F. V. (2018). The social impact investment race: toward an interpretative framework. *European Business Review*, *30*(1), 66-81. https://doi.org/10.1108/EBR-10-2016-0134

Can, R. (2023). Investor Overreaction in the BIST Sustainability Index: An Empirical Analysis from 2014-2022. *Journal of Corporate Governance, Insurance, and Risk Management*, *10*(2), 196-207. https://doi.org/https://doi.org/10.56578/jcgirm100209

Canestrino, R., Ćwiklicki, M., Magliocca, P., & Pawełek, B. (2020). Understanding social entrepreneurship: A cultural perspective in business research. *Journal of Business Research*, *110*, 132-143. https://doi.org/10.1016/j.jbusres.2020.01.006

Castellas, E. I., & Ormiston, J. (2017). Impact Investment And The Sustainable Development Goals: Embedding Field-Level Frames In Organisational Practice. *Contemporary Issues in Entrepreneurship Research*, *8*, 87-101. https://doi.org/10.1108/S2040-724620180000008010

Castellas, I.-P. E., Ormiston, J., & Findlay, S. (2018). Financing social entrepreneurship. *Social Enterprise Journal*, *14*(2), 130-155. https://doi.org/10.1108/SEJ-02-2017-0006

Cetindamar, D., & Ozkazanc-Pan, B. (2017). Assessing mission drift at venture capital impact investors. *Business Ethics*, *26*(6). https://doi.org/10.1111/beer.12149

Chardine-Baumann, E., & Botta-Genoulaz, V. (2014). A framework for sustainable performance assessment of supply chain management practices. *Computers & Industrial Engineering*, *76*, 138-147.

Chen, H. Y., & Yang, S. S. (2020). Do Investors exaggerate corporate ESG information? Evidence of the ESG momentum effect in the Taiwanese market. *Pacific Basin Finance Journal*, *63*. https://doi.org/10.1016/j.pacfin.2020.101407

Chen, W., & Holden, N. M. (2017). Social life cycle assessment of average Irish dairy farm. *Int J Life Cycle Assess*, *22*, 1459-1472.

Clark, C., Rosenzweig, W., Long, D., & Olsen, S. (2004). *Double Bottom Line Project Report: Assessing Social Impact In Double Bottom Line Ventures*. https://escholarship.org/uc/item/80n4f1mf

Clarkin, J. E., & Cangioni, C. L. (2016). Impact Investing: A Primer and Review of the Literature. *Entrepreneurship Research Journal*, *6*(2), 135-173. https://doi.org/10.1515/erj-2014-0011

Clauset, A., Newman, M. E., & Moore, C. (2004). Finding community structure in very large networks. *Phys Rev E Stat Nonlin Soft Matter Phys*, *70*(6 Pt 2), 066111. https://doi.org/10.1103/PhysRevE.70.066111

Cohen, S. (2013). What Do Accelerators Do? Insights from Incubators and Angels. *innovations*, *8*(3/4), 19-25.

Costa, E., & Pesci, C. (2016). Social impact measurement: why do stakeholders matter? *Sustainability Accounting, Management and Policy Journal*, *7*(1), 99-124. https://doi.org/10.1108/SAMPJ-12-2014-0092

Crucke, S., & Decramer, A. (2016). The Development of a Measurement Instrument for the Organizational Performance of Social Enterprises. *Sustainability 2016, Vol. 8, Page 161*, *8*(2), 161-161. https://doi.org/10.3390/SU8020161

Crunchbase. (2024). Vytal. In *Vytal Board Member and Advisor Profiles*.

Denyer, D., Tranfield, D., & Van Aken, J. E. (2008). Developing design propositions through research synthesis. *Organization Studies*, *29*(3), 393-413. https://doi.org/10.1177/0170840607088020

Dew, N., & Sarasvathy, S. D. (2007). Innovations, Stakeholders & Entrepreneurship. *Journal of Business Ethics*, *74*, 267-283. https://doi.org/10.1007/s10551-006-9234-y

Dong, Y., & Hauschild, M. Z. (2017). Indicators for Environmental Sustainability. Procedia CIRP,

Dreborg, K. H. (1996). Essence of Backcasting. *Futures*, *28*(9), 813-828.

Du, C., Freire, F., & Dias, L. (2014). Overview of social life cycle assessment. [avniR] Conference, Life Cycle in Practice,

Dumont, G. (2024). Evaluating the Credibility of Entrepreneurs' Impact Promises in Early-Stage Impact Investing. *Entrepreneurship Theory and Practice*, *0*(0). https://doi.org/https://doi.org/10.1177/10422587241249337

Ebrahim, A., & Rangan, V. K. (2014). What Impact? A framework for measuring the scale and scope of social performance. *California Management Review*, *56*(3), 118-141. https://doi.org/10.1525/cmr.2014.56.3.118

Eckerle, C. (2025 (Forthcoming)). Impact Messung und Management für Startups. In J. Anzengruber & D. Schallmo (Eds.), *Impact Entrepreneuship*. Springer.

Eckerle, C., Finner, A.-S., & Terzidis, O. (2024). Investor Perspective on Impact-driven Startups – The Prioritization of Certainty. *Social Enterprise Journal*, *20*(4), 611-631. https://doi.org/https://doi.org/10.1108/SEJ-02-2024-0028

Eckerle, C., Manthey, S., & Terzidis, O. (2022). The Entrepreneurial Perspective in Impact Investing Research: A Research Agenda. *Proceedings of the 17th European Conference on Innovation and Entrepreneurship, ECIE*.

Eckerle, C., & Terzidis, O. (2024). Designing impact due diligence for startups. *Journal of Business Venturing Design*, *3*, 100020-100020. https://doi.org/10.1016/j.jbvd.2024.100020

Eisele, F., Habermann, M., & Oesterle, R. (2002). Die Beteiligungskriterien für eine Venture Capital Finanzierung - Eine empirische Analyse der phasenbezogenen Bedeutung. *Tübinger Diskussionsbeiträge*, *238*, 1-30.

Elkington, J. (1997). The triple bottom line. *Environmental management: Readings and cases*, *2*.

Emerald. (2024). Emerald Technology Ventures. In *Emerald VC*.

Eslami, V., Ashofteh, P. S., Golfam, P., & Loáiciga, H. A. (2021). Multi-criteria decision- making approach for environmental impact assessment to reduce the adverse effects of dams. *Water Resources Management*, *35*(2), 4085-4110.

EU_SustFinance. (2020). *Taxonomy: Final report of the Technical Expert Group on Sustainable Finance*.

EuropeanCommission. (2003). What is an SME? In.

EuropeanCommission. (2022). Just and sustainable economy: Commission lays down rules for companies to respect human rights and environment in global value chains. In.

Fahrmeir, L., Heumann, C., Künstler, R., Pigeot, I., & Tutz, G. (2023). *Statistik. Der Weg zur Datenanalyse* (9 ed.). Springer Spektrum Berlin Heidelberg. https://doi.org/10.1007/978-3-662-67526-7

FAZ. (2023). Start-ups auf Mitarbeitersuche. In *Frankfurter Allgemeine*.

Fichter, K., Lüdeke-Freund, F., Schaltegger, S., & Schillebeeckx, S. J. D. (2023). Sustainability impact assessment of new ventures: An emerging field of research. *Journal of Cleaner Production*, *384*, 135452-135452. https://doi.org/10.1016/j.jclepro.2022.135452

Fichter, K., Widrat, A., & Olteanu, Y. (2021). *Moving from evaluation to impact management of start-up support programmes* (Borderstep Impact Guide, Issue. www.borderstep.de

Filser, M., Kraus, S., Roig-Tierno, N., Kailer, N., & Fischer, U. (2019). Entrepreneurship as Catalyst for Sustainable Development: Opening the Black Box. *Sustainability*, *11*(16), 4503-4503. https://doi.org/10.3390/su11164503

FNG. (2024). Über das FNG. In *Forum Nachhaltige Geldanlagen*.

Freeman, J., Carroll, G. R., & Hannan, M. T. (1983). The Liability of Newness: Age Dependence in Organizational Death Rates. *American Sociological Review, 48*(5), 692-710.

Fritsch, M., & Wyrwich, M. (2021). *Entrepreneurship. Theorie, Empirie, Politik* (3rd ed.). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-45394-0

Gangopadhyay, P., & Nilakantan, R. (2021). Peer effects and social learning in banks' investments in information technology. *International Review of Economics & Finance*, *75*, 456-463. https://doi.org/10.1016/j.iref.2021.03.024

Garbie, I. H. (2014). An analytical technique to model and assess sustainable development index in manufacturing enterprises. *International Journal of*

Production Research, *52*(16), 4876-4915. https://doi.org/https://doi.org/10.1080/00207543.2014.893066

Gartner. (n.d.). Compound Annual Growth Rate. In *Gartner Glossary*.

Gebker, M., Olvermann, M., Ohlhoff, M., Buck, L., Engel, B., Frerichs, L., Glatzel, G., Klabunde, F., Reis, L., Schneider, A. K., Schröder, B., Zonon, S., & Kauffeld, S. (2024). Overcoming complexity – Research through design and backcasting as complementary approaches to anticipating more sustainable futures. *Gruppe. Interaktion. Organisation. Zeitschrift fur Angewandte Organisationspsychologie*, *55*(2), 209-223. https://doi.org/10.1007/s11612-024-00742-8

Gidron, B., Cohen-Israel, Y., Bar, K., Silberstein, D., Lustig, M., & Kandel, D. (2021). Impact tech startups: A conceptual framework, machine-learning-based methodology and future research directions. *Sustainability (Switzerland)*, *13*(18). https://doi.org/10.3390/su131810048

GIIN. (2019). *IRIS+ and the five dimensions of impact*.

GIIN. (2020). What You Need to Know About Impact Investing. In *The Global Impact Investing Network*.

Girvan, M., & Newman, M. E. (2002). Community structure in social and biological networks. *Proc Natl Acad Sci U S A*, *99*(12), 7821-7826. https://doi.org/10.1073/pnas.122653799

Glänzel, G., & Scheuerle, T. (2016). Social Impact Investing in Germany: Current Impediments from Investors' and Social Entrepreneurs' Perspectives. *Voluntas*, *27*, 1638-1668. https://doi.org/10.1007/s11266-015-9621-z

Gläser, J., & Laudel, G. (2010). *Experteninterviews und qualitative Inhaltsanalyse als Instrumente rekonstruierender Untersuchungen* (4 ed.). VS Verlag für Sozialwissenschaften.

Global Sustainability Standards, B. (2021). *Consolidated set of the GRI Standards 2021*. https://www.globalreporting.org/how-to-use-the-gri-standards/gri- standards-english-language/

GLS. (2024). GLS Bank. In *GLS Bank*.

Goodman, L. A. (1961). Snowball Sampling. *The Annals of Mathematical Statistics*, *32*(1), 148-170. https://doi.org/10.1214/aoms/1177705148

Goyal, P., & Rahman, Z. (2014). Corporate sustainability performance assessment: an analytical hierarchy process approach. *International Journal of Intercultural Information Management*, *4*(1), 1-1. https://doi.org/10.1504/IJIIM.2014.065285

Grabenwarter, U., & Liechtenstein, H. (2011). In search of gamma an unconventional perspective on Impact Investing. In *IESE Business School Working Paper*.

Gregor, S., Chandra Kruse, L., & Seidel, S. (2020). Research perspectives: The anatomy of a design principle. *Journal of the Association for Information Systems*, *21*(6), 1622-1652. https://doi.org/10.17705/1jais.00649

Grieco, C. (2015). *Assessing Social Impact of Social Enterprises. Does One Size Really Fit All?* SpringerBriefs in Business. http://www.springer.com/series/8860

Grieco, C., Michelini, L., & Iasevoli, G. (2015). Measuring Value Creation in Social Enterprises: A Cluster Analysis of Social Impact Assessment Models. *Nonprofit and Voluntary Sector Quarterly*, *44*(6), 1173-1193. https://doi.org/10.1177/0899764014555986/FORMAT/EPUB

Grinbaum, A., & Groves, C. (2013). What Is "Responsible" about Responsible Innovation? Understanding the Ethical Issues. In *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society* (pp. 119-142). John Wiley and Sons. https://doi.org/10.1002/9781118551424.ch7

Hahn, C. (2018). *Finanzierung von Start-up-Unternehmen. Praxisbuch für erfolgreiche Gründer: Finanzierung, Besteuerung, Investor Relations* (2nd ed.). Springer Gabler.

Halbritter, G., & Dorfleitner, G. (2015). The wages of social responsibility - where are they? A critical review of ESG investing. *Review of Financial Economics, 26*, 25-35. https://doi.org/10.1016/j.rfe.2015.03.004

Haldar, S. (2019). Towards a conceptual understanding of sustainability-driven entrepreneurship. In *Corporate Social Responsibility and Environmental Management* (Vol. 26, pp. 1157-1170): John Wiley and Sons Ltd.

Hall, J. K., Daneke, G. A., & Lenox, M. J. (2010). Sustainable development and entrepreneurship: Past contributions and future directions. *Journal of Business Venturing*, *25*(5), 439-448. https://doi.org/10.1016/j.jbusvent.2010.01.002

Hall, M., Millo, Y., & Barman, E. (2015). Who and What Really Counts? Stakeholder Prioritization and Accounting for Social Value. *Journal of Management Studies*, *52*(7), 907-934. https://doi.org/10.1111/joms.12146

Handcock, M. S., Raftery, A. E., & Tantrum, J. M. (2007). Model-Based Clustering for Social Networks. *Journal of the Royal Statistical Society Series A: Statistics in Society*, *170*(2), 301-354. https://doi.org/10.1111/j.1467-985X.2007.00471.x

Harji, K., & Jackson, E. (2012). *Accelerating Impact. Achievements, Challenges and What's Next in Building the Impact Investing Industry*.

Harrer, T., & Owen, R. (2022). Reducing early-stage Cleantech funding gaps: an exploration of the role of Environmental Performance Indicators. *International Journal of Entrepreneurial Behavior & Research*, *28*(9), 268-288. https://doi.org/10.1108/IJEBR-10-2021-0849

Hawkins, T. R., Singh, B., Majeau-Bettez, G., & Strømman, A. H. (2013). Comparative Environmental Life Cycle Assessment of Conventional and Electric Vehicles. *Journal of Industrial Ecology*, *17*(1), 53-64. https://doi.org/10.1111/j.1530-9290.2012.00532.x

Hazenberg, R., Seddon, F. A., & Denny, S. (2013). Intermediary perceptions of investment readiness in the social investment market. *Seventeenth Annual Conference of the International Research Society for Public Management (IRSPM XVII)*, 10-12. http://nectar.northampton.ac.uk/5181/

Heinz, D. C., & Velamuri, V. K. (2024). Intentionality and Decision-Making in Impact Investing—Understanding Investment Motivation and Selection Criteria of Impact Investors. *Sustainability*, *16*(11), 4497-4497. https://doi.org/10.3390/su16114497

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75-75. https://doi.org/10.2307/25148625

Hirschmann, M., Moritz, A., & Block, J. H. (2022). Motives, Supporting Activities, and Selection Criteria of Social Impact Incubators: An Experimental Conjoint Study. *Nonprofit and Voluntary Sector Quarterly*, *51*(5), 1095-1133. https://doi.org/10.1177/08997640211057402

Höchstädter, K. A., & Scheck, B. (2015). What's in a Name: An Analysis of Impact Investing Understandings by Academics and Practitioners. *Journal of Business Ethics*, *132*(2), 449-475. https://doi.org/10.1007/S10551-014-2327-0

Hockerts, K. (2015). How hybrid organizations turn antagonistic assets into complementarities. *California Management Review*, *57*(3), 83-106. https://doi.org/10.1525/cmr.2015.57.3.83

Hockerts, K., Hehenberger, L., Schaltegger, S., & Farber, V. (2022). Defining and Conceptualizing Impact Investing: Attractive Nuisance or Catalyst? *Journal of Business Ethics*, *179*, 937-950. https://doi.org/10.1007/s10551-022-05157-3

Holtslag, M., Chevrollier, N., & Nijhof, A. (2021). Impact investing and sustainable market transformations: The role of venture capital funds. *Business Ethics, Environment and Responsibility*, *30*(4), 522-537. https://doi.org/10.1111/beer.12371

Honeyman, R. (2024). B Corp Handbook. In: B Corp.

Horne, J. (2019). The sustainability impact of new ventures. Measuring and managing entrepreneurial contributions to sustainable development. In.

Horne, J., & Fichter, K. (2022). Growing for sustainability: Enablers for the growth of impact startups – A conceptual framework, taxonomy, and systematic literature review. *Journal of Cleaner Production*, *349*, 131163-131163. https://doi.org/10.1016/J.JCLEPRO.2022.131163

IMMPACT.Guide. (2024). IMMPACT.Guide. Find your way to IMMPACT. In.

ImpactFrontiers. (2024). Impact Frontiers: Impact for investment decision-making. In.

IMV-Lab. (2024). Wie können wir die Wirkung von Sozialen Innovationen messbar und sichtbar machen? In.

Islam, S. M. (2021). Impact investing in social sector organisations: a systematic review and research agenda. *Accounting & Finance*, *62*(1), 709-737. https://doi.org/10.1111/acfi.12804

Jackson, E. T. (2013). Interrogating the theory of change: evaluating impact investing where it matters most. *Journal of Sustainable Finance and Investment*, *3*(2), 95-110. https://doi.org/10.1080/20430795.2013.776257

Jasiński, D., Meredith, J., & Kirwan, K. (2016). A comprehensive framework for automotive sustainability assessment. *Journal of Cleaner Production*, *135*, 1034-1044. https://doi.org/10.1016/j.jclepro.2016.07.027

Jia, X., & Desa, G. (2020). Social entrepreneurship and impact investment in rural–urban transformation: An orientation to systemic social innovation and symposium findings. *Agriculture and Human Values*, *37*(4), 1217-1239. https://doi.org/10.1007/s10460-020-10133-6

Kaplan, R. S. (2003). Strategic Performance Measurement and Management in Nonprofit Organizations. *Nonprofit Management and Leadership*, *11*(3), 353-370. https://doi.org/10.1002/nml.11308

Kaplan, R. S., & Norton, D. P. (1996). *The Balanced Scorecard: Translating Strategy into Action*. Harvard Business School Press.

Kaufmann, L., & Botha, H. (2024). Who Loses in Win-Win Investing? A Mixed Methods Study of Impact Risk. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-024-05788-8

Kiefl, S., Scharpe, K., Ajiri, A., Davis, J., Heinrich, L., Marik, F., & Martha, O. M. (2024). *Deutscher Social Entrepreneurship Monitor 2024*.

Kitchenham, B., & Charters, M. S. (2007). *Guidelines for performing systematic literature reviews in software engineering*.

Klärner, A., Gamper, M., Keim-Klärner, S., von der Lippe, H., Moor, I., Richter, M., & Vonneilich, N. (2019). Soziale Netzwerke und gesundheitliche Ungleichheiten – eine neue Perspektive für die Forschung. In A. Klärner, M. Gamper, S. Keim-Klärner, H. von der Lippe, I. Moor, M. Richter, & N. Vonneilich (Eds.), *Soziale Netzwerke und gesundheitliche Ungleichheiten* (pp. 1-30). Springer VS. https://doi.org/https://doi.org/10.1007/978-3-658-21659-7_1

Knockaert, M., Clarysse, B., & Wright, M. (2010). The extent and nature of heterogeneity of venture capital selection behaviour in new technology-based firms. *R and D Management*, *40*(4), 357-371. https://doi.org/10.1111/j.1467-9310.2010.00607.x

Kölbel, J. F., Heeb, F., Paetzold, F., & Busch, T. (2020). Can Sustainable Investing Save the World? Reviewing the Mechanisms of Investor Impact. *Organization & Environment*, *33*(4), 554-574. https://doi.org/10.1177/1086026620919202

Kollmann, T. (2019). *E-Entrepreneurship* (7th ed.). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-658-27429-0

Kollmann, T., Jung, P. B., Kleine-Stegemann, L., Ataee, J., & de Cruppe, K. (2020). *Deutscher Startup Monitor 2020. Innovation statt Krise* (9783948895044).

Kollmann, T., & Kuckertz, A. (2010). Evaluation uncertainty of venture capitalists' investment criteria. *Journal of Business Research*, *63*(7), 741-747. https://doi.org/10.1016/j.jbusres.2009.06.004

Kolotzek, C., Helbig, C., Thorenz, A., Reller, A., & Tuma, A. (2018). A company-oriented model for the assessment of raw material supply risks, environmental impact and social implications. *Journal of Cleaner Production*, *176*, 566-580. https://doi.org/10.1016/j.jclepro.2017.12.162

Kraus, S., Breier, M., & Dasí-Rodríguez, S. (2020). The art of crafting a systematic literature review in entrepreneurship research. *International Entrepreneurship and Management Journal*, *16*(3), 1023-1042. https://doi.org/10.1007/s11365-020-00635-4

Kuckartz, U. (2019). Chapter 8. Qualitative Text Analysis: A Systematic Approach. In G. Kaiser & N. Presmeg (Eds.), *Compendium for Early Career Researchers in Mathematics Education* (pp. 181-197). ICME-13 Monographs. https://doi.org/10.1007/978-3-030-15636-7_8

Kuckartz, U., & Rädiker, S. (2022). *Qualitative Inhaltsanalyse. Methoden, Praxis, Computerunterstützung* (Vol. 5). Beltz Juventa.

Kuechler, W., & Vaishnavi, V. (2008). On Theory Development in Design Science Research: Anatomy of a Research Project. *Proceedings of the Third International Conference on Design Science Research in Information Systems and Technology*. https://www.researchgate.net/publication/220393130

Kurz, B., & Kubek, D. (2016). Social impact navigator. The practical guide for organizations targeting better results. In. Berlin: PHINEO gAG.

Labuschagne, C., & Brent, A. C. (2008). An industry perspective of the completeness and relevance of a social assessment framework for project and technology management in the manufacturing sector. *Journal of Cleaner Production*, *16*(3), 253-262. https://doi.org/10.1016/j.jclepro.2006.07.028

Lall, S. A. (2019). From Legitimacy to Learning: How Impact Measurement Perceptions and Practices Evolve in Social Enterprise-Social Finance Organization Relationships. *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations*, *30*(3), 562-577. https://doi.org/10.1007/sll266-018-00081-5

Lee, M., Adbi, A., & Singh, J. (2020). Categorical cognition and outcome efficiency in impact investing decisions. *Strategic Management Journal*, *41*(1), 86-107. https://doi.org/10.1002/smj.3096

Leedy, P. D., & Ormrod, J. E. (2015). *Practical research. Planning and design* (11 ed.). Pearson. https://doi.org/10.37074/jalt.2018.1.2.15

Leendertse, J., van Rijnsoever, F. J., & Eveleens, C. P. (2021). The sustainable start-up paradox: Predicting the business and climate performance of start-ups. *Business Strategy and the Environment*, *30*(2), 1019-1036. https://doi.org/10.1002/bse.2667

Lucas, D. S., Grimes, M. G., & Gehman, J. (2022). Remaking Capitalism: The Strength of Weak Legislation in Mobilizing B Corporation Certification. *Academy of Management Journal*, *65*(3), 958-987. https://doi.org/10.5465/AMJ.2020.1688

Macclure, B. (2023). Valuing Startup Ventures. In *Investopedia*.

Macmillan, I. C., Siegel, R., & Narasimha, P. N. S. (1985). Criteria used by venture capitalists to evaluate new venture proposals. *Journal of Business Venturing*, *1*(1), 119-128. https://doi.org/10.1016/0883-9026(85)90011-4

Malhotra, N., Clavier, B., & Bailard, E. (n.d.). *The Impact Compass*. https://www.gsb.stanford.edu/experience/about/centers-institutes/csi/impact-compass

Manetti, G. (2014). The Role of Blended Value Accounting in the Evaluation of Socio-Economic Impact of Social Enterprises. *Voluntas*, 443-464. https://doi.org/10.1007/s11266-012-9346-1

Manthey, S. I. (2024). Adopting Design Science Research to Develop a Framework for Systematic Technology Application Selection. In. Karlsruhe.

Mayring, P. (2014). *Qualitative Content Analysis Theoretical Foundation, Basic Procedures and Software Solution*. www.beltz.de

Mayring, P., & Fenzl, T. (2014). Qualitative Inhaltsanalyse. In *Handbuch Methoden der empirischen Sozialforschung* (pp. 543-556). Springer Fachmedien Wiesbaden. https://doi.org/10.1007/978-3-531-18939-0_38

McCallum, S., & Viviers, S. (2020). Exploring key barriers and opportunities in impact investing in an emerging market setting. *South African Journal of Business Management*, *51*(1). https://doi.org/10.4102/sajbm.v51i1.1601

McLoughlin, J., Kaminski, J., Sodagar, B., Khan, S., Harris, R., Arnaudo, G., & Mc Brearty, S. (2009). A strategic approach to social impact measurement of social enterprises. *Social Enterprise Journal*, *5*(2), 154-178. https://doi.org/10.1108/17508610910981734

Mellor, M., & Moore, G. (2005). Business for a Social Purpose: Traidcraft and shared interest. *Development*, *48*(1), 84-91. https://doi.org/10.1057/palgrave.development.1100118

Mitchell, R. K., Cohen, B., & Mitchell, R. K. (2006). Stakeholder Theory And The Entrepreneurial Firm. *Journal of Small Business Strategy*, *17*(1).

Molecke, G., & Pinkse, J. (2017). Accountability for social impact: A bricolage perspective on impact measurement in social enterprises. *Journal of Business Venturing*, *32*(5), 550-568. https://doi.org/10.1016/j.jbusvent.2017.05.003

Mook, L., Chan, A., & Kershaw, D. (2015). Measuring Social Enterprise Value Creation. *Nonprofit Management and Leadership*, *26*(2), 189-207. https://doi.org/10.1002/nml.21185

Morgan, D. (1997). *Focus Groups as Qualitative Research*. SAGE Publications, Inc. https://doi.org/10.4135/9781412984287

Mroueh, U. M., Eskola, P., Laine-Ylijoki, J., Wellmann, K., Mäkelä, E., Juvankoski, M., & Ruotoistenmäki, A. (2000). *Life cycle assessment of road construction*.

MSCI. (2020). MSCI ESG Ratings Methodology. In.

Murnieks, C. Y., Haynie, J. M., Wiltbank, R. E., & Harting, T. (2011). 'I like how you think': Similarity as an interaction bias in the investor-entrepreneur dyad. *Journal of Management Studies*, *48*(7), 1533-1561. https://doi.org/10.1111/j.1467-6486.2010.00992.x

Nachyla, P., & Justo, R. (2024). How do impact investors leverage non-financial strategies to create value? An impact-oriented value framework. *Journal of Business Venturing Insights*, *21*. https://doi.org/10.13039/501100011033

Najmaei, A. (2016). Using Mixed-Methods Designs to Capture the Essence of Complexity in the Entrepreneurship Research: An Introductory Essay and a Research Agenda. In E. S. C. Berger & A. Kuckertz (Eds.), *Complexity in Entrepreneurship, Innovation and Technology Research* (pp. 13-36). Springer. https://doi.org/10.1007/978-3-319-27108-8_2

Nicholls, J., & Cupitt, S. (2012). Great Britain, Office of the Third Sector. A Guide to Social Return on Investment. In (2. ed.). London: Society Media.

Nicholls, J., Lawlor, E., Neitzert, E., & Goodspeed, T. (2012). *A guide to Social Return on Investment*. The SROI Network. https://socialvalueselfassessmenttool.org/wp-content/uploads/intranet/758/pdf-guide.pdf

O'Donohoe, N., Leijonhufvud, C., Saltuk, Y., Bugg-Levine, A., & Brandenburg, M. (2010). *Global Research Impact Investments. An emerging asset class*.

O'Flynn, P., & Barnett, C. (2017). *Evaluation and Impact Investing: A Review of Methodologies to Assess Social Impact*.

Ogar, E., Pecl, G., & Mustonen, T. (2020). Science Must Embrace Traditional and Indigenous Knowledge to Solve Our Biodiversity Crisis. *One Earth*, *3*(2), 162-165. https://doi.org/10.1016/j.oneear.2020.07.006

Olteanu, Y., & Fichter, K. (2020). Green Startup Monitor 2020: Selected Key Findings in English. In. Berlin.

Olteanu, Y., & Fichter, K. (2022). Startups as sustainability transformers: A new empirically derived taxonomy and its policy implications. *Business Strategy and the Environment*. https://doi.org/10.1002/BSE.3065

Ormiston, J. (2019). Blending practice worlds: Impact assessment as a transdisciplinary practice. *Business Ethics*, *28*(4), 423-440. https://doi.org/10.1111/beer.12230

Pacheco, D. F., Dean, T. J., & Payne, D. S. (2010). Escaping the green prison: Entrepreneurship and the creation of opportunities for sustainable development. *Journal of Business Venturing*, *25*(5), 464-480. https://doi.org/10.1016/j.jbusvent.2009.07.006

Paetzold, F., Busch, T., Utz, S., & Kellers, A. (2022). Between impact and returns: Private investors and the sustainable development goals. *Business Strategy and the Environment*. https://doi.org/10.1002/BSE.3070

Pelletier, N. L., Ayer, N. W., Tyedmers, P. H., Kruse, S. A., Flysjo, A., Robillard, G., Ziegler, F., Scholz, A. J., & Sonesson, U. (2007). Impact categories for life cycle assessment research of seafood production systems: Review and prospectus. *The International Journal of Life Cycle Assessment*, *12*(6), 414-421. https://doi.org/10.1065/lca2006.09.275

Petrick, S., & Birnbaum, J. (2016). *Social Impact Investment in Deutschland 2016: Kann das Momentum zum Aufbruch genutzt werden?*

Phillips, S. D., & Johnson, B. (2021). Inching to Impact: The Demand Side of Social Impact Investing. *Journal of Business Ethics*, *168*(3), 615-629. https://doi.org/10.1007/s10551-019-04241-5

Pieniazek, R., Unsworth, K. L., & Dean, H. (2024). How and why do social entrepreneurs experience goal conflict differently? *Journal of Business Venturing Insights*, *21*, 452-452. https://doi.org/10.1016/j.jbvi.2024.e00452

Pierrakis, Y., & Owen, R. (2023). Startup ventures and equity finance: How do Business Accelerators and Business Angels' assess the human capital of socio-environmental mission led entrepreneurs? *Innovation*, *25*(4), 371-395. https://doi.org/10.1080/14479338.2022.2029706

Pun, K.-F., Hui, I.-K., Lewis, W. G., & Lau, H. C. W. (2003). A multiple-criteria environmental impact assessment for the plastic injection molding process: a methodology. *Journal of Cleaner Production*, *11*(1), 41-49. https://doi.org/10.1016/S0959-6526(02)00019-7

Quist, J., & Vergragt, P. (2006). Past and future of backcasting: The shift to stakeholder participation and a proposal for a methodological framework. *Futures*, *38*(9), 1027-1045. https://doi.org/10.1016/j.futures.2006.02.010

Rafiaani, P., Dikopoulou, Z., Van Dael, M., Kuppens, T., Azadi, H., Lebailly, P., & Van Passel, S. (2020). Identifying Social Indicators for Sustainability Assessment of CCU Technologies: A Modified Multi-criteria Decision Making. *Social Indicators Research*, *147*(1), 15-44. https://doi.org/10.1007/s11205-019-02154-4

Rainock, M., Everett, D., Pack, A., Dahlin, E. C., & Mattson, C. A. (2018). The social impacts of products: a review. *Impact Assessment and Project Appraisal*, *36*(3), 230-241. https://doi.org/10.1080/14615517.2018.1445176

Reeder, N., Colantonio, A., Loder, J., & Rocyn Jones, G. (2015). Measuring impact in impact investing: an analysis of the predominant strength that is also its greatest weakness. *Journal of Sustainable Finance & Investment*, *5*(3), 136-154. https://doi.org/10.1080/20430795.2015.1063977

Reid, G. C. (1999). The application of principal-agent methods to investor-investee relations in the UK venture capital industry. *Venture Capital*, *1*(4), 285-302. https://doi.org/10.1080/136910699295820

Romme, A. G. L., & Reymen, I. M. M. J. (2018). Entrepreneurship at the interface of design and science: Toward an inclusive framework. *Journal of Business Venturing Insights*, *10*(e00094). https://doi.org/https://doi.org/10.1016/j.jbvi.2018.e00094

Romme, L. G. A., & Dimov, D. (2021). Mixing Oil with Water: Framing and Theorizing in Management Research Informed by Design Science. *Designs*, *5*(1), 13. https://doi.org/10.3390/DESIGNS5010013

Roth, K. (2021). An Analysis on Impact Measurement: How Do We Measure Impact? In K. Wendt (Ed.), *Theories of Change: Change Leadership Tools, Models and Applications for Investing in Sustainable Development* (pp. 139-152). Springer International Publishing. https://doi.org/10.1007/978-3-030-52275-9_10

Roundy, P., Holzhauer, H., & Dai, Y. (2017). Finance or philanthropy? Exploring the motivations and criteria of impact investors. *Social Responsibility Journal*, *13*(3), 491-512. https://doi.org/10.1108/SRJ-08-2016-0135

Rowley, J. (2014). Designing and using research questionnaires. *Management Research Review*, *37*(3), 308-330. https://doi.org/10.1108/MRR-02-2013-0027

Santamarta, J. C., Storch de Gracia, M. D., Carrascosa, M. Á. H., Martínez-Núñez, M., García, C. d. l. H., & Cruz-Pérez, N. (2021). Characterisation of Impact Funds and Their Potential in the Context of the 2030 Agenda. *Sustainability*, *13*(11), 6476-6476. https://doi.org/10.3390/su13116476

Santos, F., Pache, A.-C., & Birkholz, C. (2015). Making Hybrids Work: Aligning Business Models and Organizational Design For Social Enterprises. *California Management Review*, *57*(3), 36-58. https://doi.org/10.1525/cmr.2015.57.3.36

Santos, F. M., & Eisenhardt, K. M. (2009). Constructing Markets And Shaping Boundaries: Entrepreneurial Power In Nascent Fields. *Academy of Management Journal*, *52*(4), 643-671.

Schäfer, K., Corner, P. D., & Kearins, K. (2015). Social, Environmental and Sustainable Entrepreneurship Research: What Is Needed for Sustainability-as-Flourishing? *Organization and Environment*, *28*(4), 394-413. https://doi.org/10.1177/1086026615621111

Schätzlein, L., Schlütter, D., & Hahn, R. (2023). Managing the external financing constraints of social enterprises: A systematic review of a diversified research landscape. *International Journal of Management Reviews*, *25*(1), 176-199. https://doi.org/10.1111/ijmr.12310

Scherer, A. G., Palazzo, G., & Seidl, D. (2013). Managing Legitimacy in Complex and Heterogeneous Environments: Sustainable Development in a Globalized World. *Journal of Management Studies*, *50*(2), 259-284. https://doi.org/10.1111/joms.12014

Scholda, F., Vandor, P., Millner, R., & Meyer, M. (2021). Impact Evaluation in Early-Stage Impact Investing. Cognitive Patterns and Heuristics of Impact InvestorS. 81st Annual Meeting of the Academy of Management 2021: Bringing the Manager Back in Management, AoM 2021,

Schutselaars, J., Georges, A., Romme, L., Bell, J., Bobelyn, A. S. A., & Van Scheijndel, R. (2023). Designing and Testing a Tool That Connects the Value Proposition of Deep-Tech Ventures to SDGs. *Designs 2023, Vol. 7, Page 50*, *7*(2), 50-50. https://doi.org/10.3390/DESIGNS7020050

Score4Impact. (2024). *Discover the next ESG & Climate Champion. Tools & Benchmarking für Investoren, Förderer & Startups*.

score4impact. (n.d.). *score4impact - unser Ansatz*. https://score4impact.com/unser-ansatz/

SDGInvestment. (2024). *Nachhaltigkeitsinvestments für institutionelle Investoren*. https://www.sdg-investments.com/

Seckler, C., Mauer, R., & Vom Brocke, J. (2021). Design Science in Entrepreneurship: Conceptual Foundations and Guiding Principles. *Journal of Business Venturing Design*, *1*(1-2). https://www.journals.elsevier.com/journal-of-business-

SEND. (2024). Social Entrepreneurship Netzwerk Deutschland. In *Social Entrepreneurship Netzwerk e.V.*

Siefkes, M., Bjørgum, Ø., & Sørheim, R. (2023). Business angels investing in green ventures: how do they add value to their start-ups? *Venture Capital*, 1-30. https://doi.org/10.1080/13691066.2023.2260101

Sing, A. S. (2017). Common procedures for the development, validity, and reliability of a questionnaire. *International Journal of Economics, Commerce, and Management*, *5*(5), 790-801.

Singhania, M., & Swami, D. (2024). Impact investing: Scientometric review and research agenda. *Business Ethics, the Environment and Responsibility*, *33*(3), 251-286. https://doi.org/10.1111/beer.12599

Slattery, E. L., Voelker, C. C. J., Nussenbaum, B., Rich, J. T., Paniello, R. C., & Neely, J. G. (2011). A Practical Guide to Surveys and Questionnaires. *Otolaryngology–Head and Neck Surgery*, *144*(6), 831-837. https://doi.org/10.1177/0194599811399724

So, I., & Staskevicius, A. (2015). *Measuring the "impact" in impact investing*.

Souza, A., Watanabe, M. D. B., Cavalett, O., Ugaya, C. M. L., & Bonomi, A. (2018). Social life cycle assessment of first and second-generation ethanol production technologies in Brazil. *International Journal of Life Cycle Assessment*, *23*(3), 617-628. https://doi.org/10.1007/s11367-016-1112-y

Souza, R. G., Rosenhead, J., Salhofer, S. P., Valle, R. A. B., & Lins, M. P. E. (2015). Definition of sustainability impact categories based on stakeholder perspectives. *Journal of Cleaner Production*, *105*, 41-51. https://doi.org/https://doi.org/10.1016/j.jclepro.2014.09.051

Spiess-Knafl, W., & Scheck, B. (2017). *Impact Investing*. Palgrave Studies in Impact Finance. http://www.palgrave.com/series/14621

Strömmer, K., & Ormiston, J. (2022). Forward-looking impact assessment-An interdisciplinary systematic review and research agenda. *Journal of Cleaner Production*, *377*. https://doi.org/10.1016/j.jclepro.2022.134322

Sun, J., & Tang, J. (2011). A Survey of Models and Algorithms for Social Influence Analysis. In *Social Network Data Analytics* (pp. 177-214). Springer. https://doi.org/https://doi.org/10.1007/978-1-4419-8462-3_7

Svetek, M. (2022). Signaling in the context of early-stage equity financing: review and directions. *Venture Capital*, *24*(1), 71-104. https://doi.org/10.1080/13691066.2022.2063092

Szopinski, D., Schoormann, T., & Kundisch, D. (2019). Theoretical Foundation and Empirical Evidence View project Visual languages for business model representation View project COVER SHEET BECAUSE YOUR TAXONOMY IS WORTH IT: TOWARDS A FRAMEWORK FOR TAXONOMY EVALUATION. https://www.researchgate.net/publication/332711034

Tabares, S. (2021). Do hybrid organizations contribute to Sustainable Development Goals? Evidence from B Corps in Colombia. *Journal of Cleaner Production, 280*. https://doi.org/10.1016/j.jclepro.2020.124615

Takeda, S., Keeley, A., Sakurai, S., Managi, S., & Norris, C. (2019). Are Renewables as Friendly to Humans as to the Environment?: A Social Life Cycle Assessment of Renewable Electricity. *Sustainability*, *11*(5), 1370-1370. https://doi.org/10.3390/su11051370

Terzidis, O., Gutmann, M., & Ziegler, C. (2023). Design Science Research in Entrepreneurship : Scaffolding Artifacts for the Venturing Process. https://doi.org/10.5445/IR/1000162284

Then, V., & Schmidt, T. (2020). *Impact Investing in Germany 2020-A Dynamic Growth Market Executive Summary*. https://www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/Impact-Investing-in-Germany-2020_Summary.pdf

Theodoraki, C., Messeghem, K., & Rice, M. P. (2018). A social capital approach to the development of sustainable entrepreneurial ecosystems: an explorative study. *Small Business Economics*, *51*(1), 153-170. https://doi.org/10.1007/s11187-017-9924-0

Thirion, I., Reichert, P., Xhauflair, V., & De Jonck, J. (2022). From Fiduciary Duty to Impact Fidelity: Managerial Compensation in Impact Investing. *Journal of Business Ethics*. https://doi.org/10.1007/s10551-022-05155-5

Townsend, D. M., Hunt, R. A., McMullen, J. S., & Sarasvathy, S. D. (2018). Uncertainty, knowledge problems, and entrepreneurial action. *Academy of Management Annals*, *12*(2), 659-687. https://doi.org/10.5465/ANNALS.2016.0109/FORMAT/EPUB

Trautwein, C. (2021). Sustainability impact assessment of start-ups – Key insights on relevant assessment challenges and approaches based on an inclusive, systematic literature review. *Journal of Cleaner Production*, *281*. https://doi.org/10.1016/j.jclepro.2020.125330

Trautwein, C., & Fichter, K. (2018). Leitfaden zur Nachhaltigkeitsbewertung von Start-ups: Ein Praxistool für Gründerteams, Investoren und Fördermittelgeber. In. Berlin: Borderstep Institut.

Trelstad, B. (2016). Impact Investing: A Brief History. *Capitalism and Society*, *11*(2).

Truong, Y., & Nagy, B. G. (2021). Nascent ventures' green initiatives and angel investor judgments of legitimacy and funding. *Small Business Economics*, *57*(4), 1801-1818. https://doi.org/10.1007/s11187-020-00373-5

Tunçalp, D., & Yıldırım, N. (2022). Sustainable Entrepreneurship: Mapping the Business Landscape for the Last 20 Years. *Sustainability*, *14*(7), 3864-3864. https://doi.org/10.3390/su14073864

Türck, S. (2022). *Kompass für nachhaltige Unternehmensgründungen. Ein Leitfaden unter Berücksichtigung ökologischer, sozialer, ökonomischer und kultureller Dimensionen* (BestMasters ed.). Springer Gabler.

Umair, S., Björklund, A., & Petersen, E. E. (2015). Social impact assessment of informal recycling of electronic ICT waste in Pakistan using UNEP SETAC guidelines. *Resources, Conservation and Recycling*, *95*, 46-57. https://doi.org/https://doi.org/10.1016/j.resconrec.2014.11.008

van Bommel, K., Rasche, A., & Spicer, A. (2023). From Values to Value: The Commensuration of Sustainability Reporting and the Crowding Out of Morality. *Organization and Environment*, *36*(1), 179-206. https://doi.org/10.1177/10860266221086617/SUPPL_FILE/SJ-PDF-1-OAE-10.1177_10860266221086617.PDF

Varco, C., & Marcandalli, A. (2020). The Materiality of Sustainability for Investors. In *Cambridge Associates*.

Vedula, S., Doblinger, C., Pacheco, D., York, J. G., Bacq, S., Russo, M. V., & Dean, T. J. (2022). Entrepreneurship for the Public Good: A Review, Critique, and Path Forward for Social and Environmental Entrepreneurship Research. *Academy of Management Annals*, *16*(1), 391-425. https://doi.org/https://doi.org/10.5465/annals.2019.0143

Venable, J., Pries-Heje, J., & Baskerville, R. (2012). A Comprehensive Framework for Evaluation in Design Science Research. In K. Peffers, M. Rothenberger, & B. Kuechler (Eds.), *Design Science Research in Information Systems. Advances in Theory and Practice. DESRIST 2012. Lecture Notes in Computer Science* (Vol. 7286, pp. 423-438). Springer. https://doi.org/https://doi.org/10.1007/978-3-642-29863-9_31

Venable, J., Pries-Heje, J., & Baskerville, R. (2016). FEDS: A Framework for Evaluation in Design Science Research. In *European Journal of Information Systems* (Vol. 25, pp. 77-89): Palgrave Macmillan Ltd.

Verrinder, N. B., Zwane, K., Nixon, D., & Vaca, S. (2018). Evaluative tools in impact investing: Three case studies on the use of theories of change. *African Evaluation Journal*, *6*(2). https://doi.org/10.4102/aej.v6i2.340

Vives, X. (1996). Social learning and herding. Social learning and rational expectations. *European Economic Review*, *40*, 589-601.

vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., & Cleven, A. (2009). Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. In *17th European Conference on Information Systems (ECIS)*.

Wakita, K., & Tsurumi, T. (2007). Finding Community Structure in Mega-scale Social Networks. *Computers and Society*, 9. https://doi.org/https://doi.org/10.48550/arXiv.cs/0702048

Wendt, K. (2021). Theory of Change: Defining the Research Agenda. In K. Wendt (Ed.), *Theories of Change: Change Leadership Tools, Models and Applications for Investing in Sustainable Development* (pp. 3-12). Springer International Publishing. https://doi.org/10.1007/978-3-030-52275-9_1

Wöhler, J., & Haase, E. (2022). Exploring investment processes between traditional venture capital investors and sustainable start-ups. *Journal of Cleaner Production*, *377*, 134318-134318. https://doi.org/10.1016/j.jclepro.2022.134318

Yang, S., Kher, R., & Newbert, S. L. (2020). What signals matter for social startups? It depends: The influence of gender role congruity on social impact accelerator selection decisions. *Journal of Business Venturing*, *35*(2). https://doi.org/10.1016/j.jbusvent.2019.03.001

Yıldız-Geyhan, E., Altun-Çiftçioğlu, G. A., & Kadırgan, M. A. N. (2017). Social life cycle assessment of different packaging waste collection system. *Resources*,

Conservation and Recycling, *124*, 1-12. https://doi.org/10.1016/j.resconrec.2017.04.003

Yıldızbaşı, A., Öztürk, C., Efendioğlu, D., & Bulkan, S. (2021). Assessing the social sustainable supply chain indicators using an integrated fuzzy multi-criteria decision-making methods: a case study of Turkey. *Environment, Development and Sustainability*, *23*(3), 4285-4320. https://doi.org/10.1007/s10668-020-00774-2

Yunus, M., Moingeon, B., & Lehmann-Ortega, L. (2010). Building social business models: Lessons from the grameen experience. *Long Range Planning*, *43*(2-3), 308-325. https://doi.org/10.1016/j.lrp.2009.12.005

Appendix

Declaration of Authorship

Eidesstattliche Versicherung

gemäß § 13 Abs. 2 Ziff. 3 der Promotionsordnung des Karlsruher Instituts für Technologie für die KIT-Fakultät für Wirtschaftswissenschaften

1. Bei der eingereichten Dissertation zu dem Thema Impact Investing for Startups handelt es sich um meine eigenständig erbrachte Leistung.

2. Ich habe nur die angegebenen Quellen und Hilfsmittel benutzt und mich keiner unzulässigen Hilfe Dritter bedient. Insbesondere habe ich wörtlich oder sinngemäß aus anderen Werken übernommene Inhalte als solche kenntlich gemacht.

3. Die Arbeit oder Teile davon habe ich bislang nicht an einer Hochschule des In- oder Auslands als Bestandteil einer Prüfungs- oder Qualifikationsleistung vorgelegt.

4. Die Richtigkeit der vorstehenden Erklärungen bestätige ich.

5. Die Bedeutung der eidesstattlichen Versicherung und die strafrechtlichen Folgen einer unrichtigen oder unvollständigen eidesstattlichen Versicherung sind mir bekannt. Ich versichere an Eides statt, dass ich nach bestem Wissen die reine Wahrheit erklärt und nichts verschwiegen habe.

Christin Eckerle

Appendix A

A.1 Process-Based Frameworks

Social Return on Investment (SROI): After the theory of change, one of the best-known process-based approaches is SROI, which is based on six principles. According to Nicholls and Cupitt (2012), the first principle is to identify and communicate to all stakeholders what is being measured and how it will be assessed in a social value report. The second principle is to understand how change is occurring through the organization's activities and how it can be assessed through the data collected, considering both positive and negative, intended and unintended change. According to the third principle, stakeholder values should be taken into account when deciding how to allocate resources between different options to ensure that the relative importance of different outcomes matches stakeholder preferences. According to the fourth principle, only material information and evidence should be included in the financial statements to provide a true and fair view so that stakeholders can draw reasonable conclusions about impacts. According to the fifth principle, it is important to claim only the value actually created by activities. According to the sixth principle, the analysis should be presented transparently to show stakeholders on what basis it can be considered accurate and honest. Finally, there should be appropriate independent verification of the results to ensure that they meet the highest standards. The SROI measurement process itself, according to Nicholls & Cupitt (2012), consists of the following six steps: The initial stage involves identifying all impacted stakeholders and examining how the organization affects their situation, both positively and negatively. The next step is to map the results of all sustainability dimensions for each stakeholder using the input-output-outcome-impact model. Stage 3 involves identifying financial proxies for each outcome indicator to quantify the social value in monetary terms. Stage 4 is to adjust the resulting outcome value to account for counterfactuals such as deadweight, attribution, displacement and drop-off to reveal the true impact. Step 5 is to determine a discount rate that allows the impact to be projected over a five-year period and the SROI ratio to be calculated. The final stage of the SROI process involves providing guidelines on how to report and utilize all the collected data. The resulting monetary values enable both internal and external benchmarking, making

it easier to compare the social value of different activities (Nicholls & Cupitt, 2012; Horne, 2019). The outcome of such a SROI process is a holistic understanding of the social, environmental, and economic outcomes and their significance to stakeholders in terms of value (Hall et al., 2015).

The advantage of the SROI approach is that it forms a structured decision-making process and a common language within an organization. The similarity to return on investment (ROI) can also help to gain the confidence of the private sector (So & Staskevicius, 2015). On the other side, one disadvantage of SRIO is that contextual information is often neglected, so that SROI leads to overly simplistic comparisons and conclusions based on an isolated SROI indicator with little meaning (Manetti, 2014; Nicholls et al., 2012; So & Staskevicius, 2015).

Lean Impact Measurement (LIM): Developed with the aim of addressing the unique needs of early-stage start-ups, the Lean Impact Measurement (LIM) tool incorporates elements from the SROI framework and the lean start-up approach, thereby reducing barriers and resource requirements (Horne, 2019). This adaptation is supposed to enable a more streamlined and efficient impact measurement process for these ventures. According to Horne (2019), LIM is divided as SROI into six steps, which are subdivided into 2 superordinate phases. The first superordinate phase is about impact identification. The second overriding phase is about impact substantiation, whereby the impact is concretized and calculated. The first step is therefore to outline business model hypotheses. Here the start-ups employ the business model canvas and the lean start-up approach to formulate their fundamental business assumptions. Secondly, key differences between own product and market solution are analyzed and verified in regards to impact. Thirdly, quantitative assumptions about the own impact are derived following the 80/20 rule. Fourthly, the sustainability hypothesis confirmation follows by collecting the relevant data of the last five years. Fifthly, the impact is calculated concretely for this time period and verified by making it public. Sixthly, an impact monetizing follows by selecting financial proxies for outcome indicators. (Horne, 2019).

However, similar to SROI, there are also some drawbacks to this approach. There is a risk of making false assumptions and hypotheses, making the measurement inaccurate. In

addition, there is the risk of missing data or insufficient data quality, so that measurement is not possible or only possible with enormous effort (Horne, 2019).

Social Balanced Scorecard: Most social and impact-oriented adaptation of corporate processes is based on the traditional Balanced Scorecard (BSC). The BSC was developed by Kaplan and Norton (1996) to link strategy development and implementation and to translate an organization's vision, mission and strategy into key performance indicators. The social adaptation for non-profit social enterprises differs from the traditional adaptation of the BSC regarding the elements and perspectives used. The basic assumption is that non-profit organizations do not put the financial perspective first, as this is not their main objective (Kaplan & Norton, 1996). Unlike private organizations, which are accountable for their financial performance, nonprofit organizations are accountable for their mission (Arena et al., 2015; Grieco, 2015). Therefore, the mission was placed at the top of the scorecard as it is closely linked to long-term goals (Kaplan, 2003). Although the social BSC provides a comprehensive understanding of the performance and measurement management of social enterprises, it does not adequately address the complexity arising from the hybridity of social enterprises. First, expanding the customer perspective does not cover all the necessary information for stakeholders. In addition, social enterprises tend to have a broader range of stakeholders, leading to a greater need for differentiation in information provision. At the same time, the BSC is a static framework and does not take into account the overall progress of the (social) enterprise during its life cycle. Finally, some recommended indicators are difficult to quantify (Arena et al., 2015). (Eckerle, 2025 (Forthcoming))

Social Impact Navigator: Another framework is the Social Impact Navigator from Phineo (Kurz & Kubek, 2016). The Social Impact Navigator is also structured in several phases with different steps. The overarching phases are planning, analyzing, and improving results. At first, the problem to be tackled and the associated target group are determined. Subsequently, SMART (specific, measurable, accepted, realistic, timed) goals are defined, and an impact model based on the theory of change is developed. Especially regarding the definition of the appropriate measurement indicators, the Social Impact Navigator provides a much more detailed guideline compared other frameworks. The framework recommend, to ensure ease of measurement, that both SMART and

multiple indicators be used for each component of the impact chain. Furthermore, the Social Impact Navigator includes detailed guidance on how to improve the previously assessed impact and recommends learning cycles. In addition, it provides support for impact reporting, making it a very detailed guideline. (Kurz & Kubek, 2016)

Overall, the Social Impact Navigator offers a very comprehensive set of guidelines that makes it easier for young companies to understand and establish impact measurement. However, it could be helpful to add a selection of standardized metrics and indicators to facilitate the application for the user.

The SIMPLE model (Social Impact for Local Economies): This model for impact assessment, developed by McLoughlin et al. (2009), evaluates impact in four dimensions (environmental, social, economic and financial) and comprises five steps. These five assessment steps are named: (1) scope it (2) map it (3) track it (4) tell it (5) embed it (McLoughlin, 2009). In the first step, the impact is conceptualized by identifying four central impact drivers: the mission, external, internal and stakeholder drivers. The mapping part aims identify and prioritize impacts as measurement targets. Thereby, the activities, outputs, outcomes and impacts from the triple bottom line are mapped along the impact chain. The "track it" stage is then about developing appropriate impact measures. This shall be achieved through the following intermediate steps: (i) determine the outcomes, impacts and impact dimensions to be evaluated (ii) designing appropriate impact indicators for data collection and (iii) developing and (iv) implementing a data collection strategy. The "tell it" phase is to report the impact. The final step, "embed it" aims to integrate the results of the process into the decision-making processes and culture of the organization. (McLoughlin, 2009)

The tool includes a feedback loop that enables the linkage of impact measurement, ongoing business planning, and strategic management processes and also facilitates its use for continuous improvement and maximization of desired positive impacts and minimization of negative impacts. To sum up, this tool also provides a good basic framework for impact measurement and includes guidance to some extent. However, there are no standardized metrics and indicators to measure impact.

A.2 Scorecard Frameworks

Impact Compass: One of the best-known scorecard approaches regarding impact measurement is the Impact Compass. According to Malhotra et al. (n.d.), this tool helps to conceptualize and assess the impact of organizations and start-ups. This approach is very broad and covers the following six dimensions: (1) Value to society, describing the resulting positive impact for society. (2) Efficacy, describes how certain a business activity is regarding the outcome of the provided solution. (3) Impact magnitude, which describes how complete a solution is for those who benefit from it. (4) Specification, how much of the affected community can be reached through this model. (5) Environmental, social, and governance, describe how responsible the intervention is, regarding ESG criteria. (6) Mission alignment, measures how results-oriented an organization is. (Malhotra et al., n.d.)

Manual for the Sustainability Assessment for Start-ups: The manual is structured in four dimensions: business context, startup team, business concept, products, and services. Each of these dimensions can be assessed using different categories and indicators, where each indicator can be rated from 1 to 4 (Trautwein & Fichter, 2018). The indicators for the business context are ‘the risk level of the start-up's business field’ and ‘the fit between the start-up's product/service and the sustainability goals of its partners or investors’. For the team dimensions, the indicators are ‘level of orientation towards sustainability’ and ‘level of sustainability experience or expertise’. Furthermore, the business concept section assesses to which extent the ‘sustainability goals’, ‘sustainability management’, and ‘stakeholder management and transparency’ are integrated into the business activities of the start-up. In the product and services dimension, the indicators ‘contribution to solving sustainability challenges’ and ‘integration of an impact management’ are assessed. (Trautwein & Fichter, 2018)

The framework makes it possible to consider a startup’s level of maturity and allows a quick assessment and deep evaluation. Thereby, the focus of the assessment is the qualitive analysis of the strengths and weaknesses in terms of sustainability impact. Apart from the qualitative assessment, there is the option for the calculation of an overall score, which allows the comparison between different startups or internal developments and

improvements. Since the manual is a self-assessment framework, the focus should be the internal assessment. (Trautwein & Fichter, 2018)

B Impact Assessment: A well-known process-based impact measurement tool is “B Impact Assessment”, which allows companies to be certified as a “BCorp” (Tabares, 2021). According to BLab, the organization behind the assessment, this comprehensive tool evaluates a company's social and environmental performance, assigning a score ranging from zero to 200 points. It allows companies to assess the impact of their operations on their employees, communities, and the environment. By benchmarking their performance against industry peers and striving for continuous improvement, companies can identify areas for growth and address any existing blind spots (Honeyman, 2024). However, companies must pay for the audit to get the assessment and ultimately be certified as a BCorp. The price is reduced for startups but still represents a significant hurdle.

A.3 Impact Measurement Template (V3)

Figure 24: Exemplary Instantiation - Impact Measurement Template (V3) (Own Illustration)

Input

Revenue from current year		in €
Revenue from year before		in €

Scope 1 / Scope 2 Greenhouse Gas Emissions in CO2-equiv. (current year)		in tons

Scope 1 / Scope 2 Greenhouse Gas Emissions in CO2-equiv. (year before)		in tons

CAGR Revenue Development	**Values**	
Number of Periods		
Initial Value		in €
Final Value		in €

Rate of Impact Investments	**Values**	
Amount of Impact Investments		in €
Amount of Invested Capital		in €

Diversity (in %)	**Values**
Number of people within the organization who feel that they belong to minority groups	
Number of women within the organization	
Number of employees	

Affected SDGs & related target(s)	**Description**
Description of how the activities of the Startup contribute to the targeted SDG(s). Provide a logic model of your intended process.	* see space below output table

Output

Dimension	**Score**
Scope 1 Greenhouse Gas Emissions in CO_2-equiv.	0
Revenue in Relation to Scope 1 Greenhouse Gas Emissions in CO_2-equiv.	0
Difference Greenhouse Gas Emissions in CO2-equiv. between current year and the year before	0
CAGR Revenue Development (in %)	=(FV/IV)^(1/Nr. ofPeriods)-1
Rate of Impact Investments (in %)	0,00%
Diversity I: Percentage of people within the organization who feel that they belong to minority groups (in %)	0,00%
Diversity II: Percentage of women within the company (in %)	0,00%

Logic Model	Affected SDG(s)
For (who or what is the beneficiary) **who/which currently face** (state the problem) **we intend to** (state potential positive impact) **by** (how do you plan to do this)	SDG xy; Target yz
…	…

Appendix B

Additional Clusters

Figure 25: Network Structures Applying CNM, Cluster 3 – 12 (Own Illustration)