Controlling for Sustainability and Innovation: Control Practices in Startup-Corporate Collaborations, Investment Decisions, and Integrated Sustainability Accounting as Pathways for Transformational Management

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List of Abbreviations

AESA	Absolute Environmental Sustainability Assessment
AVE	Average Variance Extracted
CBD	Convention on Biological Diversity
CEO	Chief Executive Officer
CFO	Chief Financial Officer
C-level	Chief level
CO_2	Carbon Dioxide
COP	Conference of Parties
COVID	Coronavirus Desease
CSRD	Corporate Sustainability Reporting Directive
CSDDD	Corporate Sustainability Due Diligence Directive
CTO	Chief Technology Officer
DACH region	Germany, Austria, Switzerland, Lichtenstein
DAX	Deutscher Aktien Index (Stock Exchange representing 40 of the top German companies by revenue)
EC	European Commission
ECB	European Central Bank
EFRAG	European Financial Reporting Advisory Group
E-GAAP	Environment - Generally Accepted Accounting Principles
EIOPA	European Insurance and Occupational Protection Authority
ESG	Environment, Social, Governance
ESRS	European Sustainability Reporting Standards
EU	European Union
EXIOBASE	Environm. Extended Supply-Use and Input-Output Database
FIRE sectors	Finance, Insurance, and Real Estate
FLEGT	Forest Law Enforcement, Governance and Trade
GDP	Gross Domestic Product
GBF	Kunming-Montreal Global Biodiversity Framework
GRI	Global Reporting Initiative
GRI SRS	Global Reporting Initiative Sustainability Reporting Standards
IASB	International Accounting Standards Board

IFRS	International Financial Reporting Standards Foundation
IIRC	International Integrated Reporting Council
INCA	Integrated System of Ecosystem Accounts for the EU
IPCC	International Panel on Climate Change
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IR Framework	Integrated Reporting Framework
ISA	Integrated Sustainability Accounting
ISSB	International Sustainability Standards Board
IUCN	International Union for Conservation of Nature
KCWS	Knowledge Cities World Summit
LOC Framework	Levers of Control Framework
NCAVES	Natural Capital Accounting and Valuation of Ecosystem Services Project
PLS	Partial Least Squares
QDA	Qualitative Data Analysis
R&D	Research and Development
SASB	Sustainability Accounting Standards Board
SEM	Structural Equation Modelling
SFDR	Sustainable Finance Disclosure Regulation
SME	Small and Medium Enterprises
SNA	System of National Accounts
TFEU	Treaty on the Functioning of the European Union
TNFD	Taskforce on Nature-related Financial Disclosures
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UN-SEEA	United Nations System of Environmental-Economic Accounting
VRF	Value Reporting Foundation
WEF	World Economic Forum
WBCSD	World Business Council for Sustainable Development

A. Research framework

1. Motivation

The integration of sustainability considerations into business practices represents a critical leverage point for dealing with some of the most significant ecological and social challenges of our time: climate change, environmental degradation, social injustice, and an increasing lack of motivation among employees, if the company does not pursue the appropriate values.

The recent reports of the International Panel on Climate Change (IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) vehemently stress the importance of rapid responses to ecological crises. In their Summary for Policymakers (IPCC 2023), the authors underline the need for changing behavior on the part of governments, civil society, and the private sector, in order to face a "rapidly closing window of opportunity to secure a livable and sustainable future for all" (p. 25).

In terms of the social aspects of sustainability, the Sustainable Development Goals pave the ground for considering business impacts, both positive and negative, on people. Concerning the social aspect of sustainability, the quality of a company's relationships and engagement with its stakeholders is critical. Therefore, a transformation of the private sector towards a life-serving economy is indispensable.

Considering the governmental aspects of sustainability, transparency issues or efforts to promote diversity within the executive board and in the workforce are taken place. Oftentimes, these are based on social pressure and regulatory framework conditions like the German Act on Corporate Due Diligence Obligations in Supply Chains as well as other legal and disclosure requirements.

The new report to the Club of Rome (2022), which analyzes ecological and social threats, concludes that the challenges can be met, but only if the right paths are followed. Until now, economists dealing with sustainability as a research topic have been criticized for not effectively contributing to sustainable development and for having a limited impact on managerial practice (Meuer *et al.* 2020). Nevertheless, authors like Starik and Kanashiro (2013) recognize that even though businesses have their limits in addressing many of the above-mentioned challenges or potential to halt or reverse them, "the management profession, including business academics, appears to have the opportunity, even the responsibility, to play significant roles in examining and addressing many of these challenges" (p. 10). This situation may be one of the

reasons why, in the contemporary business landscape, company positioning towards innovation and sustainability is shaping the fabric of success more than ever before.

As organizations navigate the intricate web of goals and objectives, it becomes evident that effective management controls serve as the compass guiding them toward desired outcomes. Whether the aim is sustainability or innovation (or even sustainability innovations), management control constitutes a fundamental element of any business activity and supports strategy implementation and execution (Merchant and Van der Stede 2017; Sitkin et al. 2010, Otley 1994). Organizations rely on a wide range of management control techniques to support decision-making and guide employee behavior (e.g. Merchant and Otley 2007; Collier 2005; Fisher 1998; Abernethy and Chua 1996). Answering the overall research question of how management control and accounting needs to be shaped to foster business decisions in line with ecological and social values, the dissertation follows the research call of Orecchini *et al.* (2012) for business academics to play a substantial role basing research around the sustainability challenges of our time.

This dissertation aims at contributing to a more profound understanding of the effects associated with management control effectiveness in general, but also with certain distinct management control and accounting approaches for integrating sustainability into decision-making and innovation processes.

To understand the subtle interplay between management processes and tangible results, this dissertation delves into the realm of startup-corporate collaborations for innovation and takes a closer look at investment decisions. The work underlines the transformative potential of the right management configurations, especially within the contexts of innovation (Study 1) and, more pointedly, sustainability innovations (Study 2). Extending the view to the realm of investment decisions (Study 3), we dissect how the intricacies of management controls for sustainability influence the strategic choices that underpin financial endeavors.

In addition to the first three studies which focus on management control, Study 4 identifies shortcomings and opportunities for change, so as to consider the context of sustainability accounting. Different constellations of stakeholders might catalyze change in regulations and business practices. In Study 4, the dissertation casts a discerning eye on desirable constellations and the confluence of accounting setups, reporting mechanisms, and stakeholder dynamics, revealing constellations of these for ushering in a new era of sustainable decision-making, were ecological and social aspects are considered.

In this respect again, the results contribute to the overall research question of how the private sector can contribute effectively to sustainable development by better integrating

sustainability considerations into business practices. Study 4 examines so-called level-four theorizing by linking solutions to multi-contextual problems and promotes an inter- and transdisciplinary understanding of the need for integrated sustainability accounting. To do so, it provides an overview of the development of concepts and complex relations between actors in the field of sustainability accounting standards and offers a prospective analysis of the desired development of integrated sustainability accounting.

For the first two studies, the research setting is an interorganizational one, where the collaboration between young and established companies toward innovation success is defined as a setting for analyzing control mechanisms. We investigate the general relevance of collaborations for innovation success, as well as the practical relevance to studying the circumstances in which young companies interact with established ones. Here, we identify a scientific research gap as well as a knowledge gap hindering practical implementation. Apart from adding knowledge to literature streams in management control, the following research is based on the subject area of entrepreneurship. This is the case because strategic orientation is an element of any entrepreneurial lifecycle, including strategy development on how challenges like the need for sustainability considerations may be integrated into the respective business practices. New insights are generated regarding how management control and entrepreneurship interact.

While none of the traditional management theories seem to adequately reflect the essence of sustainability challenges (Starik and Kanashiro 2013), there is further a lack of shared theoretical assumptions on the general concept of sustainability in business practices (Meuer *et al.* 2020; Salas-Zapata *et al.* 2016). Accordingly, this dissertation adds to the scientific discourse by identifying the role of management control practices, for incorporating sustainability considerations into business activities, based on theoretical management frameworks.

Building on comprehensive reviews of the relevant literature and rigorous empirical analyses, partly quantitatively (Studies 1 and 2) and partly qualitatively (Studies 2, 3 and 4), the dissertation yields valuable implications for theory and practice, and provides novel insights into the diverse effects of management control mechanisms for (sustainability) innovation success, for the role of management control in considering sustainability in investment decisions, and for further sustainability considerations in management accounting practices.

Several frameworks exist that can guide the analysis of control contexts. In this dissertation, Studies 1 and 2 extend the use of the object-of-control framework, a term coined by Merchant and Van der Stede (2017), and Study 3 extends the use of Simons' (1994; 1995) levers-of-control framework. Both of these frameworks represent a holistic view of distinct control approaches which has been called for by Ferreira and Otley (2009), Epstein (2008),

Malmi and Brown (2008), as well as Sandelin (2008), to reduce the risk of model underspecifications, in order to prevent the emergence of spurious findings that might overstate the relevance of a particular control approach. Respectively, the overarching effectiveness of control systems has been analyzed in Studies 1 and 2. Goebel and Weißenberger (2017a), for example, elaborate on the relevance of informal management controls, for the consideration of sustainability in business practices as well. Study 1 identifies distinctions between the types of informal management controls (personnel and cultural) as well as of formal management controls (results and action), which enriches our understanding of differences related to the different types of management control. Study 3, in which decision-making according to Simons' (1994; 1995) typology of belief systems, boundary systems, interactive controls, and diagnostic controls were analyzed, finds a predominance of the relevance of belief systems and interactive controls for the successful integration of sustainability into decision making. We lastly enrich, from a much broader perspective, the management accounting and control literature by presenting an interdisciplinary identified target constellation, as well as a draft of desirable criteria for a corporate integrated sustainability accounting. Both may be used as a basis for further discussion and investigation.

Through theoretical exploration and empirical inquiry, this dissertation endeavors to carve a path toward a future in which management control and accounting research and practices not only reflect the objectives of today, but also shape the sustainable successes of tomorrow.

2. Outline and research background

This dissertation consists of the four mentioned distinct studies, each of which is a stand-alone research endeavor that has its specific question to answer, a theoretical perspective, data set, and contribution. What they have in common is contributing to the debate on how sustainability can best be incorporated into future business practices. The consideration of sustainability in decision-making is not tied to certain types of businesses or certain sectors. The studies thus take a closer look at young and established enterprises in all industries. Within a business, sustainability can further be considered in terms of different business functions. This dissertation demonstrates the integration of sustainability considerations into management controls related to innovation processes, investment decisions, and the context of management accounting.

The studies within the present dissertation contribute to four different literature streams that are concerned with (1) management control focusing on integrating sustainability considerations when striving for innovation success (2) interorganizational management with a focus

on the collaboration between established and young companies, (3) management control in the context of transformational management, as well as (4) sustainability accounting.

Especially Studies 1 and 2 contribute to the research stream on management control for innovation success, by examining the role of different types of controls, and management system control effectiveness in general. They further add value to the literature stream of interorganizational management and more detail on control practices in corporate-startup collaborations. Study 3 provides insights into management control in transformational management settings, and Study 4 elaborates on what might constitute a valuable extension of research on sustainability accounting.

Describing the literature stream on management control, Speklé and Kruis, in their literature review from 2014, underline the heterogeneity of theories, methods, and topics. Management control has been defined as "the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (Anthony 1965, p.17). Following this definition, management control supports strategy implementation and execution (Merchant and Van der Stede 2017) and represents a core management function (Merchant 1985). Understanding how various management control mechanisms affect decision-making in organizations is therefore of paramount importance to effectively implement objectives (Flamholtz *et al.* 1985), the integration of sustainability into business practices being one of them. Previously, most research studies only address a limited subset of control mechanisms at the expense of more comprehensive control approaches. Otley (2001), for example, stresses that extant management accounting research "has concentrated too much on accounting and not enough on management" (p. 243). Lately, several conceptual frameworks propose incorporating a more comprehensive management control perspective (e.g. Merchant and Van der Stede 2017; Ferreira and Otley 2009; Malmi and Brown 2008; Simons 1995b). Considerable attention is devoted to the object-of-control framework (Merchant and Van der Stede 2017; Merchant 1985). This approach differentiates between formal (results and action controls) and more informal control mechanisms (personnel and cultural controls). For this dissertation, the object-of-control framework is used as the main conceptual typology. Using this framework, we rely on well-established constructs for each type of management control in our survey development for quantitative evaluation. As a basis for Study 3, however, we capitalize on the Levers of Control (LOC) framework introduced by Simons (1994, 1995b). A number of qualitative studies extend the application of the framework to broader organizational issues such as sustainability (Martyn *et al.* 2016) and we recognize a better fit of this framework in the research context of investment decisions, with a focus on

transformational management. Especially interactive control systems and controls from the area of belief systems would stimulate organizational learning and the emergence of new ideas and strategies, as well as creating inspirational forces, as Simons (1995) states it, which are characteristics well in line with transformational management. Furthermore, the LOC framework is used more extensively in qualitative studies, like our Study 3, compared to quantitative studies (Martyn *et al.* 2016).

According to Otley (1999), management control has long been almost exclusively associated with accounting-based information systems and become disconnected from strategic planning and operational management. While he argues that this focus is too narrow and proposes more emphasis on the *management* of performance than on the *measurement* of performance, some research projects have lately followed this route. There is, for example, the work of Goebel and Weißenberger (2016; 2017a; 2017b), which, in all of the cited studies, focus on the management of performance and emphasize the importance of informal controls. Furthermore, they subsume the impact of different types of management controls under the construct of management system control effectiveness, which serves as a conceptual basis for the present work. In 2019, Oro *et al.* analyze the interface between management control, strategy, and performance in family businesses. Making use of Simons' LOC framework, they find that family values take form in the belief systems that shape the use of management controls. On this basis dealing with the same framework as in Study 3 of this dissertation, a concentration on values such as sustainability further develops the literature strand. Feder and Weißenberger (2019), who focus on corporate social responsibility, which is significantly related to sustainability management (Sharma and Khanna 2014), elaborate suggestions for designing effective management control systems as a basis for long-term behavior in line with corporate goals and strategic objectives. Their findings concerning the relevance of attitude and managers' intentions are in line with and complemented by our findings in Study 3. Here, understanding behavior is crucial to determining the extent of possible management control problems that might be targeted by appropriate management controls. A recent publication by Gomez-Conde *et al*. (2021), focuses on management control systems and innovation, which is the topic of the studies 1 and 2 of this dissertation. However, Gomez-Conde *et al.* (2021) study management control in startups, whereas our focus is on interorganizational management. We describe the related research strand in more detail below.

As described before, sustainability considerations include environmental, social and governmental aspects. The empirical research of the work herein concentrates on environmental aspects because these are currently particularly pressing, virulent issues in companies and in

social discourse. Regarding the strategic goal of sustainability, Guenther *et al.* in 2016 described the management control literature as beginning to address the issue of environmental responsibility, and the topic of environmental or sustainability management controls as "[…] gaining momentum" (p. 148). The terms used in this context are 'environmental management control systems' (Pondeville *et al.* 2013), 'eco-control' (Henri and Journeault 2010), 'sustainability control systems' (Gond *et al.* 2012), or 'socially responsible management control system' (Durden 2008). All of these stand for the integration of environmental issues into organizational strategy (Guenther *et al.* 2016). Management control in the context of sustainability management can play a role in many different business areas, starting from strategy considerations and extending to reporting practices. While striving for competitive advantages may be a motivation for including sustainability in corporate strategies, there is also motivation to avert negative implications if not considering sustainability sufficiently. In this context, Hahn *et al.* (2019) show, for example, that legitimation strategies in the wake of negative incentives are crucial for the behavior of external investors and that only substantial legitimation strategies have investment-relevant effects. Considering the strategic relevance of sustainability-related control practices, we identify a clear research gap, because research so far has concentrated mostly on the influence of management control on environmental and financial performance (Henri and Journeault 2010). Sustainability management control which concentrates solely on these two aspects and without interlinkages to management control in general, and to the strategic orientation of an organization, lacks potential to holistically integrate sustainability considerations into business practices. Accordingly, this is an objective of the present dissertation, which was introduced by Gond *et al.* (2012) who call it "the integration challenge" (p. 208).

Apart from the focus on management control in this dissertation, we also contribute to the strand of research on the interorganizational context of managing (sustainability) with a focus on the collaboration between established and young companies. Especially in seeking innovation success, companies have been looking for collaborative business activities for a long time (Alter and Hage 1993). Lately, the collaboration between established companies and startups has become common practice and with growing relevance (Dörner *et al.* 2020), which promises to enhance especially the innovation performance of established firms (Groote and Backmann 2020). Even though most larger, established companies are indeed implementing startup collaborations, there has long been little scientific evidence related to these collaborations (Das and He 2006). Until today there seems to be a paucity of research on evaluating corporate-startup collaborations (Steiber *et al.* 2021). With our research, we contribute to the strategic entrepreneurship and collaborative innovation literature by showing that the joint

action between established firms and startups can lead in general to innovation success (Study 1) and specifically also to sustainability innovation success (Study 2). Beyond merely showing the relationship between collaboration and innovation success, this dissertation also provides insights into the effect of management control practices in interorganizational management contexts. Most studies tend to describe external factors as relevant for successful collaboration, and not management control aspects that characterize how the collaboration is governed (Groote and Backmann 2020). In 2021, Caglio and Ditillo call for research on management controls for collaboration between firms aiming at innovation, which is exactly the call this dissertation has follows with studies 1 and 2.

The third literature stream of this dissertation is about management control in the context of transformational management. For the elaboration of a Transformation Management Compass in Study 3, the concept of transformational leadership (or management), originally proposed by Burns (1978), plays a central role. It was further extended by Bass (1999), who differentiates it from transactional leadership. Transformational managers (or leaders) recognize and support initiatives that have the potential to add value to the organization. They are visionary and look towards the future of the company and the larger ecosystem in which it operates. Transformational management, as well as transactional management, can benefit from the use of management controls, but are likely to use them differently. While for transactional management, the aim of management control is to manage more efficiently and effectively, transformational management can be thought of as using management controls for guiding the organization towards a common vision with the aim of adding value to the firm beyond its status quo. Most relevant to the dissertation is the relationship between management control and transformational management of an organization which has, to the best of our knowledge, not been researched in this manner before. Crutzen and Herzig (2013) argue that responding to sustainability requires strategic renewal and extensive organizational learning and change. Rodrigue *et al.* (2013) and Johnstone (2019) underline that companies often fail to enable an effective dialogue between strategic and operating levels, which would ensure the integration of sustainability into decision-making on all levels. Describing the "crossroads" of management accounting for carbon and management control, Cuckston (2013) published a case study in which he narrows down the topic of biodiversity conservation in the context and financial accounting. Pondeville *et al.* (2013) focus on decision-making when examining environmental control systems and the role of contextual and strategic factors. Recently, Taïbi *et al.* (2020) use intervention research to describe accounting mechanisms for strong sustainability. When considering investment decisions, as in Study 3 of this dissertation, Epstein *et al.* (2010) published a relevant

paper describing the challenge of integrating sustainability into operational and capital investment decision-making. Very close to the concept of transformational management is the work of Schaltegger *et al.* (2012) who distinguish, on the one hand, between managers who have a mindset, which integrates financial, social, and environmental aspects, and rather operational managers, on the other hand, which strive to improve profitability by making incremental sustainability-related improvements to products and processes. In 2020, Siegrist *et al.* developed a conceptual framework embedding environment and sustainability into corporate financial decision-making. In this context, Beusch *et al.* (2022) provide evidence that dialogue between managers with different mindsets may hamper subordinating sustainability to financial concerns. The ground for the aforementioned work was paved by Sharma and Jaiswal (2018), who examine the circumstances in which dialogue mitigates the marginalization of sustainability initiatives. In Study 3 of this dissertation, we approach the aforementioned research gap by examining in detail which types of management controls may influence the integration of sustainability into decision-making and head toward transformational management.

The final topic of this dissertation refers to management accounting for innovation and sustainability. In addition to the content-related requirements for an effective accounting system, it needs to provide information for management and decision-making, instead of solely serving as a means of documenting and reporting. Gray *et al.* (1993, p. 56) state that "a sustainable organization leaves the biosphere at the end of the accounting period no worse off than it was at the beginning". At the time of Gray *et al.*'s publication in 1993, though, sustainability accounting was neither part of corporate practice nor part of the academic field of accounting (p.9). Rather, it serves to open up a space for new, mediating representations between "conventional" accounting literature / practice and "alternative" critiques / theories. It thus represents a gap in the academic literature for discussion and mutual learning. Lately, regulation for sustainability accounting has been growing and developed into a complex regulatory setup, but with a lack of stringent and comparable format, as well as a lack of academic research on how such a format might evolve. When sustainability aspects are included consistently and decision-making is supported, the conditions for an *integrated* accounting approach are met. Based on Bebbington and Larrinaga's (2014) analysis of the interaction between accounting, nature, and society, doing business should be in line with the needs of future generations, and long-term economic success relies on a well-functioning Integrated Sustainability Accounting (ISA)[1]. For a long time, information gathering and sharing have been mainly motivated by the need to

[1] The corporate ISA we are referring to in the present research is not to be confused with the International Standards on Auditing, also called ISA for short.

satisfy stakeholders, and for the publicity-oriented creation of an image as a responsible firm (Bebbington and Larrinaga 2014). Adams and Larrinaga (2019) aim at improving sustainability accounting and performance to inform practice and policy developments in parallel, because of "a lack of cross-fertilization of research on social and environmental issues across accounting, management, and policy journals" (Adams and Larrinaga 2019, p. 2368). As an example, the accounting literature on motivation for corporate social responsibility disclosure is disconnected from the management literature on motivations for corporate social responsibility (Gray *et al.* 2014, p. 37). Study 4 of the dissertation thus tackles this and the even greater connection gap between the academic disciplines of economics, political sciences, and natural sciences. Several publications describe the deficiencies of conventional accounting (Gray 1992; Mathews 1997; Schaltegger and Burritt 2000), as well as the limits of the underlying philosophy of accounting, which focuses on monetary, quantitative measures of corporate economic activities (Maunders and Burritt 1991; Lehman 1999; Mathews 2001). With Spence *et al.* (2010), objectives beyond the external accountability focus are considered. Schaltegger and Burritt (2000) popularly theorize sustainability accounting as a strategy and management tool for which they identify a lack of methodological maturity in accounting standards as well as common management practices. In 2010, Burritt and Schaltegger distinguish between two streams of research, both solely from a microeconomic perspective: the managerial and the critical path of sustainability accounting literature and practice. The managerial path emphasizes the use of sustainability accounting to support corporate decision-making (Burritt *et al.* 2002), while the critical path follows the assumption that sustainability accounting is of little use for tackling sustainability problems (e.g.: Gray and Milne 2002). Furthermore, the intergenerational perspective of sustainability, which is quite relevant in practice, seems so far to have been rather unexplored academically (Guenther *et al.* 2016). This dissertation also responds to the research calls of Cooper and Coulson (2014), Malsch *et al.* (2011), and Neu *et al.* (2001) who request researchers to engage in current social and ecological struggles by identifying alternative social arrangements. The aim of our research is not only the extension of existing accounting standards to include ecological (and social) aspects, but also, in line with Soll (2014), to create a starting point for the negotiation of these issues across society.

3. Research methods

The dissertation chooses a holistic approach that is characterized by applying a variety of methods. Oftentimes research in the field of business administration is handling complex interrelationships. Sustainability considerations and management control in business practices are ideal

examples of such complexity. While sustainability is such a multifaceted topic, firstly because it comprises an environmental, social, and governmental perspective, the integration of sustainability aspects into the corporate context affects very different areas of business. Management control as well is interrelated with different areas of business practice, and so different methods have proved their worth in this field of research. Publications in this research field are either conceptual or empirical and are then further divided into quantitative and qualitative research. This dissertation makes use of all the methodological approaches mentioned to allow for as many perspectives as possible on the overall research question and enable various points of contact for the further development of the research results.

3.1. Quantitative empirical research approach: survey data analyzed by structural equation modeling

With the survey method (applied in studies 1 and 2), we empirically investigate the relationship between an innovation strategy and innovation success, as well as the effects of an interorganizational management context. To be more precise, we analyze the collaboration of established companies and startups. Here, we apply different types of management control and the overarching concept of management control system effectiveness. While the former described the research setting of Study 1of this dissertation, Study 2 shares the general setup but focuses on analyzing the relationships between sustainability innovation strategy and sustainability innovation success. Here, we examine the role of sustainability management controls.

The survey method, more specifically the questionnaire-based type of survey research, is a widely used method within empirical research in management accounting and control (Hoque 2006; Speklé and Widener 2018; Young 1996). Most surveys, like ours, are based on self-reported data collected from individuals who are the most appropriate source of information relevant to the phenomenon being studied (Hoque 2006; Speklé and Widener 2018; Van der Stede *et al.* 2005). Making use of a structured questionnaire, we were able to maintain the necessary degree of standardization that allows statistical analysis (Speklé and Widener 2018). We followed the recommendations from Dillmann *et al.* (2009) and Van der Stede *et al.* (2005) when conceptualizing and designing the questionnaire. For studies 1 and 2 we rely on the same questionnaire. However, when calculating the two different research models of the study, we use different items for analysis.

Variables of our research model are measured as latent variables with multiple indicators. Most of the variables derived from existing literature and were considered acceptable when they had consistently shown sufficient levels of reliability and validity. The wording has been

slightly adjusted in some cases and for several variables, we changed the context from an intraorganizational context to an interorganizational one.

We analyze our survey data based on structural equation modeling (SEM). SEM is a useful methodology for analyzing survey data due to its ability to handle complex relationships and multiple variables (Weijters 2021). Specifically, we apply the method of partial least squares SEM (PLS-SEM) for our analysis and calculation. Different from covariance-based SEM, PLS-SEM is a variance-based approach generally used for the explorative identification of relationships (Hair *et al.* 2017, p. 2). We decide on this approach because the PLS technique constitutes a non-parametric approach, which means that it does not rely on normally distributed data (Henseler *et al.* 2009). Moreover, it is less restrictive in terms of necessary sample size requirements and allows for the analysis of rather complex research models (Hair *et al.* 2011) Further, it is also preferred in research areas with less comprehensive theoretical foundations (Reinartz *et al.* 2009) which has long been a pervasive characteristic of researching management control systems (Malmi and Brown 2008; Sandelin 2008). Using SEM as a 'second generation of multivariate analysis' (Fornell 1987) has further been proposed to overcome more traditional statistical analysis techniques due to its advanced features and is considered "tailor-made for management accounting research" by Smith and Langfield-Smith (2004, p. 76).

Evaluation and interpretation of results follow a two-stage approach suggested by Hulland (1999). More specifically, this means assessing the reliability and validity of our measurement models before complementing these analyses with an evaluation of the structural model.

3.2. Qualitative empirical research approaches: inductive concept development, analytic induction, and constellation analysis

Studies 2, 3 and 4 of this dissertation apply a qualitative empirical research approach. For Study 2 this approach complements the methodological access described in the former chapter, which means that Study 2 is characterized by a mixed-method approach. Apart from the aforementioned quantitative analyses, for Study 2 we additionally analyze information from qualitative interviews by using the methodology of inductive concept development by Gioia *et al.* (2013). We did so to exploratively enrich our understanding of what might further our quantitatively achieved findings to influence innovation success as a result of collaboration with startups and which role management control might play in this context. We conducted the interviews with 16 randomly chosen managers out of our sample, which ensured us to talk to key informants in the context of management control in startup collaborations. We considered our interview partners as their organizations' "knowledgeable agents" (Gioia *et al.* 2013, p. 17). When coding

our transcripted interviews, we went through a 1st-order analysis of our data (i.e. using informant-centric terms and codes) and a 2nd-order analysis (i.e. using researcher-centric concepts, themes, and dimensions after Van Maanen 1979) to finally come up with additional success factors that were not included in our research model and that complement our findings of the quantitative analysis. We analyze our data according to this approach, which Gioia *et al.* (2013) describe as tandem reporting of informant and researcher and which helps readers to see the rigor of our qualitative concept development (Tracy 2010; Pratt 2008), by using the coding software MaxQDA. Our findings from this research step help us better understand the relations between the constructs of our research model and the mechanisms of how strategy, collaborations, management controls, and success are connected. They further help refine what we identify as effective management controls highlighting certain interorganizational success factors to be especially relevant.

In Study 3 we used the research approach of analytical induction (Robinson 1951; Znaniecki 1934, p. 249) to learn about the practical expression of management controls in the context of considering sustainability in investment decisions. We capitalize on the paradigm of analytic induction because we aim at analyzing our data with a tentative definition of a phenomenon or initial framework based on preexisting knowledge of theory. Here, our research is guided by previous knowledge of theory from the field of management control and transformational management, together comprising the theoretic scaffolding of the study (Wener and Woodgate 2013). More specifically, Simons' (1995) LOC framework guides our research. Interviews were conducted and analyzed iteratively, beginning with an initial set of questions, and following the principle of the hermeneutic circle, to refute, support, or further develop the initial framework. Here as well, we use the coding software MaxQDA. We categorized our data in thematic codes along the lines of the initial theoretical framework. That is, we first pull together essential quotes relevant to the four main components of management control theory, as well as for transactional and transformational management, each as they relate to (sustainability) accounting and decision-making in the organizations under observation. Finally, we use these factors and our uncovered interactions between them to derive the framework of a Transformation Management Compass.

Our qualitative data derives from 17 semi-structured interviews that are well-suited to gain a better understanding of how management control is influencing investment decisions. With this, we are able to identify hurdles and promising ways forward to better integrate sustainability into decision-making. To form our sample for Study 3, we identify decision-makers

with authoritative decision-making positions in companies with headquarters in a German-speaking country. While beginning with an initial key informant sampling from our professional networks (Deaux and Callaghan 1985), we then expand our reach to increase the breadth of our sample, as demonstrated by Homburg *et al.* (2012) to ensure both the validity and acceptable reliability of key informants. Having a sample of managers at different levels and in different functions allows for a robust examination of our research question. Including the perspective of different hierarchical levels is relevant because changes in control practices may take place through a top-down process or a bottom-up process. An example of a bottom-up approach would be a situation wherein individual change agents, committed to sustainability, influence control systems design through having dialogues with strategic-level managers (Johnstone 2019). In addition to the aforementioned interviewees that talk about their experiences of decision-making in their respective companies, to gain a bird's eye view, we also speak to a few experts with a broader perspective on business activities like a representative of an institute developing methodologies for sustainability accounting, a university professor, specializing in the field of general controlling and accounting, and a business lawyer with an international background and experiences of being a partner in one of the largest corporate law firms worldwide.

During the interviewing process, as suggested for qualitative research processes (Phillippi and Lauderdale 2018), we took field notes. These serve to reflect observations and thoughts arising during the conservations. These notes were consulted continuously during the period of interviewing to identify aspects that might have been neglected in the initial phase of the research or that (until this point) appeared to be of greater importance than initially expected. Such secondary analysis was qualitatively documented again using notes. By using this procedure, we follow the well-cited work of Burritt *et al.* (2011) in the accounting context and others.

Study 4 of the dissertation herein comprises a conceptual assessment of socio-technical systems influencing the potential introduction of integrated sustainability accounting. Our basic approach is subsumed under the distinct, yet legitime, research paradigm of design science, which Simon (1996) characterized as "the science of the artificial". Mainstreaming recognition of design science occurred with the Hevner et al. (2004) publication. Design sciences capitalizes on design theory as one of the five types of theories in Gegor's (2006) taxonomy. Different from the other types of theory in Gregor's taxonomy, design theory can be considered prescriptive instead of descriptive knowledge, which means that this type of theory gives prescriptions for design and action, which means it shows how something is done. Relevant for our work of

analyzing sustainability accounting systems is the underlying justification knowledge which includes informal knowledge from the field and experience of practitioners (Kuechler and Vaishnavi 2008). Hevner describes its contribution quite simply by the following statement: "Design-science research addresses important unsolved problems in unique or innovative ways or solved problems in more effective or efficient ways" (Hevner et al. 2004, p. 81). More efficient ways in our context mean that ecological, social, and governmental aspects are integrated better in accounting practices.

To describe possible pathways in a more specific way and due to the interdisciplinary nature of our research question, we decide to make use of the methodological framework of constellation analysis. This approach was coined by Schoen *et al.* (2014). Constellation analysis aims at understanding shifts in socio-technical systems by describing constellations based on their heterogeneous factors of influence and their impacts as well as their relationships with each other (Ohlhorst and Schoen 2015). Here, we describe phenomena of social change by outlining and analyzing current and targeted constellations. Typical for using this methodological approach, the analysis of the research herein is twofold: retrospective and prospective. With a *retrospective* analysis perspective, we examine the interplay of different factors of influence, reconstructing how constellations have changed. Constellation analysis derives from the context of innovation research which is in line with our understanding of an ISA as an innovation, a "new normality" (Rammert 2010, p. 34) with new rules that, though still in the making, increasingly prove to be a guiding solution to the current problems and obstacles of the transformation to a sustainable economy. Constellation analysis was chosen as a methodological approach that can help to outline the elements, relations, and functional conditions necessary for the desired outcome.

We identify which complementary developments (social, economic, scientific, etc.) benefited, supported, or enabled the perception that there is a need for an effective sustainability accounting. With a *prospective* analysis perspective, on the other hand, we focus on the state of sustainability accounting, which is desirable, knowing that it is still in the midst of a formation process, which is considered a "niche" by Ohlhorst and Schoen (2015, p.260), or which has not yet been established.

We visualize various elements like actors or concepts and their interaction within specific constellations. This graphical mapping, first capturing the field in all its complexity, is used as a basis for gradually reducing the data through interdisciplinary discussions to the essential elements and relations. Constellation analysis was also chosen because it allows for bringing together insights from different disciplines, in particular natural sciences, and

management sciences (which in many aspects have fundamental differences in their scientific methods and their scientific culture and tradition), that would usually tend to hierarchize factors through their scientific lenses and would be less open to recognizing factors foreign to their disciplines as well as their reciprocal cross-disciplinary influences and interdependencies. Contrarily, a fundamental assumption of constellation analysis is the importance of a balanced view between the so-called "empirical societal objects of investigation" (Ohlhorst and Schoen 2015, p. 259). For the context of the research at hand, this means balancing concepts that are currently applied in the business context with scientific fundamentals like, for example, planetary boundaries.

4. Overview of studies

While all the four Studies of the dissertation herein are based on the motivation described above, their contributions to the scientific discussion as well as their practical implications can be well distinguished from each other. Table A.1 provides key information on each study, specifically each study's title, authors, research methodology, information about where the research has been presented, how the state of publication is, and which contributions are made. In the following chapters, each study will be described in more detail.

Table A.1: Overview of the four studies constituting the dissertation

No. of Study	Study 1	Study 2	Study 3	Study 4
Title	How to Make the Honeymoon Last: Effectiveness of different types of Management Controls for Innovation Success in Corporate-Startup Collaborations	Good Intentions Do Not Change the World: The Role of Sustainability Management Control for Startup Collaborations in the Relationship between Strategy and Innovation	Re-Examining Control Systems for Integrating Sustainability into Corporate Investment Decisions: Derivation of a Transformation Management Compass	Striving towards an Integrated Sustainability Accounting: A Constellation Analysis Based on Interdisciplinary Knowledge Sharing
Authors	Anna Katharina Meyer, Vincent Goettel, Barbara E. Weißenberger	Anna Katharina Meyer, Vincent Goettel, Barbara E. Weißenberger	Anna Katharina Meyer, Andrew Isaak, Barbara E. Weißenberger	Anna Katharina Meyer, Hannes Matt, J. Daniel Dahm
Research Methodology	▪ Survey ▪ Structural equation modeling	▪ Survey and semi-structured questionnaire ▪ Structural equation modeling and inductive concept development	▪ Semi-structured questionnaire ▪ Analytic induction ▪ Conceptual framework development	▪ Design science ▪ Constellation analysis ▪ Retrospective and prospective analysis
Conference Presentation	G-Forum, Karlsruhe, Germany 24th Interdisciplinary Conference on Entrepreneurship, Innovation and SMEs, 28.09.-02.10.2020		ISPGAYA, International Congress, Porto, Portugal Multidimensional Sustainability: Transitions and Convergences, 29.-30.9 2022	KCWS Knowledge Cities World Summit, Online Conference Actionable Knowledge for the Anthropocene, 16.-18.11.2022
State of Publication	Submitted to: Journal of Innovation Management	Submitted to: Long Range Planning. International Journal of Strategic Management, Special Issue: Corporate Purpose Revisited: Re-imagining the economic and social value of strategy	Published in: „Multidimensional Sustainability: Transitions and Convergences" (2023), Springer Proceedings in Earth and Environmental Sciences Submitted to: Business Strategy and the Environment	Submitted to: Qualitative Research in Accounting & Management

No. of Study	Study 1	Study 2	Study 3	Study 4
Contribution	▪ Extends the use of the object-of-control framework ▪ Examines the impact of strategic orientation and corporate-startup collaborations on innovation success ▪ Complements prior empirical studies on the effect of management control effectiveness on innovation success ▪ Extends our understanding of which type of management controls specifically influence management control effectiveness ▪ Advances research on interorganizational management control practices ▪ Contributes to strategic entrepreneurship and collaborative innovation literature	▪ Extends the use of the object-of-control framework ▪ Examines the mediating role of sustainability management controls in the effect of strategic orientation on innovation success ▪ Advances research on interorganizational management control practices ▪ Contributes to strategic entrepreneurship, sustainability management, and collaborative innovation literature ▪ Enriches the knowledge about practical implications for the implementation of sustainability management ▪ Identifies key factors for achieving sustainability innovation success	▪ Develops a framework for overcoming hurdles between transactional management and transformational management: the Transformation Management Compass ▪ Links the different types of management control with the different layers of the compass ▪ Replicates prior research based on the levers of control framework by confirming the relevance of all four of its components ▪ Underlines that management belief systems and interactive control systems play a major role in integrating sustainability into corporate investment decisions ▪ Provides success indicators for further integrating sustainability into decision making ▪ Enriches the management literature, especially with linkages to management control and sustainability	▪ Examines so-called level four theorizing by linking solutions to multi-contextual problems ▪ Promotes an inter- and transdisciplinary understanding of the need for an integrated sustainability accounting ▪ Provides an overview of the development of concepts and complex relations between actors in the field of establishing sustainability accounting standards ▪ Offers a prospective analysis of the desirable development of an integrated sustainability accounting ▪ Bridges the gap between sustainability accounting and sustainability reporting

4.1. Study 1: How to Make the Honeymoon Last: Effectiveness of different types of Management Controls for Innovation Success in Corporate-Startup Collaborations

In seeking innovation success, companies have been striving towards collaborative business activities for decades (Alter and Hage 1993). Lately, the collaboration between established companies and startups has become common practice and with growing relevance (Doerner *et al.* 2020, p. 7), but insufficient backing by academic research (Steiber *et al.* 2021). As a response to this research gap, we apply the theoretically well-grounded object-of-control framework developed by Merchant and Van der Stede (2017). While this framework distinguishes between two control types – results and action controls (formal) vs. personnel and cultural controls (informal) – we complement the aforementioned framework with agency and stewardship theory, and further add the concepts of strategic entrepreneurship (Hitt *et al.* 2001; Ireland *et al.* 2003; Ireland and Webb 2007) and collaborative innovation (Ketchen *et al.* 2007; Parida *et al.* 2012; van de Vrande 2013, 2017). In doing so, we follow recent suggestions to combine economic and behavioral theories (Merchant *et al.* 2003) and were able to confirm the appropriateness of both theories for explaining the diverse effects of management control.

We came up with the following findings: (1) Strategic orientation as well as (2) the collaboration between established companies and startups by itself, have a significant effect on innovation success. Furthermore, (3) perceived management control system effectiveness significantly impacts innovation success and is significantly influenced by (4) action control and (5) personnel control. In this manner, we extend and complement the use of the object-of-control framework and confirm its applicability in the specific context of management controls for collaborations between established companies and startups. The empirical foundation for these results derives from a survey-research approach. We ask high-level key informants from 46 established companies, headquartered in German-speaking countries, about their experiences regarding collaborations with startups and analyze our data via structural equation modeling, using the software SmartPLS.

The study contributes to the research in two major ways. First, we contribute to the strategic entrepreneurship and collaborative innovation literature by showing that the collaboration between established firms and startups can lead to innovation success. The study further complements prior empirical studies on the effect of management control effectiveness on innovation success and extends our understanding of which type of management controls specifically enhance management control effectiveness.

4.2. Study 2: Good Intentions Do Not Change the World: The Role of Sustainability Management Control for Startup Collaborations in the Relationship between Strategy and Innovation

In the presence of fundamental challenges like climate change, dwindling natural resources, and social injustice, a substantial number of established companies seek long-term competitive advantages by aligning new products and services with the principles of sustainability (e.g. Eccles *et al.* 2014; Gond *et al.* 2012; Bansal and Roth 2000). While innovations driving sustainable development do not occur coincidentally, decision-makers in all types of company need to change their business activities accordingly (Schaltegger and Wagner 2010, p. 223). Our study concentrates on sustainability innovations via startup collaboration, focusing on management controls suitable for achieving this innovation success – all of which entails relationships that have not been researched sufficiently (e.g. Arjaliès and Mundy 2013; Caglio and Ditillo 2021; Guenther *et al.* 2016; Gond *et al.* 2012; Klein *et al.* 2021). Making use of a mixed-method approach, the results of a survey are combined with qualitative interviews with decision-makers. As indicated, we analyze the data gathered from survey responses from high-level key informants from 45 established companies, via structural equation modeling. We further collected data from 16 semi-structured interviews to refine our understanding of the survey responses.

Study 2 reveals a lack of direct connection between strategic objectives and sustainability innovation success, which leads to the assumption that good intentions alone do not change the world, and that the application of sustainability management controls may help in this regard. Since these controls have a mediating effect, they are a promising instrument for conveying strategic objectives in the direction of innovation success. Furthermore, we identify additional success factors for achieving sustainability innovation success through startup collaborations. The following seems to be promising: increasing the degree of ownership in the established company of the jointly developed innovation, having reliable financial and organizational backing of the collaboration within the established company, a value- and vision-fit between the collaborating entities, as well as embracing and effectively managing cultural differences.

Our study's contribution to literature is threefold: First, we extend and complement the use of the object-of-control framework and confirm its applicability in the specific context of sustainability management controls for startup collaborations. Second, we contribute to the management control literature by investigating management control in an interorganizational context. Third, against the background of the questionable effectiveness of traditional

management controls in improving companies' social and environmental performance, we find evidence that the use of sustainability management controls is essential to translating a strategic sustainability innovation objective into actual sustainability innovation success.

4.3. Study 3: Re-Examining Control Systems for Integrating Sustainability into Corporate Investment Decisions: Derivation of a Transformation Management Compass

Investment decisions are of course fundamental to economic activity. How an organization decides to spend its money mould its strategic orientation, culture, and understanding of values. Study 3 aims to identify how sustainability considerations influence internal investment decisions and which type of control systems are at the forefront of this influence.

We capitalize on the widely adopted LOC framework from Simons (1994; 1995). Rodrigue *et al.* (2013) mapped sustainability-related controls onto the four levers of control dimensions of Simons (1995), which also inform our view on control systems, and guide the structuring of our data. The data derives from conducting semi-structured, multi-sectoral interviews with 17 key informants. We analyze the information received by adopting the research paradigm of analytic induction (Robinson 1951; Znaniecki 1934, p.249). In doing so, we began with a tentative definition of a phenomenon or initial framework based on existing theory and empirical findings and testes this based on our data.

We find evidence supporting the relevance of all four of its essential components: belief systems, boundary systems, diagnostic control systems, and interactive control systems. Belief systems in particular seem to be important, including management beliefs and buy-in, the financial backing for business activities in the context of sustainability and potential business cases, and the alignment with the overall (strategic) objectives. Furthermore, changes over time, such as the social discourse on sustainability, subsumed under the concept of belief system change, are considered relevant. Interactive control systems seem to be similarly important, including the following subthemes: room for discussion, institutional collaboration, and inter-organizational dialogue.

We further identify key indicators for seriously integrating sustainability into decision-making by differentiating between the roles of transformational and transactional management. We reveal the need for a corresponding value orientation, a certain willingness to pay, and openness to risk-taking and innovation, as well as clear advocacy and clarification of responsibilities for the integration of sustainability aspects into current business practices. Based on these findings, we develop a Transformation Management Compass, in which the different

layers of the compass (from the center to the outer layers) symbolize the hurdles that divide management based on rules and regulations from transactional management to transformational management. We further link the different types of management control with the different layers of the compass.

4.4. Study 4: Striving towards an Integrated Sustainability Accounting: A Constellation Analysis Based on Interdisciplinary Knowledge Sharing

Longstanding scientific discourses, based on interdisciplinary approaches, identify a need to change management and accounting practices in order to control for sustainability-relevant business practices (Gray *et al.* 1993, p.9). Unlike traditional financial accounting and reporting, in which the content of reporting directly follows the rules of accounting, this is not the case for sustainability reporting (Barker and Eccles 2018, p. 21). Rather, the methods of sustainability reporting are guided by a broad variety of frameworks and guidelines, that in general do not require or follow a consistent data base. As a result, sustainability reporting and sustainability accounting are largely unconnected fields in the past. Study 4 aims to identify the fundamentals of effective corporate Integrated Sustainability Accounting (ISA), describing a constellation of elements (i.e., actors, regulation, scientific foundations, etc.) enabling its implementation. We analyze the increasing complexity of relationships by tying a well-known theory (Actor-Network Theory) to a new methodological approach of analysis: Constellation Analysis (Ohlhorst and Schoen 2015).

Even though Study 4 does not employ a new theory (i.e. considered level-one and level-two theorizing by Llewelyn (2003)), it aims at providing an understanding of what needs to change, what solutions could look like, and how the constellation of actors and other influencing elements needs to change. Llewelyn (2003) refers to the introduction of new concepts as level-three theorizing, representing new ways of thinking and acting, which allows practical developments in the face of sustainability problems. Llewellyn's level-four theorizing further offers the linking of solutions to multi-contextual problems, considering their complexity and interdependency which is precisely what the present study provides. Based on constellation analysis, Study 4 identifies a target constellation, which displays the elements of influence, including actors, concepts, and desirable constellations, which can also be described as elements of governance intended to create and enforce the legal and regulatory frameworks, as well as the institutional and international ones that will render a life-serving future.

5. Core results and contributions

Our aim was to answer the overall research question of how control practices need to be shaped to foster business decisions in line with ecological and social values, here subsumed under the term sustainability. Our core results are that the use of sustainability management control is significantly related to sustainability innovation success and play an essential part in translating a strategic innovation objective into actual innovation success. In terms of management control effectiveness for innovation in general, we find that especially action control and personnel control had a significant effect. Here, we extend and complement the use of the object-of-control framework and confirm its applicability in an interorganizational context, namely the collaboration between established companies and startups, and in the context of sustainability management. With this, we add evidence to the limited body of knowledge regarding different types of management control and their relative effect on intended outcomes (Goebel and Weißenberger 2017a).

Our findings further underline the relevance of strategic objectives for (sustainability) innovations. We complement the aforementioned framework with agency and stewardship theory, and add the concepts of strategic entrepreneurship (Hitt *et al.* 2001; Ireland *et al.* 2003; Ireland and Webb 2007) and collaborative innovation (Ketchen *et al.* 2007; Parida *et al.* 2012; van de Vrande 2013, 2017). In doing so, we followed recent calls to combine economic and behavioral theories (Merchant *et al.* 2003), and were able to confirm the appropriateness of both theories in explaining the diverse effects of management control mechanisms. As a response to Merchant *et al.*'s (2003) call for more cross-disciplinary research that bridges individual paradigms by linking economic and behavioral theories, we can confirm that agency and stewardship theory offer complementary explanations for a better understanding of the effects of management controls Here, our findings are not only relevant for accounting theory and practice, but also broaden our understanding of relationships between strategy and goal attainment.

We also enrich the innovation literature with empirical evidence that collaboration, in our case the collaboration between established companies and startups, is useful to achieve innovation success. These findings lead to a scientific backing of this type of collaboration – and we consider our results as one of the firsts in the field. Our results further add to the body of literature that examines the relationship between management control systems and innovation (Davila *et al.* 2009). Deriving from our qualitative research approach, we confirm that collaborations between established firms and startups need to ensure the ownership of the envisaged innovation, that the collaboration needs reliable financial and organizational backing for the innovation within the established company, a common value-and vision-fit of the

collaborating parties, as well as the embracement of cultural differences by both partners. These findings, in turn, reveal the variety of potentially influential factors and contingencies in this complex management control environment and offer fruitful avenues for future investigations of these factors in further quantitative studies. As a result of our qualitative study on sustainability in investment decisions, we find evidence for the relevance of all four of Simons' (1994) essential components, which, in combination, form the LOC framework of belief systems, boundary systems, diagnostic control systems, and interactive control systems. Belief systems seem important, including management beliefs and buy-in, the financial backing for business activities in the context of sustainability and potential business cases, and alignment with overall (strategic) objectives. Further, changes over time, such as the social discourse on sustainability, subsumed under the concept of belief system change, are considered relevant. Interactive control systems seem to be similarly important, including the following subthemes: room for discussion of sustainability topics, institutional collaboration, and inter-organizational dialogue. The four levers of control seem to co-exist in a rather loose manner, but still not be independent of each other (a question raised by Guenther *et al.* 2016).

We finally identify key indicators for seriously and consistently integrating sustainability into decision-making by differentiating between the roles of transformational and transactional management. We reveal the need for a corresponding value orientation, a certain willingness to pay, and openness to risk-taking and innovation, for example, shown in the organizational relevance of research and development, as well as clear responsibilities for the integration of sustainability aspects into current business practices. Based on these findings, we develop a Transformation Management Compass, in which the different layers of the compass (from the center to the outer layers) symbolize the barriers between management based on rules and regulations, deriving in the shift from transactional management to transformational management that considers the so-called "high hanging fruits" (Wickert and Risi 2019, p. 8), which mean systematic and impactful change. Furthermore, we link the different types of management control with the different layers of the compass, describing pathways for incorporating transformational management for changing business activities towards "deep" or "strong" sustainability, both being terminus technici for an approach based on the notion that "critical parts of the natural capital must be preserved so as to guarantee present and future human wellbeing" (Buriti 2018, p. 8). We lastly enrich, from a much broader perspective, the management accounting and control literature by presenting an interdisciplinary identified target constellation, as well as a draft of desirable criteria for a corporate ISA. Both may be used as a basis for further discussion and investigation. We further introduce the linking of the overall consumption

capacity of natural capital with individual companies and their activities. By doing so, business activities can align their economic behavior with intergenerational needs. Apart from the relevance of an ISA for the business environment, we wish to highlight its value from a macroeconomic point of view. To better understand sources of value creation within their ecological interconnectedness and dependence, a widely incorporated ISA can support decision-making in businesses, and at the macro-level, feed economic simulations to improve policy advice, and other relevant aspects. Summing up our findings, we provide important insights into the relevance of supporting a strong and pluralistic economy, in which the diversity of capital, instead of counteracting each other, can grow mutually and dynamically stabilize each other (Dahm and Koch 2021).

6. Implications

6.1. Implications for further research

While we identify action and personnel control as significantly relevant to management system control effectiveness and indirectly to innovation success, our data do not explain *why* these two types of management control have the observed effects. Even though the management accounting literature offers some explanations, we feel that this would be an important avenue for future research, especially to inform decision-makers setting up management control systems for interorganizational management. For them, there is a need for justification to the top level as well as to their team members, to explain why certain management controls are operational in the company and why they are promising for successfully collaborating with startups. Apart from existing work in management accounting, academics from different disciplines, for example psychology, might be valuable research partners.

We further call for research that distinguishes management control in terms of ex-ante and ex-post (Snell 1992), as well as in terms of objectively and subjectively determined (e.g., Van der Stede *et al.* 2006; Moers 2005; Gibbs *et al.* 2004). While the research presented in the first two studies of this dissertation solely analyzes product and services innovation, we welcome research projects that include business model innovation in their analysis of innovation activities. Study 3, with a focus on transformational management, implicitly calls for less incremental change in business practices and therefore constitutes a first step in the direction of a more holistic approach to change. Only recently, Hahn *et al.* (2023) underline the need to really think sustainability management through, all the way towards the impact on social and ecological systems. This is something not many interviewees mentioned. Hahn *et al.* (2023)

offer some guidance for systematically relating the usage of different types of management control towards "real sustainable change". In line with this, we recommend linking management instruments to outputs (e.g. nonfinancial reports within their research context), more seriously to outcomes (in terms of social and ecological performance), and finally impacts (on social and ecological systems). In this respect further research can take up this triad for more effectively investigating sustainability management.

Future research might also link the concept of organizational citizenship behavior, which characterizes deliberate behavior at the workplace beyond organizational tasks, with the relevance of certain management controls at the company level. Although identifying changing belief systems and individual engagement as relevant, we did not analyze the reasons for this. As a basis for making this connection, Lülfs and Hahn (2014) proposed a model in which the ethical motives influencing the single member of an organization influence the organization as a whole. This is in line with recent research suggesting that developing the skills and competencies of the individual employee is essential to affecting a sustainable change over time and space (Johnstone 2019). Further, it would be useful to learn about how management accounting and management control may even encourage a changing awareness and attributes toward more decision-making in favor of sustainability (Albelda 2011). While Maniora (2018) calls for general attention to be paid to the sustainability materiality determination process, we did not determine the level of materiality of the sustainability issues described by our key informants. While not having enough insight into the single companies to judge the materiality level of the sustainability issues mentioned, we are aware of its relevance and suggest that future research examine precisely such a connection. In line with Beusch *et al.* (2022), we call for studies which more substantially incorporate stakeholder influences for integrating sustainability into investment decisions. In this context it might further be useful to analyze whether different institutional logics, as in nonprofit and for-profit organizations, would lead to different results. Mair *et al.* (2015), for example, analyze the distinct institutional logic in hybrid organizations, and find that some social enterprises might assume hybridity for symbolic reasons only, and others for substantive reasons. This might similarly be the case for sustainability considerations in different types of businesses.

This study could be extended by finding a way to measure how remote current decision-making practices are from a scientifically based measurement of companies' environmental impact, i.e., the need to identify patterns and business practices that facilitate or impede a resulting net positive worth for the environment. Furthermore, our findings only offer peripheral assistance on how to overcome the difficulty of conflicting objectives between financial,

environmental, and social issues perceived by many corporate managers (Porter and Kramer 2011). We thus encourage further research to concentrate on control practices that tackle this specific challenge. Throughout the dissertation, sustainability is never reduced to environmental sustainability. It is nevertheless obvious, that in the literature and in conversations with our key informants, environmental sustainability is the predominant tenor. The Sustainability Zeroline, for example, applies equally to social and governmental aspects and not only concentrates on the biosphere, but also on the anthroposphere, including indicators for freedom, human rights, dignity, cultural diversity, common welfare, labor, employment, etc. (Dahm 2019, p. 180). While the mechanisms for incorporating social and governmental aspects, which means taking the anthroposphere into account, seem to be similar to taking environmental aspects into account, future research is needed to determine similarities and differences. We identify differences in decision-making related to sustainability which derive from the types of investments and diverse strategic backgrounds.

6.2. Practical implications

Although collaborating with startups has become a commonly used instrument, there is still an ongoing debate on the actual effects (Doerner *et al.* 2020, p. 15). Having an effective way of steering collaborations leading to innovation success is of course something decision-makers strive for. An appropriate scientific backing so that effective management control systems have an impact on the actual innovation success may imply assigning an even higher level of importance to design and implementing management controls. The research of Back *et al.* (2019), elaborating on tools and guidelines for innovation managers in established companies to innovate with startups, might also be relevant for practitioners. The authors introduce a weighted decision matrix, from which one of five relevant areas is to approach corporate control setups. Niever *et al.* (2022) developed a reference and impact model showing the need for support in collaborations with startups, which might also support our results for the use of practitioners. Finally, Steiber *et al.* (2021) present a multi-stakeholder framework for evaluating the results of corporate-startup collaborations. Transformational business activities, as delineated in the Transformation Management Compass, could gradually be implemented by applying the Sustainability Zeroline from Dahm (2019, p. 180). Considering, inter alia, the planetary boundaries of Rockstroem *et al.* (2009), from which a large body of academic literature around the term ‘absolute sustainability’ has recently emerged (Downing *et al.* 2019), the zeroline marks the status when neither a positive nor a negative impact is derived from a certain endeavor. While it might be the most obvious objective of a company to do the least possible harm, it would, if

its activities are in the sphere of transformational management and characterized by being above the Sustainability Zeroline, probably strengthen its competitive advantage and conform to its role in being part of the solution of our grand challenges, even if not necessarily financially rewarding in the short-term. Similar to the findings of Kuehnen *et al.* (2022), we find that interviewees seldom spoke about sustainability as the basis for competitive positioning or positive business developments. Kuehnen *et al.* (2022) use the concept of positive sustainability performance, which has been difficult for their key informants to identify. From this insight, the authors deduce that the current framing of sustainability performance in corporate practice appeared to be stuck in negative frames which tend to be "stickier" than positive frames (Sparks and Ledgerwood 2017). Delving deeper into asking interviewees about positive sustainability impacts and how these might be achieved, could reveal further support for concentrating on transformational management. Overall, the findings of this dissertation enhance our understanding of the potential for incorporating sustainability into business activities. Practitioners are invited to use our findings as a stimulus to rethink their management activities. This dissertation offers various options for integrating sustainability more strongly into management and aligning decision-making. It offers actionable answers in different areas of operational management, like accounting and controlling, as well as in strategic management.

For decision-makers at the regulatory level, this dissertation could also provide insights and ways forward for aligning operational guidelines with an understanding of 'strong sustainability', as defined by Doering (2004). Programs to strengthen business practices that are guided by the principles of strong sustainability should aim to protect planetary boundaries and promote economic activity above the Sustainability Zeroline conceptualized by Dahm (2019, p. 180). It has become quite clear to everyone by now that the grand challenges of our times, including social and ecological threats, must lead to major societal changes. Whether we can mitigate the harshness of the changes through our current actions and how we deal with changing framework conditions, remains an open question for the time being. For decision-makers in private as well as in public contexts, the same applies that "it is high time to implement new thinking in new action and thereby to use the power of the differentiated, the moving, and the changing for ourselves in a learning way." (Dahm *et al.* 2021, p. 100). Combining the findings of this dissertation with the implications for academia and practice, the present work should be a helpful source for facing one of the grand challenges of our time, the need for businesses to contribute to a truly sustainable development.

References

Adams, CA and C Larrinaga, (2019). Progress: engaging with organisations in pursuit of improved sustainability accounting and performance. *Accounting, Auditing & Accountability Journal*, 32(8), 2367–2394.

Albelda, E, (2011). The role of management accounting practices as facilitators of the environmental management: Evidence from EMAS organisations. *Sustainability Accounting, Management and Policy Journal*, 2(1), 76–100.

Alter, C and J Hage, (1993). *Organizations Working Together*. Sage Publications, Newbury Park, CA.

Anthony, RN, (1965). *Planning and control systems: a framework for analysis*. Harvard Business Review Press, Boston, MA.

Arjaliès, D-L and J Mundy, (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research*, 24(4), 284–300.

Back, A, TM Werro and LM Peter, (2019). Practical Implications On How Established Companies Innovate With Startups. *International Journal of R&D Innovation Strategy*, 1(2), 1–20.

Bansal, P and K Roth, (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, 43(4), 717–736.

Barker, R and RG Eccles, (2018). *Should FASB and IASB be responsible for setting standards for nonfinancial Information?*, Oxford.

Bass, BM, (1999). Two Decades of Research and Development in Transformational Leadership. *European Journal of Work and Organizational Psychology*, 8(1), 9–32.

Bebbington, J and C Larrinaga, (2014). Accounting and sustainable development: An exploration. *Accounting, Organizations and Society*, 39(6), 395–413.

Beusch, P, JE Frisk, M Rosén and W Dilla, (2022). Management control for sustainability: Towards integrated systems. *Management Accounting Research*, 54, 100777.

Bisbe, J and D Otley, (2004). The effects of the interactive use of management control systems on product innovation. *Accounting, Organizations and Society*, 29(8), 709–737.

Buriti, R, (2018). "Deep" or "Strong" Sustainability. In: WL Filho, ed. *Encyclopedia of Sustainability in Higher Education.* Springer International Publishing, Basel.

Burns, JM, (1978). *Leadership*. Harper & Row, New York, NY.

Burritt, RL, S Schaltegger and D Zvezdov, (2011). Carbon Management Accounting: Explaining Practice in Leading German Companies. *Australian Accounting Review*, 56(21), 80–98.

Burritt, RL and S Schaltegger, (2010). Sustainability accounting and reporting: fad or trend? *Accounting, Auditing & Accountability Journal*, 23(7), 829–846.

Burritt, RL, T Hahn and S Schaltegger, (2002). Towards a Comprehensive Framework for Environmental Management Accounting - Links Between Business Actors and Environmental Management Accounting Tools. *Australian Accounting Review*, 12(28), 39–50.

Caglio, A and A Ditillo, (2021). Reviewing Interorganizational Management Accounting and Control Literature: A New Look. *Journal of Management Accounting Research*, 33(1), 149–169.

Crutzen, N and C Herzig, (2013). A review of the empirical research in management control, strategy and sustainability. In: L Songini, ed. *Accounting and control for sustainability.* Emerald, Bingley, 165–195.

Cooper, C and AB Coulson, (2014). Accounting activism and Bourdieu's 'collective intellectual' – Reflections on the ICL Case. *Critical Perspectives on Accounting*, 25(3), 237–254.

Cuckston, T, (2013). Bringing tropical forest biodiversity conservation into financial accounting calculation. *Accounting, Auditing & Accountability Journal*, 26(5), 688–714.

Dahm, JD, (2019). *Benchmark Nachhaltigkeit. Sustainability Zeroline: Das Maß für eine zukunftsfähige Oekonomie*. transcript Verlag, Bielefeld.

Dahm, JD, H-P Dürr and R zur Lippe, (2021). *Potsdam Manifesto 2005* (second edition). oekom Verlag, München.

Dahm, JD and G Koch, (2021). Precursors of an economics for the Anthropocene. In: FJ Carrillo and G Koch, eds. *Knowledge for the Anthropocene. A Multidisciplinary Approach.* Edward Elgar Publishing, 132–144.

Das, TK and IY He, (2006). Entrepreneurial firms in search of established partners: Review and recommendations. *IInternational Journal of Entrepreneurial Behavior & Research*, 12, 114–143.

Davila, A, G Foster and D Oyon, (2009). Accounting and Control, Entrepreneurship and Innovation: Venturing into New Research Opportunities. *European Accounting Review*, 18(2), 281–311.

Deaux, E and JW Callaghan, (1985). Key informant versus self-report estimates of health behavior. *Evaluation Review*, 9, 365–368.

Dillmann, DA, JD Smyth and LM Christian, (2014). *Internet, mail, and mixed-mode surveys: The tailored design method*, 4th edition, John Wiley & Sons Inc., Hoboken, NJ.

Dixson-Declève, S, O Gaffney, J Gosh, J Randers and PE Stoknes, (2022). *Earth for All: Der neue Bericht an den Club of Rome, 50 Jahre nach "Die Grenzen des Wachstums"*. oekom Verlag, München.

Doering, R, (2004). *Wie stark ist schwache, wie schwach starke Nachhaltigkeit?*, Greifswald.

Doerner, K, M Floetotto, T Henz and T Strålin, (2020). *You can't buy love. Reimagining corporate-startup partnerships in the DACH region*. McKinsey & Company.

Downing, AS, A Bhowmik, D Collste, SE Cornell, J Donges, I Fetzer, T Häyhä, J Hinton, S Lade and WM Mooij, (2019). Matching scope, purpose and uses of planetary boundaries science. *Environmental Research Letters*, 14(7), 73005.

Durden, C, (2008). Towards a socially responsible management control system. *Accounting, Auditing & Accountability Journal*, 21(5), 671–694.

Eccles, RG, I Ioannou and G Serafeim, (2014). The Impact of Corporate Sustainability on Organizational Processes and Performance. *Management Science*, 60(11), 2835–2857.

Epstein, MJ, AR Buhovac and K Yuthas, (2010). Implementing Sustainability: The Role of Leadership and Organizational Culture. *Strategic Finance*, 4, 41–47.

Epstein, MJ, (2008). Aligning, measuring, and rewarding performance in complex organizations. In: MJ Epstein and J-F Manzoni, eds. *Performance measurement and management control: measuring and rewarding performance.* Emerald Group Publishing, Bingley, 3–17.

Feder, M and BE Weißenberger, (2019). Understanding the behavioral gap: Why would managers (not) engage in CSR-related activities? *Journal of Management Control*, 30(1), 95–126.

Ferreira, A and D Otley, (2009). The design and use of performance management systems: An extended framework for analysis. *Management Accounting Research*, 20, 263–282.

Flamholtz, EG, TK Das and AS Tsui, (1985). Toward an integrative framework of organizational control. *Accounting, Organizations and Society*, 10(1), 35–50.

Fornell, C, (1987). A second generation of multivariate analysis: Classification of methods and implications for marketing research. In: Houston, M, eds. *Review of Marketing*. American Marketing Association, Chicago, IL, 407–450

Gibbs, M, KA Merchant, WA Van der Stede and ME Vargus, (2004). Determinants and Effects of Subjectivity in Incentives. *The Accounting Review*, 79(2), 409–436.

Gioia, DA, KG Corley and AL Hamilton, (2013). Seeking Qualitative Rigor in Inductive Research. *Organizational Research Methods*, 16(1), 15–31.

Goebel, S and BE Weißenberger, (2017a). Effects of management control mechanisms: towards a more comprehensive analysis. *Journal of Business Economics*, 87(2), 185–219.

Goebel, S and BE Weißenberger, (2017b). The Relationship Between Formal and Informal Controls, Ethical Work Climates, and Organizational Performance. Journal of Business Ethics, 141(3), 505–528.

Goebel, S and BE Weißenberger, (2016). The Dark Side of Tight Financial Control: Causes and Remedies of Dysfunctional Employee Behaviors. *Schmalenbach Business Review*, 17(1), 69–101.

Gomez-Conde, J, E Lopez-Valeiras, R Malagueño and R Gonzalez-Castro, (2021). Management control systems and innovation strategies in business-incubated start-ups. *Accounting and Business Research*, 1–27.

Gond, J-P, S Grubnic, C Herzig and J Moon, (2012). Configuring management control systems: Theorizing the integration of strategy and sustainability. *Management Accounting Research*, 23(3), 205–223.

Gray, R, CA Adams and D Owen, (2014). *Accountability, social responsibility and sustainability*. Pearson Education Limited, London.

Gray, R and MJ Milne, (2002). *Sustainability Reporting. Who's Kidding Whom?*

Gray, R, J Bebbington and D Walters, (1993). *Acccounting for the Environment*. Markus Wiener Publishing, London.

Gray, R, (1992). Accounting and Environmentalism: An exploration of the challenge of gently accounting for accountability, transparency and sustainability. *Accounting, Organizations and Society*, 17(5), 399–425.

Gregor, S, (2006). The Nature of Theory in Information Systems. *MIS Quarterly,* 30(3), 611–642.

Groote, JK de and J Backmann, (2020). Initiating open innovation collaborations between incumbents and startups: How can David and Goliath get along? *International Journal of Innovation Management*, 24(02), 2050011.

Guenther, E, J Endrikat and TW Guenther, (2016). Environmental management control systems: a conceptualization and a review of the empirical evidence. *Journal of Cleaner Production*, 136, 147–171.

Hahn, R, D Reimsbach and C Wickert, (2023). Nonfinancial Reporting and Real Sustainable Change: Relationship Status—It's Complicated. *Organization & Environment*, 36(1), 3–16.

Hahn, R, D Reimsbach, P Kotzian, M Feder and BE Weißenberger, (2019). Legitimation Strategies as Valuable Signals in Nonfinancial Reporting? Effects on Investor Decision-Making. *Business & Society*, 1(36), 139–174.

Hair, JF, GTM Hult and CM Ringle, (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS--SEM)*. Sage Publications, Thousand Oaks, CA.

Hair, JF, CM Ringle and M Sarstedt, (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice.* 19(2), 139–152.

Henri, J-F and M Journeault, (2010). Eco-control: The influence of management control systems on environmental and economic performance. *Accounting, Organizations and Society*, 35(1), 63–80.

Henseler, J, CM Ringle and RR Sinkovics, (2009). The use of partial least squares path modeling in international marketing. In: RR Sinkovics and PN Ghauri, eds. *New Challenges to International Marketing.* Emerald Group Publishing Limited, Bingley, UK, 277–319.

Hevner, A, S March, J Park and S Ram, (2004). Design Science in Information Systems Research. *MIS Quarterly,* 28(1), 75–105.

Hitt, MA, RD Ireland, SM Camp and DL Sexton, (2001). Strategic entrepreneurship: entrepreneurial strategies for wealth creation. *Strategic Management Journal*, 22(6-7), 479–491.

Homburg, C, M Klarmann, M Reimann and O Schilke, (2012). What Drives Key Informant Accuracy? *Journal of Marketing Research*, 49(4), 594–608.

Hoque, Z, ed., (2006). *Methodological issues in accounting research*. Spiramus Press Ltd, London.

Hulland, J, (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, 20(2), 195–204.

IPCC, (2023). *IPCC_AR6_SYR_SPM: Synthesis Report of the IPCC Sixth Assessment Report. Summary for Policymakers*.

Ireland, RD, MA Hitt and DG Sirmon, (2003). A Model of Strategic Entrepreneurship: The Construct and its Dimensions. *Journal of Management*, 29(6), 963–989.

Ireland, RD and JW Webb, (2007). Strategic entrepreneurship: Creating competitive advantage through streams of innovation. *Business Horizons*, 50(1), 49–59.

Johnstone, L, (2019). Theorising and conceptualising the sustainability control system for effective sustainability management. *Journal of Management Control*, 30, 25–64.

Ketchen, DJ, RD Ireland and CC Snow, (2007). Strategic entrepreneurship, collaborative innovation, and wealth creation. *Strategic Entrepreneurship Journal*, 1(3-4), 371–385.

Klein, SP, P Spieth and S Heidenreich, (2021). Facilitating business model innovation: The influence of sustainability and the mediating role of strategic orientations. *Journal of Product Innovation Management*, (00), 1–18.

Kuechler, W and V Vaishnavi, (2008). On Theory Development in Design Science Research: Anatomy of a Research Project. *European Journal of Information Systems*, 17, 489–504

Kuehnen, M, S Silva and R Hahn, (2022). From negative to positive sustainability performance measurement and assessment? A qualitative inquiry drawing on framing effects theory. *Business Strategy and the Environment*, 31(5), 1985–2001.

Lehman, G, (1999). Disclosing new worlds: a role for social and environmental accounting and auditing. *Accounting, Organizations and Society*, 24(3), 217–241.

Llewelyn, S, (2003). What counts as "theory" in qualitative management and accounting research? Introducing five levels of theorizing. *Accounting, Auditing & Accountability Journal*, 16(4), 662–708.

Lülfs, R and R Hahn, (2014). Sustainable Behavior in the Business Sphere: A Comprehensive Overview of the Explanatory Power of Psychological Models. *Organization & Environment*, 27, 43–64.

Mair, J, J Mayer and E Lutz, (2015). Navigating Institutional Plurality: Organizational Governance in Hybrid Organizations. *Organizational Studies*, 36(6), 713–739.

Malmi, T and DA Brown, (2008). Management control systems as a package—Opportunities, challenges and research directions. *Management Accounting Research*, 19(4), 287–300.

Malsch, B, Y Gendron and F Grazzini, (2011). Investigating interdisciplinary translations. *Accounting, Auditing & Accountability Journal*, 24(2), 194–228.

Maniora, J, (2018). Mismanagement of Sustainability: What Business Strategy Makes the Difference? Empirical Evidence from the USA. *Journal of Business Ethics*, 152(4), 931–947.

Martyn, P, B Sweeney and E Curtis, (2016). Strategy and control: 25 years of empirical use of Simons' Levers of Control framework. *Journal of Accounting & Organizational Change*, 12(3), 281–324.

Mathews, MR, (2001). Rejoinder: Some thoughts on social and environmental accounting education. *Accounting Education*, 10(4), 379–382.

Mathews, MR, (1997). Twenty-five years of social and environmental accounting research. *Accounting, Auditing & Accountability Journal*, 10(4), 481–531.

Maunders, KT and RL Burritt, (1991). *Accounting and Ecological Crisis*. Emerald Group Publishing Limited, Plymouth.

Merchant, KA, (1985). *Control in business organizations*. Pitman, Marshfield.

Merchant, KA and WA Van der Stede, (2017). *Management Control Systems: Performance measurement, evaluation and incentives* (fourth edition). Pearson, Essex.

Merchant, KA, WA Van der Stede and L Zheng, (2003). Disciplinary constraints on the advancement of knowledge: the case of organizational incentive systems. *Accounting, Organizations and Society*, 28(2-3), 251–286.

Meuer, J, J Koelbel and VH Hoffmann, (2020). On the Nature of Corporate Sustainability. *Organization & Environment*, 33(3), 319–341.

Moers, F, (2005). Discretion and bias in performance evaluation: the impact of diversity and subjectivity. *Accounting, Organizations and Society*, 30(1), 67–80.

Moritz, A, T Naulin and E Lutz, (2022). Accelerators as drivers of coopetition among early-stage startups. *Technovation*, 111, 102378.

Mundy, J, (2010). Creating dynamic tensions through a balanced use of management control systems. *Accounting, Organizations and Society*, 35(5), 499–523.

Neu, D, DJ Cooper and J Everett, (2001). Critical Accounting Interventions. *Critical Perspectives on Accounting*, 12(6), 735–762.

Niever, M, IM Scholz and C Hahn, (2022). Innovation Driven by Cooperation of Startups and SME. *Athens Journal of Business & Economics*, 8(4), 345–362.

Ohlhorst, D and S Schoen, (2015). Constellation Analysis as a Means of Interdisciplinary Innovation Research – Theory Formation from the Bottom Up. *Historical Social Research*, 40(3), 259–278.

Orecchini, F, V Valitutti and G Vitali, (2012). Industry and academia for a transition towards sustainability: advancing sustainability science through university-business collaborations. *Sustainability Science*, 7(1), 57–73.

Oro, IM and CEF Lavarda, (2019). Interface between management control systems and strategy and performance measures in a family business. *Revista Contabilidade & Finanças*, 30(79), 14–27.

Otley, D, (2001). Extending the boundaries of management accounting research: developing systems for performance management. *British Accounting Review*, 33, 243–261.

Otley, D, (1999). Performance management: a framework for management control systems research. *Management Accounting Research*, 10(4), 363–382.

Otley, D, (1994). Management control in contemporary organizations: Towards a wider framework. *Management Accounting Research*, 5(3-4), 289–299.

Parida, V, M Westerberg and J Frishammar, (2012). Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. *Journal of Small Business Management*, 50(2), 283–309.

Phillippi, J and J Lauderdale, (2018). A Guide to Field Notes for Qualitative Research: Context and Conversation. *Qualitative health research*, 28(3), 381–388.

Pondeville, S, V Swaen and Y de Rongé, (2013). Environmental management control systems: The role of contextual and strategic factors. *Management Accounting Research*, 24(4), 317–332.

Pratt, MG, (2008). Fitting Oval Pegs into Round Holes: Tension in Evaluating and Publishing Qualitative Research in Top-Tier North American Journals. *Organizational Research Methods,* 11 (3), 481–509.

Rammert, W, (2010). Die Innovationen der Gesellschaft. In: J Howald and H Jacobsen, eds. *Soziale Innovation.* VS Verlag für Sozialwissenschaften, Wiesbaden, 21–51.

Reinartz, W, M Haenlein and J Henseler, (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing*, 26(4), 332–344.

Robinson, WS, (1951). The Logical Structure of Analytic Induction. *American Sociological Review*, 16(6), 812–818.

Rockstroem, Johan, Steffen, Will: Noone, Kevin and Å Persson, (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, 14(2).

Rodrigue, M, M Magnan and E Boulianne, (2013). Stakeholders' influence on environmental strategy and performance indicators: A managerial perspective. *Management Accounting Research*, 24(4), 301–316.

Salas-Zapata, WA, LA Ríos-Osorio and JA Cardona-Arias, (2017). Methodological characteristics of sustainability science: a systematic review. *Environment, Development and Sustainability*, 19(4), 1127–1140.

Sandelin, M, (2008). Operation of management control practices as a package—A case study on control system variety in a growth firm context. *Management Accounting Research*, 19(4), 324–343.

Schaltegger, S, FL Freund and EG Hansen, (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), 95–119.

Schaltegger, S and M Wagner, (2010). Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Business Strategy and the Environment*, 20(4), 222–237.

Schaltegger, S and RL Burritt, (2000). *Contemporary Environmental Accounting: Issues, Concepts and Practice*. Greenleaf, Sheffield.

Schoen, S, B Noelting and M Meister, (2004). *Konstellationsanalyse. Ein interdisziplinäres Brückenkonzept für die Technik-, Nachhaltigkeits- und Innovationsforschung.* Discussion paper, 12/04.

Selasinsky, C von and E Lutz, (2013). The Effects of Pro-Social and Pro-Environmental Orientation on Crowdfunding Performance. *Sustainability*, 2021(6064), 1–27.

Sharma, G and AK Jaiswal, (2018). Unsustainability of Sustainability: Cognitive Frames and Tensions in Bottom of the Pyramid Projects. *Journal of Business Ethics*, 148(2), 291–307.

Sharma, JP and S Khanna, (2014). Corporate Social Responsibility, Corporate Governance and Sustainability: Synergies and Inter-relationships. *Indian Journal of Corporate Governance*, 7(1), 14–38.

Simon, H, (1996). *The Sciences of the Artificial* (3rd ed), MIT Press, Cambridge, MA.

Simons, R, (1994). How new top managers use control systems as levers of strategic renewal. *Strategic Management Journal*, 15(3), 169–189.

Simons, R, (1995a). Control in an Age of Empowerment. *Harvard Business Review*, 80–88.

Simons, R, (1995b). *Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal.* Harvard Business School Press, Boston, MS.

Sitkin, SB, LB Cardinal and KM Bijlsma-Frankema, (2010). Control is fundamental. In: SB Sitkin, LB Cardinal and KM Bijlsma-Frankema, eds. *Organizational control.* Cambridge University Press, Cambridge, 3–15.

Smith, D and K Langfield-Smith, (2004). Structural equation modeling in management accounting research: Critical analysis and opportunities. *Journal of Accounting Literature*, 23(1), 49–86.

Snell, SA, (1992). Control theory in strategic human resource management: the mediating effect of administrative information. *Academy of Management Journal*, 35(2), 292–327.

Soll, J, (2014). *The Reckoning: Financial Accountability and the Rise and Fall of Nations*. Basic Books, New York, NY.

Sparks, J and A Ledgerwood, (2017). When good is stickier than bad: Understanding gain/loss asymmetries in sequential framing effects. *Journal of Experimental Psychology*, 146(8), 1086–1105.

Speklé, RF and SK Widener, (2018). Challenging Issues in Survey Research: Discussion and Suggestions. *Journal of Management Accounting Research*, 30(2), 3–21.

Speklé, RF and A-M Kruis, (2014). Management Control Research: A Review of Current Developments. In: D Otley and K Soin, eds. *Management Control and Uncertainty.* Palgrave Macmillan, London, 30–46.

Spence, C, J Husillos and C Correa-Ruiz, (2010). Cargo cult science and the death of politics: A critical review of social and environmental accounting research. *Critical Perspectives on Accounting*, 21(1), 76–89.

Starik, M and P Kanashiro, (2013). Toward a theory of sustainability management: Uncovering and integrating the nearly obvious. *Organization & Environment*, 26(1), 7–30.

Steiber, A, S Alanage and V Corvello, (2021). Evaluating Corporate Startup Co-creation: a critical review of the literaure. *International Journal of Innovation Management*, 25(07).

Taïbi, S, N Antheaume and D Gibassier, (2020). Accounting for strong sustainability: an intervention-research based approach. *Sustainability Accounting, Management and Policy Journal*, 11(7), 1213–1243.

Tracy, SJ, (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry,* 16 (10), 837–851.

Van de Vrande, V, (2013). Balancing your technology-sourcing portfolio: How sourcing mode diversity enhances innovative performance. *Strategic Management Journal*, 34(5), 610–621.

Van de Vrande, V, (2017). Collaborative Innovation: Creating Opportunities in a Changing World. *ERIM Inaugural Address Series Research in Management*.

Van der Stede, WA, CW Chow and TW Lin, (2006). Strategy, Choice of Performance Measures, and Performance. *Behavioral Research in Accounting*, 18(1), 185–205.

Van der Stede, WA, SM Young and CX Chen, (2005). Assessing the quality of evidence in empirical management accounting research: The case of survey studies. *Accounting, Organizations and Society*, 30(7-8), 655–684.

Van Maanen, J, (1979). The Fact of Fiction in Organizational Ethnography. *Administrative Science Quarterly*, 24(4), 539–550.

Weijters, B, E Davidov and H Baumgartner, (2023). Analyzing factorial survey data with structural equation models. *Sociological Methods & Research*, 52(4), 2050–2082.

Wener, P and RL Woodgate, (2013). Use of qualitative methodological scaffolding process to design robust interprofessional studies. *Journal of Interprofessional Care*, 27(4), 305–312.

Wickert, C and D Risi, (2019). *Corporate Social Responsibility*. Cambridge University Press, Cambridge.

Young, SM, ed., (1996). *Survey Research in Management Accounting: A Critical Assessment*.

Znaniecki, F, (1934). *The Method of Sociology*. Rinehart & Company, New York, NY.

B. Study 1: How to Make the Honeymoon Last: Effectiveness of different types of Management Controls for Innovation Success in Corporate-Startup Collaborations

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How to Make the Honeymoon Last:
Effectiveness of different types of Management Controls for Innovation Success in Corporate-Startup Collaborations

ABSTRACT

Working together with startups is common practice in an increasing number of corporate business environments, especially when the goal of innovation takes center stage. Little is known, however, about the relationship between corporate-startup collaborations and innovation success, and how management controls can be beneficial in these collaborations. Our research shows both an influence of (1) established firms' strategic innovation orientation and (2) corporate-startup collaborations on innovation success. Further, (3) management control system effectiveness significantly impacts innovation success and is influenced by (4) action controls and (5) personnel controls. These five findings are based on a survey asking high-level key informants from 46 established companies, headquartered in German-speaking countries, about their experiences of collaborations with startups. We analyzed our data by structural equation modeling, using SmartPLS.

Keywords: Management Control; Strategy; Startups; Startup-Collaborations; Entrepreneurship; Innovation

JEL Classification: M

1. Introduction

Collaborations between established players and startups promise to enhance established firms' innovation performance (Groote and Backmann 2020). Thus, the collaboration between established companies and startups has lately become a common practice with growing relevance (Doerner *et al.* 2020). In such collaborations, new ideas and technologies may be shared and further developed (e.g., Jackson and Richter 2017; Rothaermel 2001). For startups, collaborating with established companies generally stands for access to resources, experiences, knowledge (O'Connor 2006), and increasing legitimacy in the market (Eisenhardt and Schoonhoven 1996). The established company is oftentimes interested in taking over some of the startup spirit and agility, as well as the young firms' natural way of thinking out-of -the-box, all being common traits when fewer processes and resources are available (Hogenhuis *et al.* 2016). In this way, collaboration with smaller firms can be beneficial for established players (Christensen *et al.* 2005), particularly in the initial stages of innovation development. In practice, however, expectations around measures of innovation performance and how these can be achieved vary widely across corporate-startup partnerships (Doerner *et al.* 2020).

Even though most of the larger, established companies practice startup collaborations, there has been little research on evaluating corporate-startup collaborations (Das and He 2006; Steiber *et al.* 2021), especially in terms of related innovation success for the established firms. This is different for research on collaborations between startups themselves (e.g. Mercandetti et al. 2017; Moritz *et al.* 2022; Pangarkar and Wu 2013). Studies like the one of Rigtering and Behrens (2021) analyzed corporate-startup collaborations, but not with a focus on innovation success. Their research interest was the effect of collaboration on corporate entrepreneurship and on individual-level mechanisms for it to increase. Focusing on the positive influence of collaborations especially for startups, Polidoro and Yang (2021) research respective advantages resulting from the collaborations. Similarly, Alvarez and Barney (2001) as well as Usman and Vanhaverbeke (2017) mainly considered the advantages on the side of the startups when collaborating with large partners. Not directly related to startup collaborations, but empirically strong are the findings of Bucic and Ngo (2012), who showed that large firms involved in collaborative ventures can increase their innovativeness. Further, Criscuolo *et al.* (2012) explored the differences in innovation between startups and established firms, but did not consider collaboration between the two.

Also, not much has been published on how corporate-startup collaborations can be governed by established firms in the best possible way to achieve success. Hence, we are missing scientifically backed success factors for the management of collaborations with startups aiming

at innovation outcomes. While Usman and Vanhaverbeke (2017), for example, examined how startups successfully organize and manage open innovation with large companies, their focus was on the perspective of startups. Yet, there is dearth of research about established firms' governance of startup collaborations and their related innovation success. One of the few findings in this context stems from Emden *et al.* (2006) who identify three criteria for a successful partnership selection leading to new product development: strategic alignment (e.g. match of motivation and goals), technological alignment (e.g. overlap of knowledge in addition to complementarity), and relational alignment (e.g. cultural fit). More recently, Groote and Backmann (2020) published empirical evidence on criteria for a successful selection process of partner companies leading to open innovation. Here, however, related internal management activities were not analyzed. Neither were they considered relevant in one of the aforementioned studies. What the above cited authors describe as possible alternative impact factors for the strength of collaborations are rather external factors, not management control aspects that characterize how the collaboration is governed (Groote and Backmann 2020). Yet, this governance is crucial for ensuring that firms also achieve what was set as a strategic goal in the first place (Merchant 1985; Merchant and Van der Stede 2017).

In our analysis, we focus on how corporate-startup collaborations can be managed by including different types of management controls resulting in a holistic management control system. We do so because of the potential strategy-supporting function of a firm's management controls system. Based on the work of several authors (Dent 1990; Samson *et al.* 1991; Simons 1987; Simons 1990). Langfield-Smith (1997, p. 207) emphasizes: "[…] the management controls system should be tailored explicitly to support the strategy of the business to lead to competitive advantage and superior performance". To analyze control systems applied to govern startup collaborations, based on the object-of-control framework by Merchant and Van der Stede (2017), we include four different types of management controls. The framework distinguishes control types into results and action controls (formal) vs. personnel and cultural controls (informal). Based on this framework and the concepts of strategic entrepreneurship (Hitt *et al.* 2001; Ireland *et al.* 2003; Ireland and Webb 2007) and collaborative innovation (Ketchen *et al.* 2007; Parida *et al.* 2012; van de Vrande 2013, 2017), to address the aforementioned research gap, we develop a research model to study the following relations: We initially link both innovation objectives within corporate strategy and corporate-startup collaborations with innovation success. In addition, we investigate the relations of different types of management controls for the collaborations with management controls system effectiveness, while we also investigate the effect of the latter on innovation success.

To do so, we analyze the answers of high-level key informants from 46 established companies, headquartered in German-speaking countries, and ask about their experiences regarding collaborations with startups. We analyze our data via structural equation modeling, using SmartPLS.

This study contributes to extant research in three major ways. First, we contribute to the strategic entrepreneurship and collaborative innovation literature by showing that the collaboration between established firms and startups can lead to innovation success. So far, while there have been previous qualitative research endeavours exploring the innovation success of corporate-startup collaborations (e.g., Groote and Backmann 2020), to the best of our knowledge, a comparable quantitative-empirical study focusing on the relationship between strategy and innovation success, with a focus on management control of corporate-startup collaborations has not been conducted so far.

Second, based on the object-of-control framework by Merchant and Van der Stede (2017) and its mapping of control types into formal results and action controls vs. informal personnel and cultural controls, we adjust the existing scales surveying the use of these controls for steering corporate-startup collaborations. In this way, we extend and complement the use of the object-of-control framework and partially confirm its applicability in the specific context of management controls for corporate-startup collaborations. In this way, we also answer the call for research by Caglio and Ditillo (2021) who state that additional research is needed about management controls for collaboration between firms aiming at innovation.

Third, building on Goebel and Weißenberger (2017a), we answer Merchant *et al.*'s (2003) call for more cross-disciplinary research that bridges single paradigms by linking economic and behavioral theories. With the research at hand, we can affirm that agency and stewardship theory offer complementary explanations for a better understanding of the effects of management controls.

We divide our reserach into three main sections. First, we elaborate on the theoretical background of our research. Here, we illustrate the concepts of strategic entrepreneurship and collaborative innovation, the object-of-control framework as well as agency and stewardship theory before developing our hypotheses. Second, the methods and results of our research are displayed. Finally, we discuss our results and elaborate on the theoretical and practical implications of our study, its inherent limitations, and avenues for future research.

2. Theoretical background and hypotheses

The theoretical foundation for studying the relationship between corporate strategy and innovation success via interorganizational collaboration is rooted in the concepts of strategic entrepreneurship (Hitt *et al.* 2001; Ireland *et al.* 2003; Ireland and Webb 2007) and collaborative innovation (Ketchen *et al.* 2007; Parida *et al.* 2012; van de Vrande 2013; 2017). Moreover, for steering interorganizational collaboration operatively, literature on management controls offers an appropriate theoretical framework (Merchant and Van der Stede 2017), which we complement with agency and stewardship theory to develop our hypotheses. We illustrate the aforementioned concepts and theories in the following sections.

2.1. Strategic entrepreneurship and collaborative innovation

Whenever extensive competition and technological change are characterizing business settings, companies may gain a competitive advantage by striving for high levels of innovation (Ireland *et al.* 2001; Aghion *et al.* 2005). Strategic management deals with establishing and maintaining competitive advantage through so-called advantage-seeking activities (Ireland *et al.* 2003; Venkataraman and Sarasvathy 2008). Entrepreneurship, in turn, focuses on opportunity-seeking activities for creating novel products and services (Ireland *et al.* 2003). While growth and wealth creation are central to both strategic management and entrepreneurship (Amit and Zott 2001), the combined approach is called strategic entrepreneurship and refers to firms' pursuit of superior performance via simultaneous opportunity-seeking and advantage-seeking activities (Ireland *et al.* 2003; Ketchen *et al.* 2007, p. 372; Utoyo *et al.* 2020).

When pursuing strategic entrepreneurship, large established firms face difficulties since their prevalent focus on ensuring their existing businesses' efficiency frequently impedes their continuous exploration of novel additional opportunities. Here, collaborative innovation can help established firms overcome these challenges: "Collaborative innovation is the creation of innovations across firm (and perhaps industry) boundaries through the sharing of ideas, knowledge, expertise, and opportunities." (Ketchen *et al.* 2007, p. 383; Miles *et al.* 2005)

In this regard, small and entrepreneurial firms like startups show strong opportunity-seeking skills, making them useful collaboration partners to pursue innovations for large established firms. Also, as startups may lack a wide variety of expertise and market power, inhibiting their enactment of competitive advantages necessary to appropriate value from pursued opportunities, startups are likewise interested in collaborating with established firms to benefit from their experience, and reputation (Ireland *et al.* 2003; Ireland and Webb 2007; Ketchen *et al.*

2007). Accordingly, collaborative innovation between established firms and startups can be a promising match and result in a win-win situation.

Yet, to aspire to positive outcomes of such collaborations, steering and, in more detail, an effective management controls system, is required. We will go into more detail about this system in the following section.

2.2. The object-of-control framework

Anthony (1965) defines management control as "[…] the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives" (p.17). Thus, organizational attention and efforts can be aligned with these objectives through management control. In this way, management controls shape actors' practices (Ahrens and Chapman 2007) and support corporate strategy (Kober *et al.* 2007; Langfield-Smith 1997). Vice versa, Davila *et al.* (2015) recognize corporate strategy as a significant factor in explaining the effectiveness of management controls. Likewise, Anthony (1965) characterized management control as a process of connecting strategic planning (setting long-term organizational goals) with operational control (evaluating specific assignments) (Goebel and Weißenberger 2017a).

While the early understanding of management control focused predominantly on performance measures related to financial accountability (Langfield-Smith 1997; Merchant and Otley 2007; Otley 1999), this conceptualization has been criticized and further refined to a more comprehensive framework including both formal and informal management controls, which combined are understood as a management controls system (Bisbe and Otley 2004; Flamholtz et al. 1985; Flamholtz 1996; Goebel and Weißenberger 2017a; Merchant and Van der Stede 2017).

It is generally acknowledged that formal and informal control mechanisms should not be analyzed in isolation and that firms combine both means of control in many different settings (Abernethy and Brownell 1997; Collier 2005). Therefore the need for understanding the effects of combinations of formal and informal controls is underlined in several studies (e.g., Epstein 2008). Here, some authors identify long-term competitive advantages and organizational success due to a well-designed and effective management controls system (Flamholtz 1995). As a foundation for achieving such an understanding in this study, we draw on the object-of-control framework (Merchant 1985; Merchant and Van der Stede 2017), which differentiates between formal (results and action controls) and more informal control mechanisms (personnel and cultural controls). This theoretically well-grounded framework builds on empirical research and

related seminal control categorizations (Merchant and Otley 2007; Ouchi 1977, 1979), is appropriate for identifying a diverse set of control forms in organizations, and is also easily accessible for study participants (Goebel and Weißenberger 2017a; Hutzschenreuter 2009).

Hence, the object-of-control framework combines sufficient stability (Sandelin 2008) with a broad coverage of control mechanisms, making it suitable for this study's purpose of identifying which particular controls lead to perceived management controls system effectiveness, translating into organizational performance (cf., Goebel and Weißenberger 2017a), in our case in the form of innovation success.

2.3. Agency and stewardship theory

Agency theory (Arrow 1985; Jensen and Meckling 1976; Ross 1973) assumes diverging interests between principal and agent, for which management controls system can provide an instrument for alignment (Chenhall 2003). In the case of our research, such diverging interests may also occur between the collaboration partners, namely the established company (the principal) and the startup (agent). Thus, agency theory provides the theoretical background to implement formal controls like results and action controls (e.g. Baiman 1990; Eisenhardt 1985, 1989; Goebel and Weißenberger 2017a) to ensure that the collaborating partner's behavior leads to the desired innovation success.

Focusing solely on agency theory, however, would ignore the complexity of work-related behaviors which leads to the need of complementing this purely economics-based viewpoint with a behavioral theory (Atkinson *et al.* 1997). Here, stewardship theory, which originated in sociology and psychology, promises to complement the focus on self-serving motives (Tosi *et al.* 2003; Davis *et al.* 1997). Applying agency and stewardship theory in the context of designing management control systems is also in line with Merchant *et al.* (2003) encouraging more cross-disciplinary research to bridge economic and behavioral theories. Goebel and Weißenberger (2017a) have already used both agency and stewardship theory in combination and confirmed that they offer complementary explanations for differing effects of management control mechanisms. Stewardship theory assumes that intrinsically motivated managers act in a way that can be considered pro-organizational. In the case of our study, this would mean acting in the common interest of the collaboration striving for innovation. In contrast to agency theory, the focus here lies on collective, instead of purely self-serving, motives. Such behavior is considered rational because of the greater utility of realizing collective objectives (Martynov 2009) or a sense of organizational purpose (Hernandez 2008). Stewardship behavior is facilitated through informal control mechanisms like personnel and cultural controls (Goebel and Weißenberger 2017a; Hernandez 2008). The complementary explanations of agency and

stewardship theory for the effects of different control mechanisms are promising for theoretically grounding our hypotheses development in the following.

2.4. The effect of innovation objectives in corporate strategy on innovation success

In the field of strategic entrepreneurship, researchers have earlier indicated the importance of corporate strategy for the realization of innovations (Kennedy *et al.* 2017; Utoyo *et al.* 2020). Innovativeness is also one key dimension of a strategic entrepreneurial orientation, which both startups and established firms can pursue to expand into new business areas and foster technological progress and innovation, as well as related wealth creation (Lumpkin and Dess 1996). Accordingly, given the connection between entrepreneurship and innovation which Schumpeter (1947) has already stressed, if firms decide to follow an entrepreneurial orientation, they are also prone to establish innovation objectives within their corporate strategy as part of this orientation. As Utoyo *et al.* (2020) have put it: "Entrepreneurial leadership is essential in formulating innovation strategy."

Such a strategic orientation including innovation objectives, in turn, seems to be beneficial for the respective firms' innovative performance. For instance, Zhou *et al.* (2005) find that an entrepreneurial orientation positively influences both technology- and market-based breakthrough innovations. For a group of high-tech small and medium enterprises (SMEs), Parida *et al.* (2012) were able to show a significant effect of inbound open innovation activities on innovation performance. In another study about manufacturing firms in Turkey, inter alia, innovation strategy explained financial performance (Karabulut 2015). Further researchers summarize their results by formulating that innovation strategy has a crucial impact on company performance, which they have empirically tested in Tunisian companies. Taking a closer look at their research, however, allows solely the conclusion that investment in R&D (their proxy for an innovation strategy) has a positive effect on the financial performance of companies (Ezzi and Jarboui 2016). Another research result, retrieved from data gathered in Turkish manufacturing firms, shows the relationship between organizational innovation and the innovative performance of a firm (Gunday *et al.* 2011). As Pisano (2015) stated, "[…] the problem with innovation improvement efforts is rooted in the lack of an innovation strategy" (p. 1). According to him, solely appropriate strategies promote alignment among diverse groups within an organization, clarify objectives and priorities, and help focus efforts around them. Based on the above argumentation and results, we therefore also hypothesize:

H1. *Innovation objectives within corporate strategy positively influence established firms' innovation success.*

2.5. The mediating role of interorganizational collaboration with startups

Based on the concept of collaborative innovation, we expect a certain mechanism through which strategic innovation objectives are related to innovation success. In particular, we assume startup collaborations to mediate the effect of the establishment of innovation objectives in corporate strategy on innovation success. While early work portrayed innovation as driven by organizations acting on their own, established firms nowadays strive for strategic renewal through collaborative innovation (Groote and Backmann 2020; Ketchen *et al.* 2007; Utoyo *et al.* 2020). Several authors elaborated on the concept of collaborative innovation as the creation of innovations across organizations which implies the sharing of ideas, knowledge, expertise, and opportunities (e.g. Miles *et al.* 2005). Thus, collaborative innovation may be a desirable outcome which is hard to achieve for large companies alone (Floyd and Lane 2000). Accordingly, interorganizational collaboration may supplement the internal innovative activities of companies (Hagedoorn 2002; Dodgson 1993) and positively influence their innovative performance (Rogers 2004; Baum *et al.* 2000). Faems *et al.* (2005) find that inter-organizational collaboration supports the effectiveness of innovation strategies.

Established companies increasingly collaborate with startups by absorbing and profiting from their innovative nature and optimistic opportunity-seeking attitude traditionally possessed. It is difficult to maintain such a mindset for established companies because of the common phenomenon of increasing bureaucratic procedures, complex structures, and rigid culture along with organizational growth (Floyd and Lane 2000; Ketchen *et al.* 2007). Therefore, provided an innovation objective within the corporate strategy of established firms, it stands to reason for them to collaborate with startups of the respective field for innovation generation. This can also be supported by the notion that the selection process for identifying collaborative or open innovation partners is related to the established firm's strategy (Groote and Backmann 2020). In the open or collaborative innovation context, startups can be promising partners for established firms to pursue radical innovations and novel technologies (Groote and Backmann 2020; Hyytinen *et al.* 2015; Jackson and Richter 2017; O'Connor 2006; Zingales 2000). By adopting external sources such as startups, established players can access innovative ideas and developments outside their organizations. In this way, they can decrease time to market and share risks and costs related to innovation with the involved startups (Weiblen and Chesbrough 2015).

Hence, collaborations with startups should be related to formulating innovation objectives in established firms' strategies.

Thus, we hypothesize:

H2. *Innovation objectives within corporate strategy positively influence established firms' interorganizational collaboration with startups.*

To explain the expected positive effects of established firm-startup collaborations on innovation success, the concept of collaborative innovation likewise focuses on the relations between the collaboration partners and how they influence their behavior and the collaborations' outcomes (Dyer and Nobeoka 2000). This relational perspective is important to identify the quality of collaboration and how it leads to innovation success since the type of collaborative innovation can make a difference (Tsai and Ghoshal 1998). In the case of two collaborating firms that are quite similar, meaning that they possess similar experiences and cultures, the innovation potential is comparably low. The opposite is the case when resources and assets of the collaboration partners are complementary, organizational processes are open and diversity of thought is welcomed (Granovetter 1973), as in the case of corporate-startup collaborations. Thus, the collaboration between established firms and startups with differing characteristics seems to be promising and may help overcome the respective challenges of established firms, in particular for achieving innovation.

As per the concept of strategic entrepreneurship, here, the opportunity-seeking activities of the startups, focusing on creating novel business models, products, and services, perfectly complement the already existing advantage-seeking activities of the established firms, helping the latter to innovate while remaining the efficiency of their existing business (Ireland *et al.* 2003; Ketchen *et al.* 2007; Utoyo *et al.* 2020). In a study about medium to large companies involved in collaborative ventures, Bucic and Ngo (2012) showed that inbound open innovation increases the overall innovativeness of companies. Based on the arguments and findings presented above, we hypothesize the following:

H3. *Interorganizational collaboration with startups positively influences established firms' innovation success.*

2.6. The effects of different controls on management controls system effectiveness

To achieve their strategic innovation objectives, we assume that different types of management controls are applied by established firms when entering into startup collaborations.

First, regarding formal control mechanisms affecting management control system effectiveness, some authors call results controls the backbone of a management control system (Otley 2006). They serve to define expectations, to monitor goal-attainment, and to provide feedback on employee performance (Van der Stede *et al.* 2006). Several authors underline the essential role of performance measures for an organization's strategy to lead to desired behaviors and results (Chenhall and Langfield-Smith 1998; Kaplan and Norton 2001). Accordingly, results controls may counteract control problems caused by a lack of direction or a lack of motivation (Merchant and Van der Stede 2017). Furthermore, they may be used as a basis for extrinsically rewarding employees based on their performance (Goebel and Weißenberger 2017a; Kominis and Emmanuel 2007).

Action controls, in turn, include elements like standard operating procedures with guidance on desirable behaviors, which may counteract a lack of direction (Merchant and Van der Stede 2017). Furthermore, negative effects can be reduced. Examples of negative effects may be personal limitations, which can be cushioned by integrating the expertise of supervisors or coworkers in defined processes and regular interactions (Goebel and Weißenberger 2017a; Merchant and Van der Stede 2017). Former studies have already confirmed hypotheses that formulated a positive relationship between action controls and higher levels of management controls system effectiveness (e.g., Cardinal 2001; Goebel and Weißenberger 2017a; Kihn 2007; Snell and Youngt 1995).

We thus formulate the following hypotheses:

H4a. *Established firms' results controls for collaborations with startups positively influence the management controls system effectiveness for these collaborations.*

H4b. *Established firms' action controls for collaborations with startups positively influence the management controls system effectiveness for these collaborations.*

Different from agency theory, stewardship theory further leads us to the relevance of more informal control mechanisms. Personnel and cultural controls can strengthen the intrinsic motivation of the involved staff and lead to desired behaviors (Merchant and Otley 2007; Merchant 1985). Both control types are characterized by reducing challenges that are derived from a lack of direction or personal limitations (Snell 1992). In our case, staffing for the best possible team responsible for the collaboration, as well as offering additional training options, would be examples of personnel controls (Goebel and Weißenberger 2017a).

Cultural controls are derived from norms and values which are considered relevant for the collaboration. They may further indirectly encourage desired behaviors (Goebel and Weißenberger 2017a). For instance, Chenhall *et al.* (2011) addressed the relationship between social networking, organic innovative culture and formal controls by gathering information from Russian CEOs. The mentioned authors concluded that all of these types of control mechanisms impact innovation but that companies focusing on a product differentiation strategy rely more on cultural controls. According to the argumentation and results above, our next hypotheses read as follows:

H4c. *Established firms' personnel controls for collaborations with startups positively influence the management controls system effectiveness for these collaborations.*

H4d. *Established firms' cultural controls for collaborations with startups positively influence the management controls system effectiveness for these collaborations.*

2.7. The effect of management controls system effectiveness on innovation success

Common control problems and undesired outcomes may be prevented by an effective management controls system which may "[…] increase the probability that the organization will achieve its goals" (Merchant and Van der Stede 2017, p. 6). Goebel and Weißenberger (2017a) underlined the releavance of management controls system effectiveness wich allows for a comprehensive view of management controls. Before, the different types of management controls were analyzed separately, and mainly with a focus on accounting-based controls (Malmi and Brown 2008; Widener 2007). As a consequence of concentrating on formal management controls, there has been only a limited understanding of the comprehensive impact of management controls (Tucker 2019).

In this context, a specific literature stream showed how a management controls system may help promote innovation (Bisbe and Otley 2004; Henri 2006; Widener 2007). A literature review on the effect of a management controls system on product innovation concluded that previous studies focused primarily on formal control systems and that most articles fail to provide an understanding of how combinations of control affect product innovation (Abdallah *et al.* 2019). Similarly, Lill *et al.* (2021) sum up the research results of 79 articles, published in the context of management controls system and innovation activities, and identify a major challenge for practitioners and scholars to design appropriate management controls balancing creativity and efficiency for innovation. Further, there has already been empirical evidence that the diversity of management control types positively influences firm performance (Van der

Stede *et al.* 2006). Also, Bieńkowska (2020) developed a controlling effectiveness model based on empirical data from organizations operating in Poland, wherein the quality of controlling is one of the relevant variables leading to increased organizational performance. Moreover, there is empirical backing from a study among companies headquartered in German-speaking countries that organizational performance is positively influenced by management controls system effectiveness (Goebel and Weißenberger 2017a). Thus, we assume that the latter link is also likely for a more specific form of organizational performance, namely innovation success. We, therefore, specify our final hypothesis as follows:

H5. *management controls system effectiveness in collaborations with startups positively influences established firms' innovation success.*

Our research model (see Figure B.1) gives an overview of the relevant variables, its relations, and the associated hypotheses.

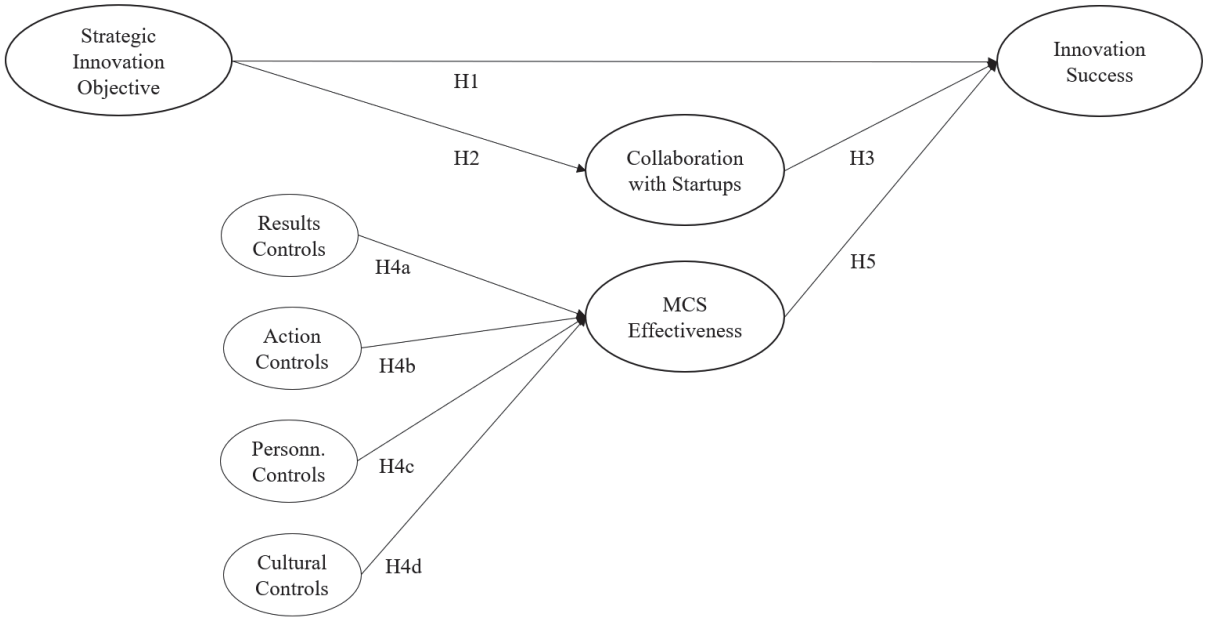


Figure B.1: Conceptual model

3. Method

3.1. Research design and sample

We gathered the data needed to test our hypotheses through a survey. We measured the constructs displayed in our research model as latent variables with multiple individual indicators and built on previously validated constructs derived from extant literature to enable

comparisons with prior research results. In some cases, we combined established scales. In some cases, we slightly adjusted scales regarding the context of collaboration between established and startup companies. The selection of constructs and the corresponding measurement items were discussed with academic experts for evaluation of clarity, specificity, and representativeness. We pretested our questionnaire with 14 researchers from the management accounting and entrepreneurship fields. They helped shape the structure and the questions toward clear distinctions between the constructs and refined the formulation of certain items. An additional three pre-testers from business practice were asked if the questions were easy to understand and if the whole setup of the questionnaire was good to handle.

We asked the participants to define their agreement with our items on a 6-point Likert scale (1=does not apply at all to 6=fully applies) or in the case of the measurement for collaboration the degree of occurrence (1=never applies to 6=mostly applies).

3.2. Measurement of variables

We measured *Strategic Innovation Objective* based on six items developed and tested by calling their construct 'strategic type', which in turn is based on Conant *et al.* (1990).*Collaboration with Startups* was measured by an adaptation of three items developed by Kahn and McDonough (1997), who researched collaboration between departments. To avoid the impact of the global COVID-pandemic, we asked our key informants for the firms' activities in 2019.

We measured *MCS (Management Control System) Effectiveness* with six adopted items from Goebel and Weißenberger (2017a). The main adjustment was related to our specification of management control activities in startup collaborations. Goebel and Weißenberger developed their items relying on constructs used by Kruis (2008), and Ferreira and Otley (2010), shaping the construct closely related to the theoretical propositions of the object-of-control framework (Merchant and Van der Stede 2017; Merchant 1985). They measure management control system effectiveness in terms of a control system's capability to address the three primary control problems in organizations, i.e., lack of direction, lack of motivation, and personal limitations. This measure focuses on the attainment of overall control goals (Kruis 2008).

We measure the four types of management control as follows: We measure the role of *Results Controls* by five items adapted from Goebel and Weißenberger (2017a). The items used were originally developed by Jaworski and MacInnis (1989) to evaluate the extent of 'output controls'. They were subsequently used in a variety of empirical studies (e.g., Jaworski and Kohli 1993; Cravens *et al.* 2004; Hutzschenreuter 2009). Overall, this measure reflects the definition and subsequent evaluation of performance goals.

Action Controls are measured by three items, as well adapted from Goebel and Weißenberger (2017a). They conceptualized action controls by relying on constructs to measure behavior control used by Jaworski and MacInnis (1989) and Hutzschenreuter (2009).

Personnel Controls are measured by four adapted items from Goebel and Weißenberger (2017a). They assessed their construct by a measurement instrument derived from Hutzschenreuter (2009) that builds on initial conceptualizations of input controls from Snell (1992). Further, they included an item used by Wargitsch (2010) to evaluate specific objectives of employee selection processes that contribute to successful employee socialization.

Cultural Controls are measured by five adapted items from Goebel and Weißenberger (2017a). They combined indicators from Wargitsch (2010), which build on Ouchi (1979) 'clan control' definition, and additional indicators from a construct used by Widener (2007) to assess an organization's 'belief system'. This construct thus captures the scope of shared norms, beliefs, and values that can influence the behavior of people involved in the collaboration.

They combined items from Widener (2007) and Wargitsch (2010), which build on Ouchi's (1979) 'clan control' definition. This measurement instrument thus captures the scope of shared norms, beliefs, and values that can influence the behavior of people involved in the collaboration.

Innovation Success is measured by three items adapted from Nitzsche *et al.* (2016). Partly, these have been used in previous studies, for example by Dyer and Song (1998a), analyzing 'business performance' and Song (1998) looking at 'new product development effectiveness'. Furthermore, Nitzsche *et al.* (2016) integrated extensions from Balachandra and Friar (1997) and Rese and Baier (2011).

For the detailed wording of the items and their origin see Table B.1.

3.3. Sample characteristics

To learn about the interrelationships of strategy, collaboration, management controls, and innovation success, we quantitatively analyzed the experiences of key informants from established companies. We ensured that our key informants were responsible for collaborations with startups within their organization.

To identify our key informants, we first needed to come up with a sample of companies that are collaborating with startups, and which are striving for joint innovation success. To the best of our knowledge, however, there is no public information available to identify companies with these objectives on a large scale. We, therefore, formed our sample in several steps of approximation. First, we retrieved a list of companies from the database Crunchbase (2019).

Companies on this list were characterized by a founding date more than 10 years in the past (hereafter labeled as established companies), and by having acquired at least one company younger than 10 years (hereafter labeled as a startup or startup company). The acquisition criterion was used because of the lack of information about actual collaborations between established and startup companies. We used the acquisition criterion because of the availability of these characteristics in Crunchbase and because of it being as closely related to the subject matter as possible. Here, we assume that companies which have already acquired startups may be generally interested in startups and related collaborations. To ensure that each company participating in our survey has not just acquired but collaborated with startups, we have clarified this point for each company before participation.

Second, to limit potential biases caused by cultural differences (Hartmann 2005), we added a geographical selection criterion. We, therefore, included only companies that are headquartered in one of the culturally comparable countries Germany, Switzerland, and Austria. We further excluded companies from the so-called FIRE sectors (Finance, Insurance, and Real Estate), following e.g. Goebel and Weißenberger (2017a), due to their divergent regulatory environments and specific business models.

After these steps of selection, we formed a population of 939 companies appropriate for participation. We then tried to identify a person responsible for either startup collaborations directly or innovation activities in a broader sense. Additionally, we research the person responsible for financial and/or management accounting. We approached them via mail one after another and offered, when agreeing to participate in our study, to send an individual benchmarking report showing the results of our research as an expression of thanking them for their participation. When showing interest, we set up a phone- or video-call to explain the research endeavor and to assure that the company collaborates with startups in the sense we are interested in and that the person answering our questionnaire is well-informed about the collaboration in general, the management controls involved, and the degree of success deriving from their collaborations. These four final criteria were also double-checked on the first page of our questionnaire. To be more precise, we asked the participants, before answering the core questions of our research to verify if the following took place or not within the last year: reaching joint objectives with startups, sharing ideas with startups, sharing information with startups, sharing resources with startups, and collaborating as a team with startups. They were further asked if they collaborated in the form of joint ventures, licensing agreements, marketing- and sales cooperations, research and development cooperations, incubator programs, accelerator programs, or corporate venturing.

3.4. Data collection

The questionnaire was structured in 8 sections, comprising 23 questions concerning our research topic and 11 questions to better understand the background of our sample and our data.

To minimize social desirability bias in measuring our constructs, we asked respondents to answer the questions as honestly as possible. To encourage them to respond without fear of reprisals, they were informed that their responses would not be connected to their companies and that their answers would be anonymously analyzed solely by one of the three involved authors. Before answering the first question, they were informed about our processes for data protection.

Data collection took place from December 2020 to March 2022. Finally, a total of 46 companies participated in our study (for descriptive statistics about the respondents and their companies see Table B.2).

3.5. Data analysis

We analyze our survey data based on structural equation modeling (SEM). SEM is a useful methodology for analyzing survey data due to its ability to handle complex relationships and multiple variables (Weijters 2021). We specifically applied the method of partial least squares SEM (PLS-SEM). Different from covariance-based SEM, PLS-SEM is a variance-based approach generally used for the explorative identification of relationships (Hair *et al.* 2017). It is therefore quite suitable for research areas with less comprehensive theoretical foundations (Reinartz *et al.* 2009). For long, this has been a pervasive characteristic of researching management control systems (Malmi and Brown 2008). Smith and Langfield-Smith (2004) even call the PLS approach to be tailor-made for management accounting research. Furthermore, the PLS technique constitutes a non-parametric approach, meaning that it does not rely on normally distributed data (Henseler *et al.* 2009) and is capable of simultaneously calculating interrelationships between different constructs and test for mediations by bootstrapping (Hair *et al.* 2017). For the research at hand another advantage is quite relevant the suitability of PLS-SEM: Being able to calculate with data from rather small samples (Henseler *et al.* 2009), we were able to receive higher levels of statistical power compared to covariance-based approaches (Reinartz *et al.* 2009). Barclay *et al.* (1995) formulated for PLS-SEM the basic rule that sample sizes need to exceed 10 times the maximum number of exogenous constructs loading on an endogenous construct, meaning structural paths loading on a specific construct. This requirement is fulfilled, considering the four different types of controls which are loading on the

endogenous construct MSC Effectiveness, resulting in a minimum sample size of 10 x 4 = 40, which we exceed with 46 participants.

Using SmartPLS 4, we estimated the model's parameters, applying a path weighting scheme with 300 iterations and a stop criterion of 10^{-7} (Hair *et al.* 2013). We further used a nonparametric bootstrapping procedure (no sign changes) with 500 subsamples, one-tailed.

To validate the measurement model, we evaluated our reflective constructs by assessing the internal consistency, the convergent and discriminant validity as well as the indicator and construct reliability (Goetz *et al.* 2010).

Some items were eliminated because their absence increased the composite reliability of the construct. Overall, most of the items were considered suitable for measuring the constructs of our research model, so we can assume indicator reliability. For measuring innovation strategy, we eliminated one item, for collaboration with startups two items, another two items we took out of the construct for action controls, one for cultural controls, and two for measuring innovation success. We retained 35 items for further analysis. In Table B.2 the measurement model results are shown, including the loadings of the remaining items as well as additional statistical information and the values of the composite reliability, the average variance extracted (AVE), and the significance of each item.

Here, for all constructs, composite reliability-estimates exceeded the standards of 0.7. The values for AVE were all above the required 0.5, with one exception: 0.434 for the strategic innovation objective. Since its value for Cronbach's Alpha was quite high with 0.828 and a composite reliability of 0.814, the value for AVE is considered acceptable. In sum, these results indicate internal consistency (Hair *et al.* 2013).

We further controlled for common method bias, which is especially relevant in research in which the data for independent and dependent variables are obtained from a single informant, as is the case for the research herein. We applied Harman's single-factor test to assess common method variance's possible impact. Here, no single factor was indicated to explain more than half of the variance. We further verified that none of our variance inflation factors is greater than 3.3. Its occurrence would stand for a proposed indication of pathological collinearity and an indication that our model may be contaminated by common method bias (Kock 2015).

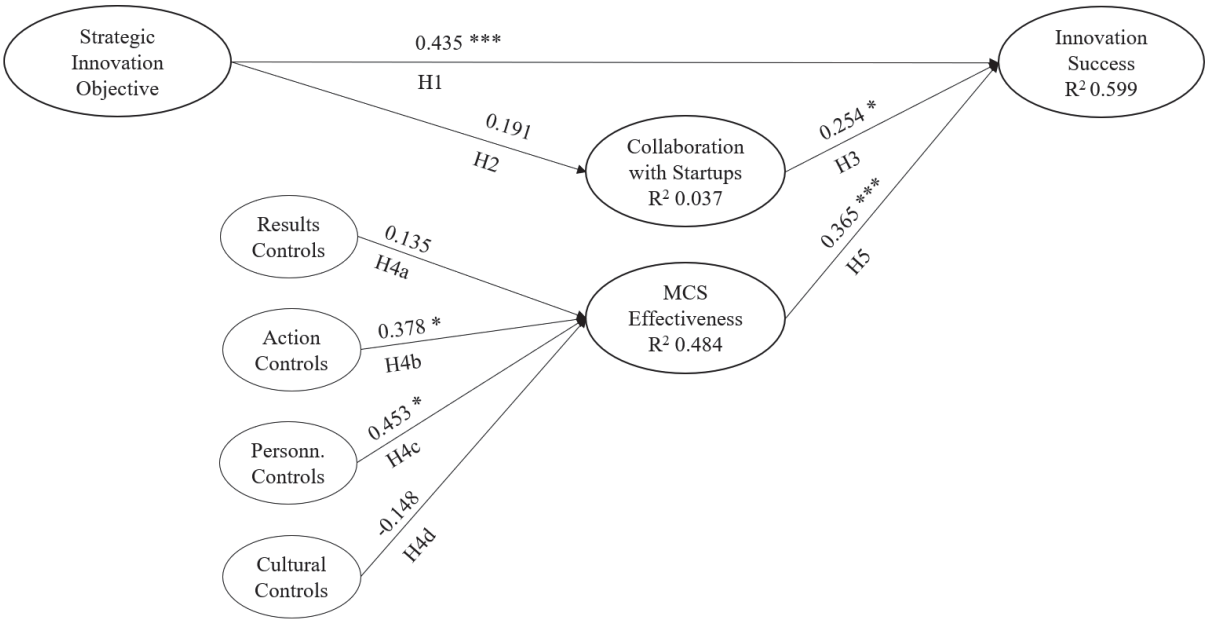
Discriminant validity was confirmed using two methods: (1) examining construct intercorrelations (MacKenzie *et al.* 2005) and (2) examining whether the AVE for each construct is greater than the square of the correlation between the constructs (Fornell and Larcker 1981). Since the square root of the AVE exceeds the intercorrelations between the construct and the other constructs, discriminant validity can be assumed. To validate this further, the cross-

loadings were verified not to be higher than the loadings. The heterotrait-monotrait values of all construct pairs were well below the conservative threshold of 0.85. To confirm this even alternatively, we examined whether the heterotrait-monotrait values differed significantly from 1 by calculating the bias-corrected bootstrap confidence intervals. The 95% confidence intervals did not include 1 in any of the construct pairs (see Table B.4). This additional test was applied because of the shortcomings of the established tests (the Fornell-Larcker criterion and the cross-loadings).

At the structural model level, the results confirmed a good fit of the estimations with the data, as the R^2 value for innovation success, was 0.599, for collaboration with startups 0.037, and management controls system effectiveness 0.484. According to Hair *et al.* (2011), the values for innovation success and management controls system effectiveness are considered moderate and, thus, satisfying. When assessing the structural model for collinearity issues, one variance inflation factor value turns out to be below 1.1 and seven between 1.1. and 2.8. Variance inflation factor values higher than 5.0 indicate multicollinearity (Hair *et al.* 2011), which means that our values indicate collinearity.

4. Results

Summarizing our findings, we identify the significant effects of an innovation strategy and collaboration on innovation success. Another factor relevant to achieve innovation success seems to be the effectiveness of how the collaboration with startups is managed. Here, we analyze four different types of management controls in place and find differing results between the four. Action controls have a direct significant effect on the effectiveness of management control systems. Furthermore, the effectiveness of management control systems has a mediating effect between action controls and innovation success. Similar effects arise for personnel controls. Figure B.2 shows our SEM results with the identified significant effects, which are explained in more detail in the following paragraphs.



*Level of significance: † p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001 (one-tailed); n.s. stands for not statistically significant; all β coefficients are standardized.*

Figure B.2: SEM results

With our first hypothesis, we proposed a direct positive effect of innovation objectives within corporate strategy on innovation success. Our data confirm this relationship on the highest possible level of significance ($\beta = 0.435$; $p < 0.001$). In H2, we proposed that innovation objectives within corporate strategy positively influence interorganizational collaboration with startups. Here, our data showed no significant effect ($\beta = 0.191$; n.s.), meaning that we were not able to confirm this hypothesis. We imagine that having an innovation strategy in place can lead to a wide range of operational implementations of which the collaboration of startups can be only one. Related to H3, we expected a positive influence of interorganizational collaboration with startups on innovation success. Here, we were able to confirm our hypothesis ($\beta = 0.254$; $p < 0.05$). This effect is not considered a mediating effect because of the missing relationship between innovation strategy and collaboration with startups.

With the subsequent four hypotheses, we formulate expectations on how different types of management controls influence management controls system effectiveness in collaborations with startups. Interestingly, we find that (H4b) action controls ($\beta = 0.378$; $p < 0.05$). and (H4c) personnel controls ($\beta = 0.453$; $p < 0.05$) significantly influence the effectiveness of management control systems. We are not able to show such an effect for (H4a) results controls ($\beta = 0.135$; n.s.) and (H4d) cultural controls ($\beta = -0.148$; n.s.). We further identify a mediating effect of management controls system effectiveness in the relation between action controls and innovation success ($\beta = 0.138$; $p < 0.05$). Likewise, we are able to show a mediating effect of

management controls system effectiveness in the relation between personnel controls and innovation success ($\beta = 0.165$; $p < 0.05$). In this way, we are also able to confirm our fifth hypothesis, assuming the positive relationship between management controls system effectiveness for the collaboration with startups and innovation success ($\beta = 0.365$; $p < 0.001$). Here, our data show a highly significant effect. In terms of non-hypothesized effects and the related control variables examined by us, please see Table B.3 for the respective results.

5. Discussion

We find evidence for a significant effect of an innovation strategy and collaboration on innovation success. Furthermore, we identify the effectiveness of how the collaboration with startups is managed to be relevant. Analyzing four different types of management control, we find differing results between the four. Action and personnel controls have a direct significant effect on the effectiveness of management control systems. Furthermore, the effectiveness of management controls system has a mediating effect between action controls and innovation success, as well as between personnel controls and innovation success.

Within the object-of framework by Merchant and Van der Stede (2017), action and results controls are considered formal controls while personnel and cultural controls are considered informal controls. Our results do not allow for a conclusion on whether informal or formal controls in general have a higher relevance in startup collaborations. While Goebel and Weißenberger (2017b) strengthened the role of informal controls (effecting organizational performance via an ethical work climate and trust), the innovation success investigated in our study rather seems to be influenced by the specific types of management control applied than by the decision for formal or informal controls. Another commonly used distinction between different management controls are ex-ante and ex-post control mechanisms (Snell 1992), representing opposite ends of the control spectrum. Personnel controls typically function as ex-ante control mechanisms that "[…] regulate the antecedent conditions of performance" (Snell 1992, p. 297). These controls are normally centered on activities ensuring that personnel will perform at a high level and, in the context of our research, in congruence with the goals of the collaboration (Merchant 1985; Peck 1994). Widener (2004) concluded from her survey with respondents from companies from a variety of sectors that ex-ante control mechanisms, like personnel controls, may prevent opportunistic behavior deriving from behavioral uncertainty that is difficult to control ex-post. These relationships support the findings of Abernethy and Brownell (1997) that personnel controls are effective in circumstances with high behavioral uncertainty or task uncertainty.

In contrast, results controls serve as an ex-post control mechanism for the regulation of results (Snell 1992). Introducing another distinction between types of management control, Sandino (2007) suggests concentrating on non-financial management control systems to implement strategies involving high levels of uncertainty. While this reasoning is relevant for our research context as well, as innovation processes are mostly characterized by a high level of uncertainty, Van der Stede *et al.* (2006) characterize the different nuances of results controls in even more detail. They distinguish not only between financial and non-financial results controls, as increasingly applied in the scientific discourse, but carve out the differences between objective and subjective performance measures. Since we did not apply this distinction in our research, our non-significant result may be rooted in the missing identification of whether subjectivity in results controls plays a role in the management control practices of the companies in our research sample.

The fact that we were not able to find a significant effect of results controls on management controls system effectiveness for collaborative innovation, is further in line with former research indicating that results controls are particularly valuable if the characteristics of envisaged performance can be defined and measured precisely (Snell 1992; Eisenhardt 1985; Ouchi 1977), which is rarely the case in innovation contexts. Nevertheless, results controls or high formalization of performance measurement remain to play a controversial role in innovation management. There has only recently been a research result, based on the data of European multi-industry companies, that high formalization together with high scores in social connectedness improves a company's ability to radically innovate (Pinter *et al.* 2023).

5.1. Theoretical implications

This study contributes to extant research in three major ways. First, we contribute to the strategic entrepreneurship and collaborative innovation literature by showing that the collaboration between established firms and startups can lead to innovation success. So far, research in this field has either focused on the impact of the partner selection process on collaboration success, the significance of, the motivations for, or the success factors of open innovation (Groote and Backmann 2020; Solesvik and Gulbrandsen 2013). Yet, while there have been previous qualitative research endeavours exploring the innovation success of corporate-startup collaborations (e.g., Groote and Backmann 2020), to the best of our knowledge, a comparable quantitative-empirical study focusing on the relationship between strategy and innovation success, with a focus on management control of corporate-startup collaborations has not been conducted so far.

Second, based on the object-of-control framework by Merchant and Van der Stede (2017) and its mapping of control types into formal results and action controls vs. informal personnel and cultural controls, we adjust the existing scales surveying the use of these controls for steering corporate-startup collaborations in an integrated way. In this way, we extend and complement the use of the object-of-control framework and partially confirm its applicability in the specific context of management controls for corporate-startup collaborations. In this way, we also answer the call for research by Caglio and Ditillo (2021) who state that additional research is needed about management controls for collaboration between firms aiming at innovation and offer a basis for designing effective management control systems (Malmi and Brown 2008; Bisbe and Otley 2004), in this particular research context. Here, we also add evidence to the limited body of knowledge regarding different types of management control and their relative effect on envisaged outcomes (Goebel and Weißenberger 2017a). This contribution is also valuable for the scientific discussion because of missing research results about how management control systems function as a connection between strategy and innovation (Chenhall *et al.* 2011). As our research model includes management controls system effectiveness as a whole and more specifically two different types of management control influencing and two different types not influencing this effectiveness, we address calls for researching broader concepts of management controls by analyzing how different types of management controls operate as a package (e.g. Malmi and Brown 2008; Chenhall 2003). As a consequence, we counteract fragmented analyses of single management controls. This is valuable because fragmented approaches may reduce the validity and reliability of empirical research results, which may arise from "[…] serious model underspecification" (Chenhall 2003, p. 131).

Third, building on Goebel and Weißenberger (2017a), we answer Merchant *et al.*'s (2003) call for more cross-disciplinary research that bridges single paradigms by linking economic and behavioral theories. With the research at hand, we can affirm that agency and stewardship theory offer complementary explanations for a better understanding of the effects of management controls, in our case for corporate-startup collaborations aiming at innovation success.

5.2. Practical implications

Decision makers in established companies may learn from our results in several ways: First, our findings underline the relevance of strategic objectives for innovations. Second, we were able to show that collaborating with startups has a direct positive effect on innovation success, which leads to a scientific backing of this type of collaboration – here, we consider our results as one of the firsts of this kind. Although collaborating with startups has become a commonly

used instrument, there is still an ongoing debate on the actual effects (Doerner *et al.* 2020). Thirdly, we point to the importance of effective management controls system, with action and personnel controls being the most relevant.

To have an effective way of steering collaborations leading to innovation success, is of course something decision-makers are striving for. Having the scientific backing that effective management controls system have an impact on the actual innovation success may be relevant in assigning an even higher level of importance to designing and implementing management controls. We find that action controls directly affect management system control effectiveness. Practical examples of action controls are joint definitions of the most important work steps, as well as reviewing the necessary steps for goal attainment. This may include the revision of timelines, work packages, and the like.

Furthermore, we identify personnel controls to be relevant for an effective management control system. From the questions asked, we can give the following examples for personnel controls: the careful selection of the people involved in the collaboration, training, and development activities for the collaborating team, and providing general opportunities to broaden personnel's range of skills. Overall, we asked whether the company developed the right processes to do so and ensures that everyone involved in the collaboration acts in line with the relevant standards and values.

Asking for innovation success, we focus on whether their company's innovative strength is higher than that of their competitors, whether the level of quality of their new products and services is more sophisticated, and if they are considering their positioning as being especially innovative in their competitive situation to be strong.

5.3. Limitations and future research

Our work is also subject to certain limitations, many of which can provide the basis for further investigations. The desirable population for investigating our study's hypotheses would consist of all established firms collaborating with startups aiming for innovation. Because of the lack of related statistics or databases leading us to identify these companies, we had to accept that we could only approximately identify a population. In doing so, we took every effort to approach an adequate population and correspondingly identify our sample (cf., Bronnenmayer *et al.* 2016).

The final size of our sample is limited in quantitative terms. However, it is a high-quality sample, given that the participating key informants are well-experienced managers, with an

assured background of being responsible for collaborations with startups in their respective companies, and with experiences in steering these collaborations.

While we only approached our key informants at one point in time, it would make sense to conduct longitudinal studies in the future given that the collaboration between established firms and startups is a dynamic process in which the way collaboration takes place and success is achieved, differs from year to year. This is especially interesting when keeping in mind that our method and tests implicitly assume that the companies in our sample are in equilibrium. It is quite probable, though, that some of them are in the process of modifying their strategies and management controls system. Here, some companies achieve better matches in their strategy-management fit, and accordingly in their performance, showing solely a specific moment in time instead of general characteristics (Moores and Yuen 2001). Future research that uses longitudinal data and/or can capture identifiable changes in innovation objectives and management controls system to steer collaborations would help to address this issue.

Another limitation may be our reliance on perceptual data because information regarding a company's control mechanisms is not publicly available. Here, our results underly commonly mentioned shortcomings of questionnaire-based survey studies, e.g., individual respondents' subjectivity and social desirability issues. This might be especially relevant for measuring the effectiveness of management controls system and innovation success. Compared to subjective concerns on this matter there is research emphasizing that self-ratings might be less biased than commonly expected because they tend to be highly correlated with objective measures (Venkatraman *et al.* 1987).

A possible constraint of our study may further be endogeneity. This might occur due to omitted variables but also due to potential simultaneity. We concluded that collaboration with startups has a positive effect on innovation success. There might also be a reverse relation as once innovation success is considered relevant for a certain company, they may want to try maintaining it by collaborating with startups. Even though we took care of an a priori theoretical specification of the relationships between our constructs, it would be presumptuous to assume that we can unambiguously differentiate cause-and-effect relations empirically in a cross-sectional study (Van der Stede *et al.* 2005).

Another limitation relates to the non-significant findings of our research, which we are interpreting cautiously. As null-hypotheses testing is largely dependent on sample size, it might be possible that if we would enhance our sample, we would find more significant results. Authors like Trapp *et al.* (2018), Schaltegger *et al.* (2012), and Anwar (2018) differentiate between the innovation of products and services (which we focused on in our research) and business

model innovation. For the latter, Schaltegger *et al.* (2012) created a framework that could be included in future research to get the full picture of innovation activities and related innovation success.

Since we focused on the culturally largely homogenous countries Germany, Austria, and Switzerland for generating our sample, we suggest future studies extend this scope to other cultural contexts. While we decided to analyze collaborations in different industries, which makes our results more generalizable, another research approach would be to focus on only one industry and thus generate a more homogeneous sample to allow for generating more distinct implications and recommendations. We also recommend applying experimental designs for researching the topic since endogeneity is not an issue in experiments in which participants are randomly assigned to different research scenarios.

As described in more detail in the results section, we call for research that further distinguishes management control in terms of ex-ante and ex-post (Snell 1992), as well as in terms of objectively and subjectively determined (e.g., Van der Stede *et al.* 2006; Moers 2005; Gibbs *et al.* 2004).

Having identified action and personnel controls to be significantly relevant for management controls system effectiveness and indirectly for innovation success, our data does not allow for explaining *why* these two types of management control have the observed effects. We feel that this would be an important avenue for future research, especially to inform decision-makers in charge of setting up management control systems. For them, there is a need for justification towards the top level as well as to their team members to explain why certain management controls are operational in the company and why these are promising for successfully collaborating with startups. Future qualitative interview studies may be helpful in this regard.

6. Conclusion

This study study empirically supports significant relationships of (1) the strategic orientation as well as (2) the corporate-startup collaboration by itself on innovation success. Further, (3) management controls system effectiveness significantly impacts innovation success and is more specifically influenced by (4) action control and (5) personnel control. Information was retrieved from a high-level sample of decision-makers from established companies, involved in setting up and managing startup collaborations. Data was collected through a standardized survey and analyzed by structural equation modeling. With our results we contribute to a growing stream of literature that analyzes the effects of different control system elements to avoid potential biases due to research models which can be considered partial or incomplete (Goebel

and Weißenberger 2017a). We applied the theoretically well-grounded framework by Merchant and Van der Stede (2017) that captures different types of management controls which, apart from Goebel and Weißenberger (2017a), have so far been rather researched in single organizations (e.g., Chenhall *et al.* 2010; Mundy 2010; Sandelin 2008) or in the context of single countries like Russia (Chenhall *et al.* 2011). In none of these studies the interorganizational context of making use of management controls was considered.

The results highlight the importance of an innovation strategy and interorganizational collaboration in the first place, but also the relevance of an effective management controls system for such collaborations. Here, certain types of management controls have a stronger effect on management controls system effectiveness and innovation success than others. Future research could focus on the different types of management control in more detail and elaborate on reasons for the differing effect. While this research solely analyzed innovation of products and services, we also welcome research projects which include business model innovation into their scope of analyzing innovation activities.

References

Abdallah, A, A Farghaly and Ae Sebaay, (2019). The Effect of Management Control Systems and Practices on Product Innovation: Literature Review. *SSRN Electronic Journal*, Available at SSRN 3334327.

Abernethy, MA and P Brownell, (1997). Management control systems in research and development organizations: The role of accounting, behavior and personnel controls. *Accounting, Organizations and Society*, 22(3-4), 233–248.

Aghion, P, N Bloom, R Blundell, R Griffith and P Howitt, (2005). Competition and Innovation: an Inverted-U Relationship. *The Quarterly Journal of Economics*, 120(2), 701–728.

Ahrens, T and CS Chapman, (2007). Management accounting as practice. *Accounting, Organizations and Society*, 32(1-2), 1–27.

Alvarez, SA and JB Barney, (2001). How Entrepreneurial Firms Can Benefit from Alliances with Large Partners. *The Academy of Management Executives*, 15(1), 139–148.

Amit, R and C Zott, (2001). Value creation in E-business. *Strategic Management Journal*, 22(6-7), 493–520.

Anthony, RN, (1965). *Planning and control systems: a framework for analysis*. Harvard Business Review Press.

Anwar, M, (2018). Business model innovation an SMEs performance — Does competitive advantage mediate? *International Journal of Innovation Management*, 22(07), 1850057.

Arrow, KJ, (1985). The economics of agency. In: JW Pratt and RJ Zeckhauser, eds. *Principals and Agents: The Structure of Business.* Harvard Business Review Press, Boston, Massachusetts, 37–54.

Atkinson, AA, R Balakrishnan, P Booth, T Groot, T Malmi, H Roberts, E Uliana and A Wu, (1997). New Directions in Management Accounting Research. *Journal of Management Accounting Research*, 9(1), 79–108.

Baiman, S, (1990). Agency research in managerial accounting: A second look. *Accounting, Organizations and Society*, 15(4), 341-371.

Balachandra, R and JH Friar, (1997). Factors for success in R&D projects and new product innovation: a contextual framework. *IEEE Transactions on Engineering Management*, 44(3), 276–287.

Barclay, DW, CA Higgins and R Thompson, (1995). The partial least squares approach to causal modeling: Personal computer adoption and use as illustration. *Technology Studies*, 2, 285–309.

Baum, JAC, T Calabrese and BS Silverman, (2000). Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology. *Strategic Management Journal*, 21(3), 267–294.

Bieńkowska, A, (2020). Controlling Effectiveness Model — empirical research results regarding the influence of controlling on organisational performance. *Engineering Management in Production and Services*, 12(3), 28–42.

Bisbe, J and D Otley, (2004). The effects of the interactive use of management control systems on product innovation. *Accounting, Organizations and Society*, 29(8), 709–737.

Bronnenmayer, M, BW Wirtz and V Goettel, (2016). Success factors of management consulting. *Review of Managerial Science*, 10(1), 1–34.

Bucic, T and LV Ngo, (2012). Examining drivers of collaborative inbound open innovation: empirical evidence from Australian firms. *International Journal of Innovation Management*, 16(04), 1250017.

Cardinal, LB, (2001). Technological Innovation in the Pharmaceutical Industry: The Use of Organizational Control in Managing Research and Development. *Organization Science*, 12(1), 19–36.

Chenhall, RH, (2003). Management control systems design within its organizational context: findings from contingency-based research and directions for the future. *Accounting, Organizations and Society*, 28(2-3), 127–168.

Chenhall, RH, M Hall and D Smith, (2010). Social capital and management control systems: A study of a non-government organization. *Accounting, Organizations and Society*, 35(8), 737–756.

Chenhall, RH, J-P Kallunki and H Silvola, (2011). Exploring the Relationships between Strategy, Innovation, and Management Control Systems: The Roles of Social Networking, Organic Innovative Culture, and Formal Controls. *Journal of Management Accounting Research*, 23(1), 99–128.

Chenhall, RH and K Langfield-Smith, (1998). The relationship between strategic priorities, management techniques and management accounting: an empirical investigation using a systems approach. *Accounting, Organizations and Society*, 23(3), 243–264.

Christensen, JF, MH Olesen and JS Kjaer, (2005). The industrial dynamics of Open Innovation -Evidence from the transformation of consumer electronics. *Research Policy*, 34(1), 1533–1549.

Collier, PM, (2005). Entrepreneurial control and the construction of a relevant accounting. *Management Accounting Research*, 16(3), 321–339.

Conant, JS, MP Mokwa and RP Varadarajan, (1990). Strategic Types, Distinctive Marketing Competencies and Organizational Performance: A Multiple Measures-Based Study. *Strategic Management Journal*, 11(5), 365–383.

Cravens, DW, FG Lassk, GS Low, GW Marshall and WC Moncrief, (2004). Formal and informal management control combinations in sales organizations The impact on salesperson consequences. *Journal of Business Research*, 57, 241–248.

Criscuolo, P, N Nicolaou and A Salter, (2012). The elixir (or burden) of youth? Exploring differences in innovation between startups and established firms. *Research Policy*, 41(2), 319–333.

Crunchbase, (2019). Sustainability Startups, https://www.crunchbase.com/hub/sustainability-startups#section-overview, accessed August 20, 2019.

Das, TK and IY He, (2006). Entrepreneurial firms in search of established partners: Review and recommendations. *IInternational Journal of Entrepreneurial Behavior & Research*, 12, 114–143.

Davila, A, G Foster and N Jia, (2015). The Valuation of Management Control Systems in Startup Companies: International Field-Based Evidence. *European Accounting Review*, 24(2), 207–239.

Davis, JH, FD Schoorman and L Donaldson, (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20–47.

Dent, JF, (1990). Strategy, organization and control: Some possibilities for accounting research. *Accounting, Organizations and Society*, 15(1-2), 3–25.

Dodgson, M, (1993). *Technological Collaboration in Industry: Strategy, Policy, and Internationalization in Innovation*. Routledge, London.

Doerner, K, M Floetotto, T Henz and T Strålin, (2020). *You can't buy love. Reimagining corporate-startup partnerships in the DACH region*.

Dyer, B and XM Song, (1998a). Innovation Strategy and Sanctioned Conflict: A New Edge in Innovation? *Journal of Product Innovation Management*, 15(6), 505–519.

Dyer, JH and K Nobeoka, (2000). Creating and managing a high-performance knowledge-sharing network: the Toyota case. *Strategic Management Journal*, 21(3), 345–367.

Eisenhardt, KM, (1985). Control: Organizational and Economic Approaches. *Management Science*, 31(2), 134–149.

Eisenhardt, KM, (1989). Agency Theory: An Assessment and Review. *Academy of Management Review*, 14(1), 57–74.

Eisenhardt, KM and CB Schoonhoven, (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science*, 7, 136–150.

Emden, Z, RJ Calantone and C Droge, (2006). Collaborating for new product development: Selecting the partner with maximum potential to create value. *Journal of Product Innovation Management*, 23, 330–341.

Epstein, MJ, (2008). Aligning, measuring, and rewarding performance in complex organizations. In: MJ Epstein and J-F Manzoni, eds. *Performance measurement and management control: measuring and rewarding performance.* Emerald Group Publishing, Bingley, 3–17.

Ezzi, F and A Jarboui, (2016). Does innovation strategy affect financial, social and environmental performance? *Journal of Economics, Finance and Administrative Science*, 21(40), 14–24.

Faems, D, B van Looy and K Debackere, (2005). Interorganizational Collaboration and Innovation: Toward a Portfolio Approach*. *Journal of Product Innovation Management*, 22(3), 238–250.

Ferreira, A and DT Otley, (2010). *Management control systems: an empirical analysis of the relationship between design, use, and performance*.

Flamholtz, E, (1995). Managing organizational transitions: Implications for corporate and human resource management. *European Management Journal*, 13(1), 39–51.

Flamholtz, E, (1996). Effective organizational control: A framework, applications, and implications. *European Management Journal*, 14(6), 596–611.

Flamholtz, EG, TK Das and AS Tsui, (1985). Toward an integrative framework of organizational control. *Accounting, Organizations and Society*, 10(1), 35–50.

Floyd, SW and PJ Lane, (2000). Strategizing throughout the Organization: Managing Role Conflict in Strategic Renewal. *The Academy of Management Review*, 25(1), 154–177.

Fornell, C and DF Larcker, (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39–50.

Gibbs, M, KA Merchant, WA Van der Stede and ME Vargus, (2004). Determinants and Effects of Subjectivity in Incentives. *The Accounting Review*, 79(2), 409–436.

Goebel, S and BE Weißenberger, (2017a). Effects of management control mechanisms: towards a more comprehensive analysis. *Journal of Business Economics*, 87(2), 185–219.

Goebel, S and BE Weißenberger, (2017b). The Relationship Between Informal Controls, Ethical Work Climates, and Organizational Performance. *Journal of Business Ethics*, 141(3), 505–528.

Goetz, O, K Liehr-Gobbers and M Krafft, (2010). Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In: V Esposito Vinzi, WW Chin, J Henseler and H Wang, eds. *Handbook of Partial Least Squares.* Springer Berlin Heidelberg, Berlin, Heidelberg, 691–711.

Granovetter, MS, (1973). The Strength of Weak Ties. *American Journal of Sociology*, 78(6), 1360–1380.

Groote, JK de and J Backmann, (2020). Initiating open innovation collaborations between incumbents and startups: How can David and Goliath get along? *International Journal of Innovation Management*, 24(02), 2050011.

Gunday, G, G Ulusoy, K Kilic and L Alpkan, (2011). Effects of innovation types on firm performance. *International Journal of Production Economics*, 133(2), 662–676.

Hagedoorn, J, (2002). Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. *Research Policy*, 31(4), 477–492.

Hair, JF, GTM Hult and CM Ringle, (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS--SEM)*. Sage Publications, Thousand Oaks, CA:.

Hair, JF, CM Ringle and M Sarstedt, (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, 19(2), 139–151.

Hair, JF, CM Ringle and M Sarstedt, (2013). Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*, 46(1-2), 1–12.

Hartmann, F, (2005). The effects of tolerance for ambiguity and uncertainty on the appropriateness of accounting performance measures. *Abacus*, 41(3), 241–264.

Henri, J-F, (2006). Organizational culture and performance measurement systems. *Accounting, Organizations and Society*, 31(1), 77–103.

Henseler, J, CM Ringle and RR Sinkovics, (2009). The use of partial least squares path modeling in international marketing. In: RR Sinkovics and PN Ghauri, eds. *New Challenges to International Marketing.* Emerald Group Publishing Limited, 277–319.

Hernandez, M, (2008). Promoting Stewardship Behavior in Organizations: A Leadership Model. *Journal of Business Ethics*, 80(1), 121–128.

Hitt, MA, RD Ireland, SM Camp and DL Sexton, (2001). Strategic entrepreneurship: entrepreneurial strategies for wealth creation. *Strategic Management Journal*, 22(6-7), 479–491.

Hogenhuis, BN, EA van Hende den and EJ Hultink, (2016). When should large firms collaborate with young ventures? *Research-Technology Management*, 59, 39–47.

Hutzschenreuter, J, (2009). *Management Control in Small and Medium-Sized Enterprises: Indirect Control Forms, Control Combinations and their Effect on Company Performance*. Gabler, Wiesbaden.

Hyytinen, A, M Pajarinen and P Rouvinen, (2015). Does innovativeness reduce startup survival rates? *Journal of Business Venturing*, 30(4), 564–581.

Ireland, RD, MA Hitt, SM Camp and DL Sexton, (2001). Integrating entrepreneurship and strategic management actions to create firm wealth. *Academy of Management Perspectives*, 15(1), 49–63.

Ireland, RD, MA Hitt and DG Sirmon, (2003). A Model of Strategic Entrepreneurship: The Construct and its Dimensions. *Journal of Management*, 29(6), 963–989.

Ireland, RD and JW Webb, (2007). Strategic entrepreneurship: Creating competitive advantage through streams of innovation. *Business Horizons*, 50(1), 49–59.

Jackson, P and N Richter, (2017). Situational logic: An analysis of open innovation using corporate accelerators. *International Journal of Innovation Management*, 21(07), 1750062.

Jaworski, BJ and AK Kohli, (1993). Market Orientation: Antecedents and Consequences. *Journal of Marketing*, 57(3), 53.

Jaworski, BJ and DJ MacInnis, (1989). Marketing Jobs and Management Controls: Toward a Framework. *Journal of Marketing Research*, 26(4), 406–419.

Jensen, MC and WH Meckling, (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360.

Kahn, KB and EF McDonough, (1997). An Empirical Study of the Relationships among Co-location, Integration, Performance, and Satisfaction. *Journal of Product Innovation Management*, (14), 161–178.

Kaplan, RS and DP Norton, (2001). *The strategy-focused organization: How balanced scorecard companies thrive in the new business environment. Harvard Business Press, 2001.* Harvard Business Press.

Karabulut, AT, (2015). Effects of Innovation Strategy on Firm Performance: A Study Conducted on Manufacturing Firms in Turkey. *Procedia - Social and Behavioral Sciences*, 195, 1338–1347.

Kennedy, S, G Whiteman and J van den Ende, (2017). Radical Innovation for Sustainability: The Power of Strategy and Open Innovation. *Long Range Planning*, 50(6), 712–725.

Ketchen, DJ, RD Ireland and CC Snow, (2007). Strategic entrepreneurship, collaborative innovation, and wealth creation. *Strategic Entrepreneurship Journal*, 1(3-4), 371–385.

Kihn, L-A, (2007). Financial consequences in foreign subsidiary manager performance evaluations. *European Accounting Review*, 16(3), 531–554.

Kober, R, J Ng and BJ Paul, (2007). The interrelationship between management control mechanisms and strategy. *Management Accounting Research*, 18(4), 425–452.

Kock, N, (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4).

Kominis, G and CR Emmanuel, (2007). The expectancy-valence theory revisited: developing an extended model of managerial motivation. *Management Accounting Research*, 18(1), 49–75.

Kruis, A-M, (2008). *Management control design and effectiveness*, The Netherlands.

Langfield-Smith, K, (1997). Management control systems and strategy: A critical review. *Accounting, Organizations and Society*, 22(2), 207–232.

Lill, P, A Wald and JC Munck, (2021). In the field of tension between creativity and efficiency: a systematic literature review of management control systems for innovation activities. *European Journal of Innovation Management*, 24(3), 919–950.

Lumpkin, GT and GG Dess, (1996). Clarifying the Entrepreneurial Orientation Construct and Linking It To Performance. *Academy of Management Review*, 21(1), 135–172.

MacKenzie, SB, PM Podsakoff and CB Jarvis, (2005). The problem of measurement model misspecification in behavioral and organizational research and some recommended solutions. *The Journal of applied psychology*, 90(4), 710–730.

Malmi, Malmi, T and DA Brown, (2008). Management control systems as a package—Opportunities, challenges and research directions. *Management Accounting Research*, 19(4), 287–300.

Martynov, A, Martynov, A, (2009). Agents or Stewards? Linking Managerial Behavior and Moral Development. *Journal of Business Ethics*, 90(2), 239–249.

Mercandetti, F, C Larbig, V Tuozzo and T Steiner, (2017). Innovation by Collaboration between Startups and SMEs in Switzerland. *Technology Innovation Management Review*, 7 (12), 23–31.

Merchant, KA, (1985). *Control in business organizations*. Pitman, Marshfield.

Merchant, KA and DT Otley, (2007). A Review of the Literature on Control and Accountability. In: CS Chapman, AG Hopwood and MD Shields, eds. *Handbook of management accounting research. vol. 1.* Elsevier, Amsterdam, 785–802.

Merchant, KA and WA Van der Stede, (2017). *Management Control Systems: Performance measurement, evaluation and incentives* (fourth edition). Pearson, Essex, England.

Merchant, KA, WA Van der Stede and L Zheng, (2003). Disciplinary constraints on the advancement of knowledge: the case of organizational incentive systems. *Accounting, Organizations and Society*, 28(2-3), 251–286.

Miles, RE, G Miles and CC Snow, (2005). *Collaborative Entrepreneurship: How Communities of Networked Firms Use Continuous Innovation to Create Economic Wealth*. Stanford University Press, Stanford, California.

Moers, F, (2005). Discretion and bias in performance evaluation: the impact of diversity and subjectivity. *Accounting, Organizations and Society*, 30(1), 67–80.

Moores, K and S Yuen, (2001). Management accounting systems and organizational configuration: A life-cycle perspective. *Accounting, Organizations and Society*, 26(4/5), 351–389.

Moritz, A, T Naulin and E Lutz, (2022). Accelerators as drivers of coopetition among early-stage startups. *Technovation*, 111, 102378.

Nitzsche, P, BW Wirtz and V Goettel, (2016). Innovation success in the context of inbound open innovation. *International Journal of Innovation Management*, 20(02), 1650025.

O'Connor, GC, (2006). Open, radical innovation: Toward an integrated model in large established firms. In: HW Chesbrough, W Vanhaverbeke and J West, eds. *Open Innovation: Researching a New Paradigm.* Oxford University Press, New York, 62–81.

Otley, D, (1999). Performance management: a framework for management control systems research. *Management Accounting Research*, 10(4), 363–382.

Otley, D, (2006). Trends in budgetary control and responsibility accounting. In: A Bhimani, ed. *Contemporary issues in management accounting.* Oxford University Press, Oxford, 291–307.

Ouchi, WG, (1977). The Relationship Between Organizational Structure and Organizational Control. *Administrative Science Quarterly*, 22(1), 95.

Ouchi, WG, (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833–848.

Pangarkar, N and J Wu, (2013). Alliance formation, partner diversity, and performance of Singapore startups. *Asia Pacific Journal of Management*, 30(3), 791–807.

Parida, V, M Westerberg and J Frishammar, (2012). Inbound Open Innovation Activities in High-Tech SMEs: The Impact on Innovation Performance. *Journal of Small Business Management*, 50(2), 283–309.

Peck, SR, (1994). Exploring the link between organizational strategy and employment relationship: the role of human resources policies. *Journal of Management Studies*, 31(5), 715–736.

Pinter, D, K-H Leitner and FM Schweitzer, (2023). How Formalisation and Connectectedness moderate the effect of foresight on radical innovation: empirical evidence from European companies. *International Journal of Innovation Management*.

Pisano, GP, (2015). You Need an Innovation Strategy, https://hbr.org/2015/06/you-need-an-innovation-strategy, accessed March 18, 2023.

Polidoro, F and W Yang, (2021). Corporate Investment Relationships and the Search for Innovations: An Examination of Startups' Search Shift Toward Incumbents. *Organization Science*, 32(4), 909-939.

Reinartz, W, M Haenlein and J Henseler, (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing*, 26(4), 332–344.

Rese, A and D Baier, (2011). Success factors for innovation management in networks of small and medium enterprises. *R&D Management*, 41(2), 138–155.

Rigtering, JPC and MA Behrens, (2021). The Effect of Corporate — Startup Collaborations on Corporate Entrepreneurship. *Review of Managerial Science,* 15(8), 2427–2454.

Rogers, M, (2004). Networks, Firm Size and Innovation. *Small Business Economics*, 22(2), 141–153.

Ross, SA, (1973). Economic Theory of Agency: The Principal's Problem. *American Economic Review*, 63(2), 134–139.

Rothaermel, FT, (2001). Incumbent's advantage through exploiting complementary assets via interfirm cooperation, Strategic Management Journal(22), 687–699.

Samson, DA, K Langfield-Smith and P McBride, (1991). The Alignment Of Management Accounting With Manufacturing Priorities: A Strategic Perspective. *Australian Accounting Review*, 1(1), 29–40.

Sandelin, M, (2008). Operation of management control practices as a package—A case study on control system variety in a growth firm context. *Management Accounting Research*, 19(4), 324–343.

Sandino, T, (2007). Introducing the First Management Control Systems: Evidence from the Retail Sector. *The Accounting Review*, 82(1), 265–293.

Schaltegger, S, FL Freund and EG Hansen, (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), 95.

Schumpeter, JA, (1947). The Creative Response in Economic History. *The Journal of Economic History*, 7(2), 149–159.

Simons, R, (1987). Accounting Control Systems and Business Strategy: An Empirical Analysis. *Accounting, Organizations and Society*, 12(4), 357–374.

Simons, R, (1990). The role of management control systems in creating competitive advantage: new perspectives. *Accounting, Organizations and Society*, 15(1-2), 127–143.

Smith, D and K Langfield-Smith, (2004). Structural equation modeling in management accounting research: critical analysis and opportunities. *Journal of Accounting Literature*, 23, 49–86.

Snell, SA, (1992). Control theory in strategic human resource management: the mediating effect of administrative information. *Academy of Management Journal*, 35(2), 292–327.

Snell, SA and MA Youngt, (1995). Human resource management and firm performance: testing a contingency model of executive controls. J Manag. *Journal of Management*, 21(4), 711–737.

Solesvik, MZ and M Gulbrandsen, (2013). Partner Selection for Open Innovation. *Technology Innovation Management Review*, 3(4), 11–16.

Song, Xea, (1998). The Impact of Cross-Functional Joint Involvement Across Product Development Stages: An Exploratory Study. *Journal of Product Innovation Management*, 15(4), 289–303.

Steiber, A, S Alanage and V Corvello, (2021). Evaluating corporate startup co.creation: a critical review of the literarue. *International Journal of Innovation Management*, 25(07), 2150073.

Tosi, HL, AL Brownlee, Silva Paula and JP Katz, (2003). An Empirical Exploration of Decision-making Under Agency Controls and Stewardship Structure. *Journal of Management Studies*, 40(8), 2053–2071.

Trapp, M, KI Voigt and A Brem, (2018). Business models for corporate innovation management: Introduction of a business model innovation tool for established firms. *International Journal of Innovation Management*, 22(1), 1850007.

Tsai, W and S Ghoshal, (1998). Social Capital and Value Creation: The Role of Intrafirm Networks. *The Academy of Management Journal*, 41(4), 464–476.

Tucker, BP, (2019). Heard It through the Grapevine: Conceptualizing Informal Control through the Lens of Social Network Theory. *Journal of Management Accounting Research*, 31(1), 219–245.

Usman, M and W Vanhaverbeke, (2017). How startups successfully organize and manage open innovation with large companies. *European Journal of Innovation Management*, 20(1), 171–186.

Utoyo, I, A Fontan and A Satrya, (2020). The role of entrepreneurial leadership and configuring core innovation capabilities to enhance innovation performance in a disruptive environment. *International Journal of Innovation Management*, 24(06), 2050060.

van de Vrande, V, (2013). Balancing your technology-sourcing portfolio: How sourcing mode diversity enhances innovative performance. *Strategic Management Journal*, 34(5), 610–621.

van de Vrande, V, (2017). Collaborative Innovation: Creating Opportunities in a Changing World. *ERIM Inaugural Address Series Research in Management*.

Van der Stede, WA, CW Chow and TW Lin, (2006). Strategy, Choice of Performance Measures, and Performance. *Behavioral Research in Accounting*, 18(1), 185–205.

Van der Stede, WA, SM Young and CX Chen, (2005). Assessing the quality of evidence in empirical management accounting research: The case of survey studies. *Accounting, Organizations and Society*, 30(7-8), 655–684.

Venkataraman, S and SD Sarasvathy, (2008). Strategy and Entrepreneurship. In: MA Hitt, RE Freeman and JS Harrison, eds. *The Blackwell handbook of strategic management.* Blackwell, Oxford, 655–673.

Venkatraman, N and V Ramanujam, (1987). Measurement of business economic performance: an examination of method convergence. *Journal of Management*, (13), 109–122.

Wargitsch, C, (2010). *Management control in Familienunternehmen*. Peter Lang, Frankfurt (Main).

Weiblen, T and HW Chesbrough, (2015). Engaging with Startups to Enhance Corporate Innovation. *University of California, Berkley*, 57(2), 66–90.

Weijters, B, E Davidov and H Baumgartner, (2023). Analyzing factorial survey data with structural equation models. *Sociological Methods & Research*, 52(4), 2050–2082.

Widener, SK, (2004). An empirical investigation of the relation between the use of strategic human capital and the design of the management control system. *Accounting, Organizations and Society*, 29(3-4), 377–399.

Widener, SK, (2007). An empirical analysis of the levers of control framework. *Accounting, Organizations and Society*, 32(7-8), 757–788.

Zhou, KZ, CK(Yim and DK Tse, (2005). The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations. *Journal of Marketing*, 69, 42–60.

Zingales, L, (2000). In Search of New Foundations. *The Journal of Finance*, 55(4), 1623–1653.

Appendix

Table B.1: Measures and their origin

Questionnaire items	Original constructs	Source
Strategic Innovation Objective		
Compared to our competitors, our products and services are more innovative and constantly changing.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
Compared to our competitors, we have the image of being more innovative and creative.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
We maintain our competitiveness by being able to consistently develop new products and services.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
Our executives focus on the development of new products and services more than the executives of many of our competitors.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
Unlike our competitors' executives, our managers have broader competencies to enable entrepreneurial and flexible change.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
Compared to the situation of our competitors, our fluctuations in demand are most likely due to our practice of aggressively entering new markets with new types of products and services.	Strategic Type	Dyer and Song (1997), Conant *et al.* (1990)
Collaboration with Startups		
In 2019, together with startups we achieved goals collectively.	Collaboration	Kahn and McDonough (1997)
In 2019, we shared resources with startups.	Collaboration	Kahn and McDonough (1997)
In 2019, we worked together with startups as a team.	Collaboration	Kahn and McDonough (1997)
Management System Control Effectiveness		
Our management control systems for collaborating with startups enable a targeted influence on the behavior of the participants.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)
Our management control systems for collaboration with startups ensure the coordination of tasks within the collaboration.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)

Questionnaire items	Original constructs	Source
Our management control systems for collaboration with startups promote motivation within the collaboration.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)
Our management control systems for collaboration with startups guarantee a target-oriented performance evaluation of the collaboration.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)
Our management control systems for collaboration with startups support internal decision-making processes within the collaboration.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)
Our management control systems for collaboration with startups provide relevant information.	Management System Control Effectiveness	Goebel and Weißenberger (2017), Ferreira and Otley (2010), Kruis (2008)
Results Controls		
We agree on individual goals for the collaboration with startups.	Results Controls, Output Control	Goebel and Weißenberger (2017), Jaworski and MacInnis (1989)
We control the target achievements of our collaboration with startups.	Results Controls, Output Control	Goebel and Weißenberger (2017), Jaworski and MacInnis (1989)
Any deviations from the targets within the collaboration with startups must be explained by the respective persons responsible.	Results Controls, Output Control	Goebel and Weißenberger (2017), Jaworski and MacInnis (1989)
The startups with which we collaborate receive feedback on the extent to which the targets have been achieved.	Results Controls, Output Control	Goebel and Weißenberger (2017), Jaworski and MacInnis (1989)
Further commitments to collaborate with startups are linked to the achievement of predefined targets.	Results Controls, Output Control	Goebel and Weißenberger (2017), Jaworski and MacInnis (1989)
Action Controls		
We review the steps necessary to achieve our goals (e.g., timelines and work packages) in our collaboration with startups.	Action Controls, Behavior Control	Goebel and Weißenberger (2017), Hutzschenreuter (2009), Jaworski and MacInnis (1989)
For recurring activities within the collaboration with Startups, we define the most important work steps.	Action Controls, Behavior Control	Goebel and Weißenberger (2017), Hutzschenreuter (2009), Jaworski and MacInnis (1989)
We provide information on the most important steps for achieving goals within the collaboration with startups.	Action Controls, Behavior Control	Goebel and Weißenberger (2017), Hutzschenreuter (2009), Jaworski and MacInnis (1989)

Questionnaire items	Original constructs	Source
Personnel Controls		
The people involved are carefully selected based on whether they fit the values and standards for our collaboration.	Personnel Controls, Input Control	Goebel and Weißenberger (2017), Hutzschenreuter (2009), Snell (1992)
It is important to us that we have a suitable selection process for the people involved in the collaboration.	Personnel Controls, Input Control	Goebel and Weißenberger (2017), Hutzschenreuter (2009), Snell (1992)
We consider training and development activities for the people involved in the cooperation to be very important.	Personnel Controls, Input Control	Goebel and Weißenberger, (2017), Hutzschenreuter (2009), Snell (1992)
Our company offers numerous opportunities for the people involved in the collaboration to broaden their range of skills.	Personnel Controls, Input Control	Goebel and Weißenberger, (2017), Hutzschenreuter (2009), Snell (1992)
Cultural Controls		
Values and norms play a major role in our collaboration with startups.	Cultural Controls, Belief System	Goebel and Weißenberger (2017), Widener (2007)
Our mission statement communicates the values for our collaboration with startups.	Cultural Controls, Clan Control	Goebel and Weißenberger (2017), Wargitsch (2010), Ouchi (1979)
Our personnel responsible for collaboration with startups communicate fundamental values to the startups.	Cultural Controls, Belief System	Goebel and Weißenberger, (2017), Widener (2007)
The people involved are aware of the fundamental values of collaboration.	Cultural Controls, Belief System	Goebel and Weißenberger, Widener (2007)
The values for our collaboration with startups are perceived as motivating by the people involved.	Cultural Controls, Clan Control	Goebel and Weißenberger, (2017), Wargitsch (2010), Ouchi (1979)
Innovation Success		
Our development of new products and services together with startups is much more successful than that of our competitors.	Innovation Success, Business Performance, New Product Development Effectiveness	Nitzsche *et al.* (2016), Dyer and Song (1998), Song (1998)
The quality of the new products and services we have developed in collaboration with startups is significantly higher than that of our competitors.	Innovation Success, New Product Development Effectiveness	Nitzsche *et al.* (2016), Song (1998)
Our collaboration with startups makes our company one of the most innovative in our industry.	Innovation Success	Nitzsche *et al.* (2016)

Table B.2: Measurement model results

First-order construct	Items	Loadings (λ_i)	Significance (bootstrapping; n = 500)
Strategic Innovation Objective	Compared to our competitors, our products and services are more innovative and constantly changing.	0.730	5.747
Mean = 0.051 SD = 0.817 CR = 0.814 AVE = 0.434	Compared to our competitors, we have the image of being more innovative and creative.	0.789	4.417
	We maintain our competitiveness by being able to consistently develop new products and services.	0.540	3.511
	Our executives focus on the development of new products and services more than the executives of many of our competitors.	0.454	1.617
	Unlike our competitors' executives, our managers have broader competencies to enable entrepreneurial and flexible change.	0.825	4.274
	Compared to the situation of our competitors, our fluctuations in demand are most likely due to our practice of aggressively entering new markets with new types of products and services.	0.519	2.825
Collaboration with Startups	In 2019, together with startups we achieved goals collectively.	0.908	0.000
Mean = 0.752 SD = 0.078 CR = 0.752 AVE = 0.515	In 2019, we shared resources with startups.	0.540	0.000
	In 2019, we worked together with startups as a team.	0.655	0.000
MSC Effectiveness	Our management control systems for collaborating with startups enable a targeted influence on the behavior of the participants.	0.963	12.381
Mean = 0.942 SD = 0.018 CR = 0.941 AVE = 0.734	Our management control systems for collaboration with startups ensure the coordination of tasks within the cooperation	0.849	10.776
	Our management control systems for collaboration with startups promote motivation within the collaboration	0.885	12.196
	Our management control systems for collaboration with startups guarantee a target-oriented performance evaluation of the cooperation.	0.876	8.324
	Our management control systems for collaboration with startups support internal decision-making processes within the collaboration.	0.803	6.587
	Our management control systems for collaboration with startups provide relevant information.	0.749	5.648

First-order construct	Items	Loadings (λ_i)	Significance (bootstrapping; n = 500)
Results Controls	We agree on individual goals for the collaboration with startups.	0.923	0.000
Mean = 0.882 SD = 0.040 CR = 0.886 AVE = 0.615	We control the target achievements of our collaboration with startups.	0.879	0.000
	Any deviations from the targets within the collaboration with startups must be explained by the respective persons responsible.	0.823	0.000
	The startups with which we collaborate receive feedback on the extent to which the targets have been achieved.	0.676	0.000
	Further commitments to collaborate with startups are linked to the achievement of predefined targets.	0.564	0.000
Action Controls	We review the steps necessary to achieve our goals (e.g., timelines and work packages) in our collaboration with startups.	0.831	0.000
Mean = 0.824 SD = 0.056 CR = 0.834 AVE = 0.629	For recurring activities within the collaboration with Startups, we define the most important work steps.	0.664	0.000
	We provide information on the most important steps for achieving goals within the collaboration with startups.	0.869	0.000
Personnel Controls	The people involved are carefully selected based on whether they fit the values and standards for our collaboration.	0.810	5.148
Mean = 0.814 SD = 0.047 CR = 0.817 AVE = 0.530	It is important to us that we have a suitable selection process for the people involved in the collaboration.	0.664	3.976
	We consider training and development activities for the people involved in the cooperation to be very important.	0.638	2.865
	Our company offers numerous opportunities for the people involved in the collaboration to broaden their range of skills.	0.783	6.279
Cultural Controls	Values and norms play a major role in our collaboration with startups.	1.031	0.000
Mean = 0.862 SD = 0.045 CR = 0.845 AVE = 0.539	Our mission statement communicates the values for our collaboration with startups	0.770	0.000
	Our personnel responsible for collaboration with startups communicate fundamental values to the startups	0.678	0.000
	The people involved are aware of the fundamental values of collaboration.	0.569	0.000
	The values for our collaboration with startups are perceived as motivating by the people involved.	0.503	0.000

First-order construct	Items	Loadings (λ_i)	Significance (bootstrapping; n = 500)
Innovation Success	Our development of new products and services together with startups is much more successful than that of our competitors.	0.863	10.770
Mean = 0.860 SD = 0.055 CR = 0.867 AVE = 0.685	The quality of the new products and services we have developed in collaboration with startups is significantly higher than that of our competitors.	0.771	8.560
	Our collaboration with startups makes our company one of the most innovative in our industry.	0.846	9.330

SD: Standard Deviation CR: Composite Reliability AVE: Average Variance Extracted

Table B.3: Non-hypothesized effects and related control variables

Relations measured	Path coefficients	Significance level (p-values)
Focus on exploration		
Focus on exploration → strategic innovation objective	0.770	< 0.001 (0.000)
Focus on exploration → MSC effectiveness	0.291	< 0.01 (0.008)
Focus on exploration → innovation success	-0.274	< 0.05 (0.042)
Focus on exploitation		
Focus on exploitation → strategic innovation objective	0.464	< 0.005 (0.002)
Focus on exploitation → MSC effectiveness	0.282	<0.005 (0.002)
Focus on exploitation → collaboration with startups	0.442	<0.01 (0.005)
Focus on exploitation → innovation success	-0.261	<0.05 (0.024)
Strategic importance of collaboration		
Strategic importance of collaboration with startups → MSC effectiveness	0.319	< 0.01 (0.009)
Strategic importance of collaboration with startups → collaboration with startups	0.350	< 0.05 (0.029)
Strategic importance of collaboration with startups → strategic innovation objective	0.397	< 0.05 (0.016)
Trust within the collaboration		
Trust within the collaboration → collaboration with startups	0.554	< 0.001 (0.000)
Trust within the collaboration → MSC effectiveness	0.376	< 0.005 (0.004)
Trust within the collaboration → strategic innovation objective	0.355	< 0.005 (0.004)

Relations measured	Path coefficients	Significance level (p-values)
Social interaction within the collaboration		
Social interaction within the collaboration → collaboration with startups	0.432	< 0.005 (0.001)
Social interaction within the collaboration → strategic innovation objective	0.296	< 0.05 (0.043)
Satisfaction with the collaboration		
Satisfaction with the collaboration → MSC effectiveness	0.497	<0.001 (0.000)
Satisfaction with the collaboration → collaboration with startups	0.626	<0.001 (0.000)
Satisfaction with the collaboration → strategic innovation objective	0.405	< 0.05 (0.016)
Satisfaction with the collaboration		
Satisfaction with the collaboration → mgt. syst. control effectiveness	0.497	<0.001 (0.000)
Satisfaction with the collaboration → collaboration with startups	0.626	<0.001 (0.000)
Satisfaction with the collaboration → strategic innovation objective	0.405	< 0.05 (0.016)

C. Study 2: Good Intentions Do Not Change the World: The Role of Sustainability Management Control for Startup Collaborations in the Relationship between Strategy and Innovation

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Good Intentions Do Not Change the World: The Role of Sustainability Management Control for Startup Collaborations in the Relationship between Strategy and Innovation

ABSTRACT

For established companies aspiring sustainability innovations, collaborating with startups can be essential. Regarding such collaborations between established companies and startups, we investigate the role of sustainability management control for innovation success in an interorganizational context. Also, we explore further innovation drivers within the interorganizational context of management control. We develop our research model drawing on strategic orientation-innovation research and the object-of-control framework. Using a mixed-methods approach, structural equation modeling initially shows that the strategic sustainability innovation objective is positively related to the package of sustainability management controls for startup collaborations, and that these controls positively influence sustainability innovation success. While startup collaborations themselves also lead to innovation success, the strategic objective alone does not. Qualitative interviews additionally explain that sustainability innovation success via startup collaborations is mainly based on cultural controls like managing cultural differences, owning the jointly aspired innovations, reliable financial and organizational backing, and a value-/vision-fit between the collaborators.

Keywords: strategic objective, management controls, sustainability management controls, startup collaborations, sustainability innovation success

1. Introduction

In the presence of grand challenges like climate change and dwindling natural resources, a substantial number of established companies seek long-term competitive advantages through aligning new products and services with the principles of sustainability (e.g., Eccles *et al.* 2014; Gond *et al.* 2012; Porter and Kramer 2011; Bansal and Roth 2000). Yet, given that "[…] innovations driving sustainable development do not necessarily occur by accident but can be created by leaders who put them into the core of their business activities" (Schaltegger and Wagner 2010, p. 223), this study enlarges the knowledge on how organizations can foster the development and implementation of such innovations. Extant literature indicates that collaborating with startups seems to be a promising approach to rejuvenate organizational structures, access external knowledge and, thus, spur innovation (Weiblen and Chesbrough 2015; Kraus and Kauranen 2009; Clercq and Dimov 2008). Therefore, many established companies collaborate with startups that are offering business innovations, some even directly in the context of sustainability (Todeschini *et al.* 2017; Gond *et al.* 2012; Rogers 2004). Controlling for innovation in an interorganizational context, however, is challenging for decision makers of established firms collaborating with startups – and also a constant cause for practitioners to excessively discuss pitfalls and potential success factors. A recent publication by McKinsey & Company with the telling title "You can't buy love – Reimagining corporate-startup partnerships in the DACH region" underlines this challenge by stressing that the corporate investment alone is no sufficient success factor as long as commitment and attention are lacking (Doerner *et al.* 2020).

Aiming for sustainability innovations via startup-collaborations can only be a starting point that needs to be implemented by appropriate, but frequently lacking, management controls to achieve innovation success (Gond *et al.* 2012). Management controls shape actors' practices (Ahrens and Chapman 2007; Hopwood 1976) and thus are most relevant for successful strategy implementation (Kober *et al.* 2007; Langfield-Smith 1997), as they "[…] can, if used appropriately, push organizations in the direction of sustainability" (Gond *et al.* 2012, p. 206), leading to innovation success. Thus, sustainability management control (named sustainability control hereinafter) might be the missing puzzle piece and will be conceptualized and operationalized in the further course of this research.

While the amount of academic literature on this topic has grown and it is argued that management control is essential in supporting sustainability (Crutzen *et al.* 2017; Durden 2008), surprisingly, its impact on organizational innovativeness in this area has been scarcely addressed (Guenther *et al.* 2016). Further, the role of sustainability control in the relation between a strategic sustainability objective and the final sustainability innovation success has not

been researched sufficiently (Klein *et al.* 2021). Also, there is a dearth of research on the interorganizational aspects of management control in the context of sustainability innovations via startup collaborations (e.g., Caglio and Ditillo 2021; Guenther *et al.* 2016; Arjaliès and Mundy 2013).

Therefore, based on strategic orientation-innovation research and the object-of-control-framework, we establish a research model that sheds light on the relationships between a strategic objective for sustainability innovation, sustainability control for startup collaborations, and sustainability innovation success. Thereby, we aim at identifying the role of management control for sustainability innovation success in an interorganizational context, exemplarily by the collaboration of established companies with startups. As a first step, our study therefore surveys managers of established companies headquartered in Germany, Austria, and Switzerland on startup collaborations. In the second step, we use a qualitative approach and conduct follow-up interviews with randomly selected managers to elaborate on which additional factors may lead to innovation success.

Our study's contribution to literature is threefold. First, based on the object-of-control framework developed by Merchant and Van der Stede (2017) and its mapping of control types into results and action controls (formal) vs. personnel and cultural controls (informal), we not only modify existing scales surveying the use of these controls for sustainability control purposes. We also add one self-developed item for contractual control, complementing the object-of-control framework with regard to interorganizational control practices. In this way, we extend and complement the use of the object-of-control framework and confirm its applicability in the specific context of sustainability controls for startup collaborations.

Second, we contribute to the management control literature by investigating interorganizational management control and its relevance for the relation between strategic orientation and innovation success. With this finding, we answer the call for research of Caglio and Ditillo (2021) who state that additional research is needed about management controls for collaboration between firms aiming at innovation.

Third, against the background of the questionable effectiveness of traditional management controls in improving companies' social and environmental performance, we build on the notion that companies should focus on those management controls "[…] that fulfill their purpose most efficiently and/or effectively" (Crutzen *et al.* 2017, 1299–1300). In this regard, we find according evidence that particular the use of sustainability controls for startup collaborations is essential for translating a strategic sustainability innovation objective into the desired innovation success.

2. Literature overview

2.1. Sustainability and collaborative innovation

While some researchers particularly refer to eco-friendly innovations (Heidenreich *et al.* 2017), Schaltegger and Wagner (2010) have coined the broader term of sustainability innovations. With the understanding of Schumpeter's (1934) idea of 'creative destruction', sustainability innovations are considered to destroy conventional products and services and replace them with superior environmental and social ones (Schaltegger and Wagner 2010). Some of these have the characteristics of radical innovations, and therefore challenge established firms with rigid routines (Schaltegger and Wagner 2010). Startups, on the contrary, have characteristics that put them in a position to better pursue radical innovation (Klepper 1996; Utterback and Abernathy 1975). Apart from radical innovation, Sebode *et al.* (2012) describe incremental changes as being relevant when managing innovation for sustainability as well.

Yet, because of startups' typical liabilities of newness, inexperience, and/or smallness (Gruber 2004), the advantages of acting in networks for them are stressed not only in entrepreneurship research in general (Ozgen and Baron 2007; Carolis and Saparito 2006) but also concerning sustainability innovations (Boons and Roome 2005).

In this regard, collaborative innovation is understood as the creation of innovations across organizations through the sharing of ideas, knowledge, expertise, and opportunities (Miles *et al.* 2005). Floyd and Lane (2000) suggest collaborative innovation to fuel the strategic renewal that established companies often find hard to attain. Thus, interorganizational collaboration has been widely understood to supplement the internal innovative activities of organizations (Deeds and Rothaermel 2003; Hagedoorn 2002; Dodgson 1993) and to positively influence the innovative performance of firms (Rogers 2004; Baum *et al.* 2000; Deeds and Hill 1996).

2.2. Sustainability and management control

To obtain superior performance in a certain area, firms tend to align management controls to their strategic goals (Chenhall and Langfield-Smith 2003). Regarding the strategic goal of sustainability, Guenther *et al.* (2016) describe the management control literature as beginning to address the issue of environmental responsibility and the topic of environmental or sustainability management controls as "[…] gaining momentum" (p. 148). The terms used in this context are "environmental management control systems" (Pondeville *et al.* 2013, p. 317), "eco-control" (Henri and Journeault 2010, p. 63), "sustainability control systems" (Gond *et al.* 2012, p. 205) or "socially responsible management control system" (Durden 2008, p. 671). All of these

are described to provide an opportunity for the integration of environmental issues into organizations' strategy implementation (Guenther *et al.* 2016). While earlier research asked the question of whether environmental management controls per se a positive impact on performance, Epstein and Manzoni (2008) have investigated a discussion on the specific mechanisms underlying this impact. In this vein, it is important to understand what control systems in general are used for. Simons (1995, p. 5) for instance describes management control systems as "[…] information-based routines and procedures managers use to maintain or alter patterns in organizational activities". Environmental management control systems, based on the principles of general management control systems, may therefore "[…] simultaneously foster environmental and financial performance by translating environmental objectives and activities into competitive advantages and, ultimately, superior financial performance" (Guenther *et al.* 2016, p. 150). Guenther *et al.* (2016) further conceptualize environmental control systems in more detail in the form of a so-called positioning framework. Doing so, they define a time dimension (distinguishing between intergenerational and intragenerational), a scope dimension referring to the triple bottom-line of sustainability (i.e., economic, environmental, and social sustainability) as well as a focus of control dimension, which addresses the continuum between the strategic and the operational level of an organization. Here, the differentiation between sustainability accounting and sustainability controls is also worth mentioning. Some authors describe sustainability accounting as intended to support managerial decision-making while others reduce sustainability accounting to its reporting function. Sustainability control goes beyond this understanding by "[…] influencing routines and behaviors and by aligning those […] with the environmental strategies and objectives of the firm" (Guenther *et al.* 2016, p. 152). Feder and Weißenberger (2019), even though focusing on corporate social responsibility and not sustainability in general, discussed suggestions for designing effective management control systems as a basis for long-term behavior in line with corporate goals and strategic objectives. Considering work on corporate social responsibility in the context of sustainability management is valid, because of the significant correlation between corporate social responsibility and sustainability, identified by Sharma and Khanna (2014). The work herein is concerned with control mechanisms and how they relate to attitude and intentions, in our case for integrating sustainability concerns into investment decisions.

3. Theoretical background and hypotheses

3.1. The effect of a strategic sustainability innovation objective on innovation success

One way to foster innovation success in an organizational context is to set the scene and define innovation as a strategic objective. Of course, innovation may also emerge from employees, customers, or other stakeholders without a firm's explicit strategy being at this. Nevertheless, there is widely accepted research that indicated the importance of corporate strategy for the realization of sustainability innovations (Kennedy *et al.* 2017). This applies on a theoretical level because a company's objective to foster sustainability innovation suggests establishing sustainability innovation objectives in corporate strategy as an integral element of the three seminal strategic orientations influencing innovation outcomes (Achtenhagen *et al.* 2013; Baker and Sinkula 2007; Zhou *et al.* 2005), namely market orientation (Noble *et al.* 2002), technology orientation (Gatignon and Xuereb 1997), and entrepreneurial orientation (Lumpkin and Dess 1996).

For example, striving strategically for climate-friendly mobility solutions might act as a stimulus to find innovative solutions either by approaching customers (i.e., market orientation), scanning for new technologies (i.e., technology orientation), or searching for new market opportunities (i.e., entrepreneurial orientation). First, since the pressure for focusing on sustainability often derives from external stakeholders, companies striving for sustainability need to increase their knowledge about the respective market to adequately respond to it (Du *et al.* 2016). Second, tackling sustainability challenges and creating competitive advantages oftentimes require new technologies. In a case study, Kennedy *et al.* (2017) find that choosing to increase sustainability efforts intensifies technological knowledge. Moreover, former research shows that valuing creativity and encouraging employees to think out of the box, as being common in technology-oriented companies (Zhou *et al.* 2005), is frequently necessary for developing sustainability innovations. Third, researchers find that an increasing commitment to sustainability positively influences how proactively an environmental strategy is implemented (Murillo-Luna *et al.* 2008), and the search for new opportunities (Du *et al.* 2016), which both are characteristic of an entrepreneurial orientation. We therefore hypothesize:

H1: *The establishment of a sustainability innovation objective within corporate strategy is positively related to the success of sustainability innovations.*

3.2. The mediating role of collaboration with startups

Based on the concept of collaborative innovation, we expect that there is a certain mechanism through which strategic sustainability innovation objectives are related to innovation success.

In particular, we assume startup collaborations to mediate the effect of the establishment of a sustainability innovation objective in corporate strategy on sustainability innovation success.

Whereas early literature portrayed innovation as driven by organizations acting on their own (Ketchen *et al.* 2007), established firms nowadays strive for strategic renewal by collaborative innovation which is understood as "[…] the creation of innovations across firm (and perhaps industry) boundaries through the sharing of ideas, knowledge, expertise, and opportunities […]" (Ketchen *et al.* 2007, 374). They increasingly do so by absorbing and profiting from the innovative nature and optimistic opportunity-seeking attitude traditionally possessed by startups. Maintaining such a mindset is difficult over time because of the common phenomenon of increasing bureaucratic procedures, complex structures and rigid culture along with organizational growth (Ketchen *et al.* 2007; Floyd and Lane 2000). Therefore, provided an innovation objective within the corporate strategy of established firms, it stands to reason for them to collaborate with startups for innovation generation. Thus, we hypothesize:

H2a: *The establishment of a sustainability innovation objective within corporate strategy is positively related to the collaboration with startups.*

To explain the expected positive effects of established firm-startup collaborations on sustainability innovation success, the concept of collaborative innovation likewise focuses on the relations between partner firms and how they influence the firms' behavior and the collaborations' outcomes (Dyer and Nobeoka 2000). This relational perspective is important to identify how collectively implemented collaboration leads to innovation success (Tsai and Ghoshal 1998). In the case of two collaborating firms that are quite similar, meaning that they possess similar experiences and cultures, the innovation potential is quite low. The opposite is the case when resources and assets are complementary, organizational processes are open and diversity of thought is welcomed (Granovetter 1973). Thus, collaboration between established firms and startups with differing characteristics seems to be the key to success and may help overcoming the respective challenges of established firms (Ketchen *et al.* 2007), for instance also for achieving sustainability innovation. Based on the arguments presented above, we hypothesize the following:

H2b: *The collaboration with startups is positively related to the success of sustainability innovations.*

3.3. The mediating role of sustainability controls for startup collaborations

Based on the object-of-control framework (Merchant and Van der Stede 2017), we expect that there are specific manifestations of management controls through which a strategic sustainability innovation objective can lead to innovation success. In more detail, we assume sustainability-oriented management controls for the collaboration with startups to mediate the effect of a strategic sustainability innovation objective on related innovation success.

Management control in general is defined as processes by which managers ensure that resources are received and utilized effectively and efficiently in the accomplishment of the organization's goals (Anthony 1965), and that, thus, organizational attention and efforts are aligned with these goals (Cardinal 2001). Davila *et al.* (2015) further recognize strategy as a significant contextual factor for the explanation of the effectiveness of management controls. Thus, management controls shape actors' practices (Ahrens and Chapman 2007) and support corporate strategy (Kober *et al.* 2007; Langfield-Smith 1997). Accordingly, we assume that once established firms decide on sustainability innovation as an objective within their corporate strategy, they will also use specific management controls to achieve this objective. In particular, we propose that they will apply so-called sustainability controls to steer their startup collaborations aiming for sustainability innovations. This assumption can also be supported since traditional management controls are limited in incorporating environmental issues (Burritt and Schaltegger 2010) and the integration of sustainability in respectively tailored control systems has been considered an enduring effort in firms' journey towards sustainability before (Gond *et al.* 2012). Accordingly, we hypothesize the following.

H3a: *The establishment of a sustainability innovation objective within corporate strategy is positively related to the use of sustainability controls.*

These sustainability controls can be derived and conceptualized based on the object-of-control framework coined by Merchant and Van der Stede (2017). In more detail, we apply a holistic view of management controls (Mundy 2010) and conceptualize sustainability controls as related to each of the four control types from the object-of-control framework. This allows for an appropriate differentiation between formal (results and action controls) and more informal mechanisms (personnel and cultural controls). Also, given the interorganizational character of the corporate-startup collaborations, we add an item concerned with the contractual basis of the collaboration. While this might be closest to the type of results controls, defined by Merchant and Van der Stede (2017), it might be reasonable to consider an additional type of control when managing in an interorganizational context. As management controls particularly developed for

fostering sustainability innovation are crucial for achieving related success, we hypothesize the following:

H3b: *The use of sustainability controls is positively related to the success of sustainability innovations.*

Figure C.1 summarizes our hypotheses and presents our conceptual model of how the establishment of a sustainability innovation objective within corporate strategy positively influences sustainability innovation success. We expect that the collaboration with startups and the related use of sustainability controls both mediate this effect.

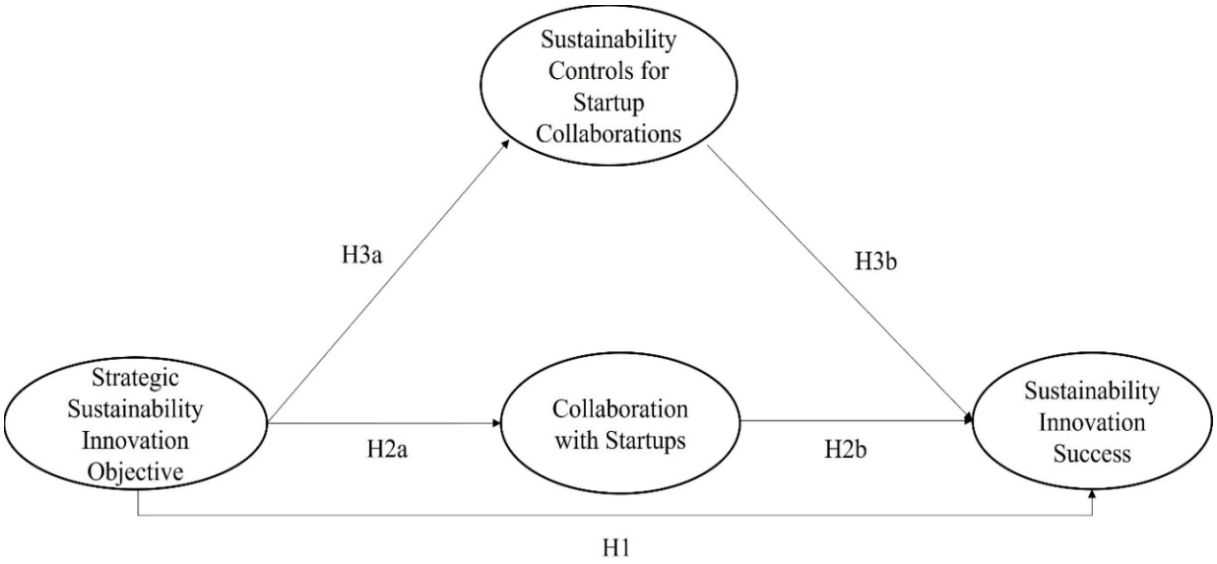


Figure C.1: Conceptual model

4. Method

This research applies a mixed-methods approach (cf., Bhimani *et al.* 2016). First, we chose a survey since earlier literature provides limited quantitative empirical evidence on our research aim and context. Second, our research contains complementary qualitative interviews to gain additional insights which have not been captured through our research model.

4.1. Survey

First, we based our quantitative analysis on established companies listed on Crunchbase (2019) which were older than 10 years and have acquired at least one company younger than 10 years. While a startup acquisition is not the same as collaborating with startups, we used this criterion as it is closely related to the subject matter. We assume that companies which have already

acquired startups may be generally interested in startups and related collaborations. Thus, they are very likely to represent suitable information sources for our study's purpose. To make sure that each company participating in our survey in fact is experienced in collaborating with startups, we have clarified this point in a phone call with each company before participation.

Second, we added the geographical selection criterion of the culturally comparable countries Germany, Switzerland, and Austria to limit potential biases caused by cultural differences (Hartmann 2005) and, following e.g. Goebel and Weißenberger (2017), excluded companies from the so-called FIRE sectors (Finance, Insurance, and Real Estate) due to their divergent regulatory environments and specific business models. In so doing, we could identify a population of 939 companies that we considered appropriate for participation. We collected the needed information employing an online survey. To minimize social desirability bias when measuring constructs, respondents were asked to answer the questions as honestly as possible. To encourage respondents to cooperate without fear of reprisals, they were also informed that their responses would not be connected to their firms and their answers would be anonymously analyzed solely by the three involved authors. All respondents were offered, for their contribution, an individualized benchmarking report and a summary of the results.

Data collection took place from December 2020 to March 2022. Finally, a total of 45 top-level managers dealing with startup collaborations (e.g., CFO, Head of Controlling, Head of Venturing) participated as key informants in our study (each manager from a different company, for descriptive statistics about the respondents and their companies see Table C.1).

4.2. Measures

The chosen constructs are based on the literature and measured by combining established scales. If necessary, we slightly adjusted scales concerning the subject of sustainability and the startup collaboration context. Concerning sustainability, we did not specify whether we are interested in environmental, social, or governmental sustainability. For us, innovation in all of these areas, but concentrated on innovations of products and services, was part of our research. The list of constructs and the corresponding measurement items have been discussed with academic experts, experienced in conducting empirical research in the fields of management accounting and entrepreneurship, for evaluation of clarity, specificity, and representativeness. Furthermore, we ask them to critically assess the items from the standpoint of domain representativeness. An empirical pre-test with 14 researchers of the management accounting and entrepreneurship fields helped shape the questionnaire toward clear distinctions between the constructs and refining the formulation of certain items. Another three pre-testers were executives from business

practice. Based on the detailed critique received, we eliminated some items and revised others to improve their specificity and precision.

We asked the participants of the main study to define their degree of agreement with our items on a 6-point Likert scale (1=does not apply at all to 6=fully applies) or in the case of the measurement for collaboration with startups the degree of occurrence (1=never applies to 6=mostly applies).

Independent and dependent variables

We measure sustainability innovation objective within corporate strategy based on three adapted items from Dyer and Song (1998), two items from Lisi (2015), and one items from Farooq *et al.* (2014).

Collaboration with startups is measured with two items adapted from Kahn and McDonough (1997). Another three items were eliminated because their absence increased the composite reliability of the construct. In their original use, the authors requested information about collaboration activities during the last three months. In our case, to avoid the impact of the global COVID-pandemic, we asked for the firms' activities in 2019.

We measure sustainability controls with six items based on the well-established control types defined in the object-of-control framework. As results controls, we adapted two items from the scale of formal environmental management control used by Pondeville *et al.* (2013). For action and personnel controls, we adapted two items measuring environmental management practices used by Aragón-Correa (1998). For cultural controls, we adjusted one item each from the constructs of top management commitment and internal environmental orientation, both used by Banerjee *et al.* (2003). We further added one item which is closest to the management control type of results controls, but which complements the object-of-control framework in the special context of interorganizational control practices. For the operationalization of this construct, we consulted Bedford and Speklé's (2018) inventory of constructs in survey-based management accounting and control research. Doing so we were able to assign our construct to one of four possible categories depending on the object of measurement which in our case is named 'management accounting and control practices and organizational design'. Similar constructs to ours from this category, apart from the ones we are taking our single items from, are 'eco-control', 'environmental management practices' and 'environmental performance measure use' (p. 278), and slightly 'social control' (p. 286).

Sustainability innovation success was measured through a combination of items from three constructs tested in former research. Two items were adapted from the scale of

sustainability innovation performance by Calik and Bardudeen (2016). One more item was adjusted from measuring innovation success by Nitzsche *et al.* (2016) and one from the aforementioned authors as well as from Farooq *et al.* (2014). Additionally, we adapted two items from Dyer and Song (1998) measuring relative firm success. A seventh item was eliminated because its absence increased the composite reliability of the construct (for the detailed items of the variables and their origin see Table C.2).

Common method bias

As indicated in many studies, common method variance is a potential problem that needs to be controlled, particularly in research in which the data for independent and dependent variables are obtained from a single informant. Thus, we applied Harman's single-factor test to assess common method variance's possible impact. Here, we did not find a single factor to explain more than half of the variance.

4.3. Interviews

To exploratively enrich our understanding of what might further influence innovation success as a result of collaboration with startups, we conducted qualitative in-depth interviews with 16 randomly chosen managers out of our sample, which ensured us to talk to key informants in the context of startup collaborations. Apart from additional influencing factors, we were interested in learning about the practical expression of the different management controls implemented. We considered our interview partners as their organizations' "knowledgeable agents" (Gioia *et al.* 2013, p. 17), knowing what they do when aspiring innovation success in collaboration with startups, and being best suited to explain their intentions, actions, and learnings. By choosing this approach, we intended to further explain and complement the quantitatively achieved findings. In our semi-structured interviews, we asked for failures and success factors in terms of controlling for innovation success. Here, we did not focus on sustainability because the reasoning for adding qualitative data to our quantitative findings was not to refine our construct of sustainability controls but to learn about how corporate-startup collaborations are managed and what, from the practitioner's point of view, seems to be relevant for successfully achieving objectives. All interviews were recorded with the permission of the interviewees and fully transcribed for subsequent coding and analysis. Interviews ranged from 15 to 45 minutes in length and were conducted between 10th January 2022 and 16th March 2022 (for further information about the interviewees and their companies see Table C.3).

We analyzed the information from our interviews by using the methodology of inductive concept development by Gioia *et al.* (2013). We experienced what Glaser and Strauss (1967) termed theoretical saturation after twelve interviews so additional interviews were only conducted to ensure that no significant new insights emerged beyond this point. We went through a 1st-order analysis (i.e., using informant-centric terms and codes) and a 2nd-order analysis (i.e., using researcher-centric concepts, themes, and dimensions) (Van Maanen 1979) to finally come up with additional success factors which have not been included in our research model and which complement our findings of the quantitative analysis. This approach, which Gioia *et al.* (2013) describe as tandem reporting of informant and researcher helps readers to see the rigor of our qualitative concept development. Our coding scheme, which has been applied in MaxQDA, covered answers which have not been covered by our conceptual model. In this way, we obtained additional information based on our mixed-method approach.

5. Results

5.1. Survey data

We analyze our survey data based on structural equation modeling (SEM). SEM is a useful methodology for anlyzing survey data due to its ability to handle complex relationships and multiple variables (Weijters 2021). Specifically, we applied the method of partial least squares SEM (PLS-SEM) for our analysis and calculation. Different from covariance-based SEM, PLS-SEM is a variance-based approach generally used for the explorative identification of relationships (Hair *et al.* 2017). We decided on this approach because the PLS technique constitutes a non-parametric approach, which means that it does not rely on normally distributed data (Henseler, Ringle, and Sinkovics 2009). Further, it is also preferred in research areas with less comprehensive theoretical foundations (Reinartz *et al.* 2009) which has long been a pervasive characteristic of researching management control systems (Malmi and Brown 2008). Smith and Langfield-Smith (2004, p. 76) even go as far as saying that the PLS approach is “tailor-made for management accounting research”. Another advantage is its possibility of simultaneously calculating interrelationships between different constructs and the option to use a bootstrapping approach for testing mediations (Hair *et al.* 2017). Relevant for our research is further the suitability of PLS-SEM for generating insights based on rather small samples (Henseler *et al.* 2009), providing higher levels of statistical power concerning small sample sizes compared to covariance-based approaches (Reinartz *et al.* 2009). As a basic rule, Barclay *et al.* (1995) describe the required sample size for PLS-SEM being 10 times the maximum number of

exogenous constructs loading on an endogenous construct, that is, structural paths that load on a specific construct. In our case, this requirement is fulfilled since in our research model the maximum number of exogenous constructs (strategic sustainability innovation objective, startup collaborations, and sustainability controls) loading on an endogenous construct (sustainability innovation success) is three, resulting in a minimum sample size of 10 x 3 = 30, which we clearly exceed with 45 participants.

Using SmartPLS 3, we estimate the model's parameters, applying a path weighting scheme with 300 iterations and a stop criterion of 10^{-7} (Hair *et al.* 2013). We further used a nonparametric bootstrapping procedure (no sign changes) with 500 subsamples, one tailed.

5.2. Measurement model results

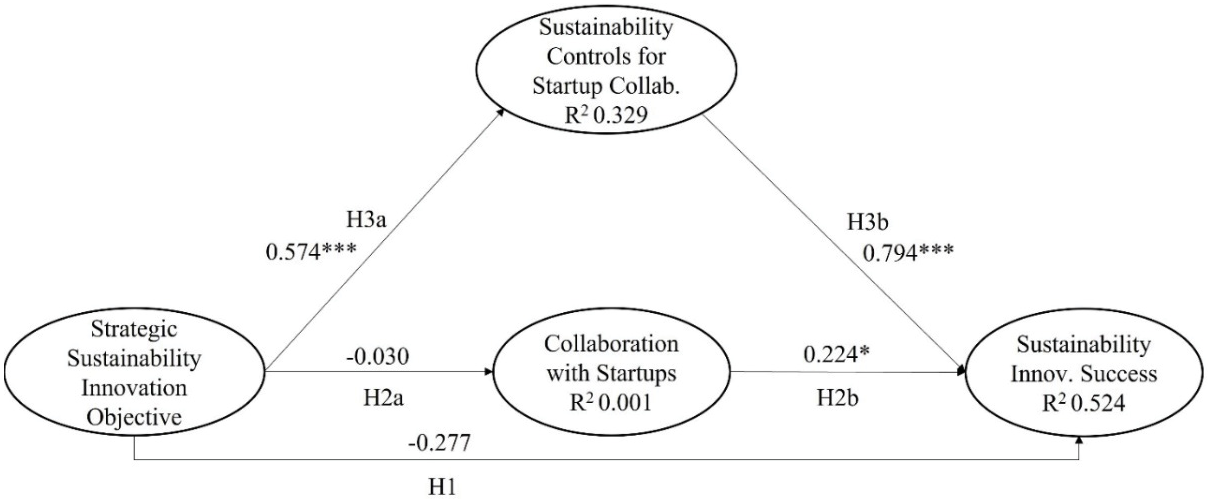
For the validation of our measurement model, we evaluated our reflective constructs. We did so by assessing the internal consistency, the convergent and discriminant validity as well as the indicator and construct reliability (Goetz *et al.* 2010). Especially for our construct of sustainability management control, Guenther *et al.* (2016) requested for "[…] measures that can be used for operationalization", adding that "[…] construct validity studies would be quite valuable" (p. 167). Here, for all constructs, composite reliability estimates, and average variance extracted (AVE) values exceeded the standards of 0.7 and 0.5 respectively, showing internal consistency (Hair *et al.* 2013). Standardized item loadings ranged from 0.578 to 0.914 such that we can assume indicator reliability. Only two items have a value below 0.7, but above 0.5, which we kept because eliminating them would decrease the composite reliability of the constructs they were assigned to. Two items with loadings below 0.7, but above 0.5, were eliminated because their absence increased the composite reliability of the constructs they were assigned to. Another two items with loadings below 0.5 were eliminated as well. We retained 21 items for further analysis. All the constructs' AVE exceeds the recommended minimum value of 0.5 confirming convergent validity, showing that the constructs explain more than half of their indicators' variance (for more details about the measurement model results see Table C.4).

Discriminant validity was confirmed using two methods: (1) examining whether the average variance extracted for each construct is greater than the square of the correlation between the constructs (Fornell and Larcker 1981) and (2) examining construct intercorrelations (MacKenzie *et al.* 2005). Since the square root of the AVE exceeds the intercorrelations between the construct and the other constructs, discriminant validity can be assumed. In addition, discriminant validity is further supported, since the cross-loadings were not higher than the loadings. The heterotrait-monotrait values of all construct pairs were below the threshold of 0.85, which

even is considered a conservative threshold. We further examined whether the heterotrait-monotrait values differed significantly from 1 by calculating the bias corrected bootstrap confidence intervals. We can report that the 95% confidence intervals did not include 1 in any of the construct pairs (see Table C.5). This additional test was applied because of the shortcomings of the established, tests (the Fornell-Larcker criterion and the cross-loadings).

5.3. Structural model results

The results at the structural model level confirmed a good fit of the estimations with the data, as the R^2 value for sustainability innovation success turned out to be 0.524. The R^2 value for sustainability controls is 0.329, while the one for collaboration with startups is 0.001. According to Chin (1998), both the values for sustainability innovation success and sustainability controls are considered moderate and, thus, satisfying. Three of our variance inflation factor values at structural model level turn out to be below 1.1 and two below 3.4. Since variance inflation factor values higher 5.0 indicate multicollinearity (Hair *et al.* 2011), our values indicate collinearity. Figure C.2 shows our SEM results with the identified significant effects.



*Level of significance: † p < 0.10, * p < 0.05, **p < 0.01, *** p < 0.001 (one-tailed); n.s. stands for not statistically significant; all β coefficients are standardized.*

Figure C.2: SEM results

In H1 we proposed a direct positive effect of strategic sustainability innovation objective on sustainability innovation success, which turned out not to be significant (β = -0.276; n.s.). Further, we examined whether strategic sustainability innovation objective is positively related to collaboration with startups as proposed in H2a. Our results did not confirm a significant positive effect of strategic sustainability innovation objective on collaboration with startups (β = -0.030;

n.s.). However, supporting H2b, we find a (low) significant positive effect of collaboration with startups on sustainability innovation success ($\beta = 0.224$; $p < 0.1$). Also, we examine whether the construct of strategic sustainability innovation objective is positively related to sustainability controls. Here, we find a highly significant positive effect ($\beta = 0.574$; $p < 0.001$), providing support for H3a. Regarding H3b, we also find a highly significant positive effect from sustainability controls on sustainability innovation success ($\beta = 0.794$; $p < 0.001$). In addition, given the significance regarding both H3a and H3b, we estimate the indirect effect of strategic sustainability innovation objective via sustainability controls for startup collaborations on sustainability innovation success. To do so, we apply the bootstrapping method in PLS for the sampling distribution of the indirect effect following Hair *et al.* (2017). Based on our results, we find a significant mediating effect of sustainability controls in the relation between strategic sustainability innovation objective and sustainability innovation success ($\beta = 0.477$; $p \leq 0.001$).

Summarizing these findings, we see a missing direct connection between strategic objectives and sustainability innovation success which leads to the assumption that good intentions alone do not change the world, whereas the application of sustainability controls may help in this regard. Since these controls have a mediating effect, they are a promising instrument conveying strategic objectives toward innovation success. In terms of non-hypothesized effects and the related control variables examined by us, please see Table C.6 for the respective results.

5.4. Interview data

To complement the results from our quantitative research, we explore additional success factors for sustainability innovation. These seem to be the missing puzzle pieces for understanding the relations between the constructs of our research model and the mechanisms of how strategy, collaborations, controls, and success are connected.

To demonstrate rigor, our data structure shows how we progressed from raw data to terms and themes (Tracy 2010; Pratt 2008). Our intention when coding and analyzing the interview material was to identify which factors in more depth have some explanatory power for sustainability innovation success. They are refined by what we identify as effective management controls highlighting the relevance of the following interorganizational success factors.

Ownership of the innovation

Interview partners in several cases describe prior failures caused by defense mechanisms like the famous “not invented here”-phenomenon. To overcome this challenge, they stressed that it

is very important, in terms of personnel controls, to involve the right people and assure some sort of organizational involvement in every step of the collaborative process.

Reliable backing

We identify the relevance of reliable backing by decision-makers in the organization, mainly by our informants talking of the detrimental effects of lacking such kind of backing. They highlighted the importance of financial and organizational backing of the collaboration. They describe disadvantageous situations where the money had been withdrawn from one day to another or the managing director lost interest which led to lower prioritizing of the collaboration and a vast decrease in innovation success.

Value-fit and vision-fit

The most common statements in our interviews are related to cultural controls. Interview partners talk about the need for trust and sympathy for successful collaborations. They say that sometimes the heart decides and that the collaborating partners have to like each other. Further, they say the belief in the partners' integrity is important, as well as the feeling that the startup is not lying. Furthermore, a joint vision and shared objectives are considered as important for successful collaborations.

Embracing differences

Again, in the context of cultural controls, it became clear quite fast that representatives of the established companies were not keen to take away the startups culture and identity but to embrace the differences for which they decided to initiate the collaboration. Even though it was not considered to be easy at all times, a learning culture on both sides and cultural openness was considered to be important. Sometimes this even meant that some sort of cultural translation was needed and the ability of the collaborating partners to empathize with each other.

In this regard, based on our interview results, additional explanations for achieving sustainability innovation success through startup collaborations seem to lie in the following: The ownership of the jointly developed innovation, the reliable financial and organizational backing of the collaboration within the established company, a value- and vision-fit between the collaborating entities, as well as the need for embracing and managing cultural differences (for exemplary related citations of the interviewees see Table C.7, for the inductively elaborated data structure concerning these factors see Figure C.3).

6. Discussion and conclusion

With the research at hand, we show that applying sustainability controls turns out to be a promising way to achieve sustainability innovation success. In addition, we also find that already the collaboration with startups itself positively affects sustainability innovation success. Here, we were able to substantially add knowledge to the common understanding of how management controls relate to innovation success, especially in interorganizational management settings. Furthermore, our findings provide first empirical evidence that firms which establish a sustainability innovation objective in their corporate strategy implement sustainability controls for their collaboration with startups.

Based on these findings, our research enriches the management control literature in three major ways: First, based on the object-of-control framework by Merchant and Van der Stede (2012) and its control types (formal: results and action controls; informal: personnel and cultural controls), we develop and query a set of sustainability control items adapting all these control types. In this way, we extend the framework and confirm its applicability in the particular research context. Besides, we add one self-developed item for contractual control, further supplementing the object-of-control framework with particular regard to interorganizational control practices. Doing so, we offer a new set of items to define the construct of sustainability controls applied in the context of collaboration between established firms and startups, which complements traditional control practices.

Second, we contribute to the literature by investigating interorganizational management control and finding its relevance for the relation between strategic orientation and innovation success. With this finding, we answer the call for research of Caglio and Ditillo (2021) who state that, due to the complexity of interorganizational control practices, additional research is needed about management control for collaboration between firms aiming at innovation. In this regard, we provide further empirical evidence on the importance of interorganizational management control for achieving innovation success, using a mixed methods approach with both a survey and interviews. Thereby, our findings also show the importance of interorganizational management control for the concept of collaborative innovation.

Based on the aforementioned interviews, we could identify additional relevant factors for sustainability innovation success, enriching the understanding of how interorganizational management controls support the success of collaborations. Based on the understanding that sustainability innovations are similar to radical innovations, we come up with the additional finding that collaborations between established firms and startups have to ensure the ownership of the envisaged innovation, that the collaboration needs a reliable financial and organizational

backing for the innovation within the established company, a common value- and vision-fit of the collaborating parties as well as the embracement of cultural differences by both partners. These findings, in turn, show the variety of potentially influential factors and contingencies in this complex management control environment and offer fruitful avenues for future investigations of the mentioned factors in further quantitative studies. Highlighting the need for mainly informal controls, our findings are also in line with the work of Sandino (2007), who suggests that non-financial management control systems are a better fit for strategies involving high levels of uncertainty (which is the case for any form of innovation development). Our findings especially strengthen the importance of cultural controls to alleviate personal limitations. Here, we do not support the general understanding of Merchant and Van der Stede (2012) who are stressing the boundary functions of cultural controls. On the contrary, the cultural controls which are identified as important for innovation success can rather be associated with Simons' belief systems (1995). Here, future research may specify this distinction, analyzing if it is rather the sustainability or the interorganizational context driving these results.

Third, against the background of the questionable effectiveness of traditional management controls in improving companies' social and environmental performance (Burritt and Schaltegger 2010), we build on the notion that companies striving for sustainability innovation should focus on those management controls "[…] that fulfil their purpose most efficiently and/or effectively" (Crutzen *et al.* 2017, p. 1299–1300). In this regard, we find that a strategic sustainability innovation objective is positively related to established firms' use of particular sustainability controls for startup collaborations, and that these sustainability controls are essential for translating a strategic sustainability innovation objective into the desired innovation success. In doing so, we enhance theory guiding the design of effective management controls for achieving sustainability innovation.

Our research is also subject to certain limitations, many of which can provide the basis for further investigations. Initially, while we used cross-sectional data, it would also make sense to conduct longitudinal studies given that the collaboration between established firms and startups is a dynamic process and that the related sustainability innovation success may also differ from year to year and increase over time.

The desirable population for investigating our study's hypotheses would consist of all established firms collaborating with startups to generate sustainability innovations and using management controls to steer this collaboration. Yet, as related statistics or databases about such firms do not exist, we have been compelled to opt for an alternative solution for identifying a population (see section 'Survey'). In doing so, we have taken every effort to approach an

adequate population and correspondingly identify our sample (cf., Bronnenmayer *et al.* 2016). Also, while we focused on the culturally largely homogenous countries Germany, Austria, and Switzerland for generating our sample, future studies could also extend this study's scope to other cultural contexts.

Furthermore, our PLS-SEM approach has some limitations related to the variance-based analysis. Here, we need to notice the lack of overall goodness-of-fit measures compared to the covariance-based approach. However, as described PLS does not rely on normally-distributed data and results can therefore be interpreted much more intuitive. Moreover, while our sample may indeed be quantitatively limited, it surely is a high-quality sample, given that the participating experts are well-experienced managers responsible for startup collaborations and their steering. Talking to them personally before participation ensured that they are well experienced concerning the range of our topics. An additional quality characteristic lies in the low number of data sets that needed to be excluded from our statistical evaluation because of missing data points.

Concerning the non-significant findings of our study, we recommend interpreting them cautiously. As null-hypotheses testing is largely dependent on sample size, it is at least likely that if we would enhance our sample, we would find more significant results.

Potential endogeneity may also be a limitation in our study. This may be the case not only due to omitted variables but also due to potential simultaneity. For example, even though we find that sustainability controls have an impact on sustainability innovation success, there might also be a reverse relation as firms with great sustainability innovation success may want to maintain this success by installing sustainability controls. Also, they may simply be able to afford such controls in contrast to firms with low innovation success. Overall, although we took considerable care of an a priori theoretical specification of the relationships between our constructs, it is not possible to unambiguously differentiate cause-and-effect relations empirically in a cross-sectional study (Widener 2007; Van der Stede *et al.* 2005). While future studies thus may observe alternative relationships, it would also be recommendable to apply experimental designs for researching the topic since endogeneity is not an issue in experiments in which participants are randomly assigned to different research scenarios.

Since we decided for the specific sustainability focus, we combined the four types of management controls (results, action, personnel, and cultural) into one sustainability control construct, with the drawback of not being able to make a statement on the impact of the framework's single types of control. Thus, our call for future research includes the investigation of single constructs for each of the four types of management controls coined by Merchant and

Van der Stede (2012), as earlier applied by Goebel and Weißenberger (2017) and Kleine and Weißenberger (2014) in other research contexts.

Also, while we integrated different industries of the established firms in our sample, which makes our results more generalizable, one future alternative may also be to focus on only one industry and thus generate a more homogeneous sample which would allow for generating more focused implications and recommendations.

Despite the mentioned limitations, we believe that our findings provide important insights about the relevance of strategic objectives for sustainability innovations, the related startup collaborations, the application of sustainability controls for steering such collaborations, and additional factors for achieving sustainability innovation success.

In this regard, based on our results, we also contribute to the ongoing debate in practice on the effect of startup collaborations (Doerner *et al.* 2020) by showing the value of attracting startups for increasing sustainability innovation success for established firms. Also, we show that the application of sustainability controls can help managers responsible for the startup collaborations to steer them in the direction of innovation success. Thereby, we underline that solely relying on a strategic endeavor for sustainability innovations is not sufficient. While there is a common understanding of the need to ‘walk the talk’ and a general agreement of the fact that strategic objectives alone lack the power for achieving success, we are pleased to strengthen this understanding of practitioners with our empirical analysis.

References

Achtenhagen, L, L Melin and L Naldi, (2013). Dynamics of Business Models – Strategizing, Critical Capabilities and Activities for Sustained Value Creation. *Long Range Planning,* 46 (6), 427–442.

Ahrens, T and CS Chapman, (2007). Management Accounting as Practice. *Accounting, Organizations and Society,* 32 (1-2), 1–27.

Anthony, RN, (1965). *Planning and control systems: a framework for analysis*. Harvard Business Review Press.

Aragón-Correa, JA, (1998). Strategic Proactivity and Firm Approach to the Natural Environment. *Academy of Management Journal,* 41 (5), 556–567.

Arjaliès, D-L and J Mundy, (2013). The use of management control systems to manage CSR strategy: A levers of control perspective. *Management Accounting Research*, 24(4), 284–300.

Baker, WE and JM Sinkula, (2007). Does Market Orientation Facilitate Balanced Innovation Programs? An Organizational Learning Perspective. *Journal of Product Innovation Management,* 24 (4), 316–334.

Banerjee, SB, ES Iyer and RK Kashyap, (2003). Corporate Environmentalism: Antecedents and Influence of Industry Type. *Journal of Marketing,* 67 (2), 106–122.

Bansal, P and K Roth, (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal,* 43 (4), 717–736.

Barclay, DW, CA Higgins and R Thompson, (1995). The Partial Least Squares Approach to Causal Modeling: Personal Computer Adoption and Use as Illustration. *Technology Studies,* 2, 285–309.

Baum, Joel A. C., Tony Calabrese, and Brian S. Silverman. 2000. Don't Go It Alone: Alliance Network Composition and Start-ups' Performance in Canadian Biotechnology. *Strategic Management Journal* 21 (3): 267–294.

Bedford, DS and OF Speklé, (2018). Constructs in Survey-Based Management Accounting and Control Research: An Inventory from 1996 to 2015. *Journal of Management Accounting Research,* 30(2), 269–322.

Bhimani, A, H Silvola and P Sivabalan, (2016). Voluntary Corporate Social Responsibility Reporting: A Study of Early and Late Reporter Motivations and Outcomes. *Journal of Management Accounting Research,* 28 (2), 77–101.

Boons, F and N Roome, (2005). Sustainable Entreprise in Clusters of Innovation - New Directions in Corporate Sustainability Research and Practice. In *Environmental Strategy and Competitive Advantage*, edited by S Sharma and JA Aragón-Correa, 259–85. Elgar, Northampton, Mass.

Bronnenmayer, M, BW Wirtz and V Goettel, (2016). Success Factors of Management Consulting. *Review of Managerial Science,* 10 (1), 1–34.

Burritt, RL and S Schaltegger, (2010). Sustainability Accounting and Reporting: Fad or Trend? *Accounting, Auditing & Accountability Journal,* 23 (7), 829–846.

Caglio, A and A Ditillo, (2021). Reviewing Interorganizational Management Accounting and Control Literature: A New Look. *Journal of Management Accounting Research,* 33 (1), 149–169.

Calik, E and F Bardudeen, (2016). A Measurement Scale to Evaluate Sustainable Innovation Performance in Manufacturing Organizations. *Procedia CIRP,* 40, 449–454.

Cardinal, LB, (2001). Technological Innovation in the Pharmaceutical Industry: The Use of Organizational Control in Managing Research and Development. *Organization Science,* 12 (1), 19–36.

Carolis, DM de and P Saparito, (2006). Social Capital, Cognition, and Entrepreneurial Opportunities: A Theoretical Framework. *Entrepreneurship Theory and Practice,* 30 (1), 41–56.

Chenhall, RH, M Hall and D Smith, (2010). Social Capital and Management Control Systems: A Study of a Non-Government Organization. *Accounting, Organizations and Society,* 35 (8), 737–756.

Chenhall, RH and K Langfield-Smith, (2003). Performance Measurement and Reward Systems, Trust, and Strategic Change. *Journal of Management Accounting Research,* 15 (1), 117–43.

Clercq, D de and D Dimov, (2008). Internal Knowledge Development and External Knowledge Access in Venture Capital Investment Performance. *Journal of Management Studies,* 45 (3), 585–612.

Crunchbase (2019): Academic Research Access. Available at: https://about.crunchbase.com/partners/academic-research-access/

Crutzen, N, D Zvezdov and S Schaltegger, (2017). Sustainability and Management Control. Exploring and Theorizing Control Patterns in Large European Firms. *Journal of Cleaner Production,* 143, 1291–1301.

Davila, A, G Foster and N Jia, (2015). The Valuation of Management Control Systems in Start-up Companies: International Field-Based Evidence. *European Accounting Review,* 24 (2), 207–239.

Deeds, DL and CWL Hill, (1996). Strategic Alliances and the Rate of New Product Development: An Empirical Study of Entrepreneurial Biotechnology Firms. *Journal of Business Venturing,* 11 (1), 41–55.

Deeds, DL and FT Rothaermel, (2003). Honeymoons and Liabilities: The Relationship Between Age and Performance in Research and Development Alliances. *Journal of Product Innovation Management,* 20 (6), 468–484.

Dodgson, M, (1993). *Technological Collaboration in Industry: Strategy, Policy, and Internationalization in Innovation.* Routledge, London.

Doerner, K, M Floetotto, T Henz and T Strålin, (2020). *You Can't Buy Love. Reimagining Corporate-Start-up Partnerships in the DACH Region.* Available at: https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/cant-buy-love-corporate-start-up-partnerships-in-the-dach-region

Du, S, G Yalcinkaya and L Bstieler, (2016). Sustainability, Social Media Driven Open Innovation, and New Product Development Performance. *Journal of Product Innovation Management,* 33, 55–71.

Durden, C, (2008). Towards a Socially Responsible Management Control System. *Accounting, Auditing & Accountability Journal,* 21 (5), 671–694.

Dyer, B and XM Song, (1998). Innovation Strategy and Sanctioned Conflict: A New Edge in Innovation? *Journal of Product Innovation Management,* 15 (6), 505–519.

Dyer, JH and K Nobeoka, (2000). Creating and Managing a High-Performance Knowledge-Sharing Network: The Toyota Case. *Strategic Management Journal,* 21 (3), 345–367.

Eccles, RG, I Ioannou and G Serafeim, (2014). The Impact of Corporate Sustainability on Organizational Processes and Performance. *Management Science,* 60 (11), 2835–2857.

Epstein, MJ and J-F Manzoni, eds., (2008). *Performance Measurement and Management Control: Measuring and Rewarding Performance.* Emerald Group Publishing, Bingley.

Farooq, M, O Farooq and SM Jasimuddin, (2014). Employees Response to Corporate Social Responsibility: Exploring the Role of Employees' Collectivist Orientation'. *European Management Journal,* 32 (6), 916–927.

Floyd, SW and PJ Lane, (2000). Strategizing Throughout the Organization: Managing Role Conflict in Strategic Renewal. *The Academy of Management Review,* 25 (1), 154–177.

Fornell, C and DF Larcker, (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research,* 18 (1), 39–50.

Gatignon, H and J-M Xuereb, (1997). Strategic Orientation of the Firm and New Product Performance. *Journal of Marketing Research,* 34 (1), 77–90.

Gioia, DA, KG Corley and AL Hamilton, (2013). Seeking Qualitative Rigor in Inductive Research. *Organizational Research Methods,* 16 (1), 15–31.

Glaser, BG and A Strauss, (1967). *The Discovery of Grounded Theory: Strategies for Qualitative Research.* Aldine Publishing Co, Chicago, IL.

Goebel, S and BE Weißenberger, (2017). Effects of Management Control Mechanisms: Towards a More Comprehensive Analysis. *Journal of Business Economics,* 87 (2), 185–219.

Goetz, O, K Liehr-Gobbers and M Krafft, (2010). Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In *Handbook of Partial Least Squares*, edited by VE Vinzi, WW Chin, J Henseler and H Wang, 691–711. Springer, Berlin, Heidelberg.

Gond, J-P, S Grubnic, C Herzig, and J Moon, (2012). Configuring Management Control Systems: Theorizing the Integration of Strategy and Sustainability. *Management Accounting Research,* 23 (3), 205–223.

Granovetter, MS, (1973). The Strength of Weak Ties. *American Journal of Sociology,* 78 (6), 1360–1380.

Gruber, M, (2004). Marketing in New Ventures: Theory and Empirical Evidence. *Schmalenbach Business Review,* 56 (2), 164–199.

Guenther, E, J Endrikat and TW Guenther, (2016). Environmental Management Control Systems: A Conceptualization and a Review of the Empirical Evidence. *Journal of Cleaner Production,* 136, 147–171.

Hagedoorn, J, (2002). Inter-Firm R&D Partnerships: An Overview of Major Trends and Patterns Since 1960. *Research Policy,* 31 (4), 477–492.

Hair, JF, G Thomas, M Hult and CM Ringle, (2017). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM).* Sage Publications, Thousand Oaks, CA.

Hair, JF, CM Ringle, and M Sarstedt, (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice,* 19 (2), 139–151.

Hair, JF., CM Ringle and M Sarstedt, (2013). Partial Least Squares Structural Equation Modeling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning,* 46 (1-2), 1–12.

Hartmann, F, (2005). The Effects of Tolerance for Ambiguity and Uncertainty on the Appropriateness of Accounting Performance Measures. *Abacus,* 41 (3), 241–264.

Heidenreich, S, P Spieth and M Petschnig, (2017). Ready, Steady, Green: Examining the Effectiveness of External Policies to Enhance the Adoption of Eco-Friendly Innovations. *Journal of Product Innovation Management,* 34 (3), 343–359.

Henri, J-F and M Journeault, (2010). Eco-Control: The Influence of Management Control Systems on Environmental and Economic Performance. *Accounting, Organizations and Society,* 35 (1), 63–80.

Henseler, J, CM Ringle and RR Sinkovics, (2009). The Use of Partial Least Squares Path Modeling in International Marketing. In *New Challenges to International Marketing*. Vol. 20, edited by RR Sinkovics and PN Ghauri, 277–319. Advances in International Marketing. Emerald Group Publishing Limited, Bingley.

Hopwood, AG, (1976). *Accounting and Human Behaviour.* Prentice-Hall contemporary topics in accounting series. Prentice-Hall, Eaglewood Cliffs, N.J.

Kahn, KB and EF McDonough, (1997). An Empirical Study of the Relationships Among Co-location, Integration, Performance, and Satisfaction. *Journal of Product Innovation Management,* 14 (3), 161–178.

Kennedy, S, G Whiteman and J van den Ende, (2017). Radical Innovation for Sustainability: The Power of Strategy and Open Innovation. *Long Range Planning,* 50 (6), 712–725.

Ketchen, DJ, RD Ireland and CC Snow, (2007). Strategic Entrepreneurship, Collaborative Innovation, and Wealth Creation. *Strategic Entrepreneurship Journal,* 1 (3-4), 371–385.

Klein, SP, P Spieth and S Heidenreich, (2021). Facilitating Business Model Innovation: The Influence of Sustainability and the Mediating Role of Strategic Orientations. *Journal of Product Innovation Management*, 38 (2), 1–18.

Kleine, C and BE Weißenberger, (2014). Leadership Impact on Organizational Commitment: The Mediating Role of Management Control Systems Choice. *Journal of Management Control,* 24 (3), 241–266.

Klepper, S, (1996). Entry, Exit, Growth, and Innovation over the Product Life Cycle. *The American Economic Review,* 86 (3), 562–583.

Klewitz, J and EG Hansen, (2014). Sustainability-Oriented Innovation of SMEs: A Systematic Review. *Journal of Cleaner Production,* 65, 57–75.

Kober, R, J Ng and BJ Paul, (2007). The Interrelationship Between Management Control Mechanisms and Strategy. *Management Accounting Research,* 18 (4), 425–52.

Kraus, S and I Kauranen, (2009). Strategic Management and Entrepreneurship: Friends or Foes? *International Journal of Business Science & Applied Management,* 4 (1), 37–50.

Langfield-Smith, K, (1997). Management Control Systems and Strategy: A Critical Review. *Accounting, Organizations and Society,* 22 (2), 207–232.

Lisi, IE, (2015). Translating Environmental Motivations into Performance: The Role of Environmental Performance Measurement Systems. *Management Accounting Research,* 29, 27–44.

Lumpkin, GT and GG Dess, (1996). Clarifying the Entrepreneurial Orientation Construct and Linking It to Performance. *Academy of Management Review,* 21 (1), 135–172.

MacKenzie, SB, PM, Podsakoff and CB Jarvis, (2005). The Problem of Measurement Model Misspecification in Behavioral and Organizational Research and Some Recommended Solutions. *The Journal of Applied Psychology,* 90 (4), 710–30.

Malmi, T and DA Brown, (2008). Management Control Systems as a Package—Opportunities, Challenges and Research Directions. *Management Accounting Research,* 19 (4), 287–300.

Merchant, KA and WA Van der Stede, (2017). *Management Control Systems.* 4thed. Pearson Education, River St Hoboken, NJ.

Miles, RE, G Miles and CC Snow, (2005). *Collaborative Entrepreneurship: How Communities of Networked Firms Use Continuous Innovation to Create Economic Wealth.* Stanford University Press, Stanford, CA.

Milstein, MB, T London and H Stuart, (2007). Revolutionary Routines: Capturing the Opportunity for Creating a More Inclusive Capitalism. In *Handbook of Transformative Cooperation: New Designs and Dynamics*, edited by SK Piderit, RE Fry and DL Cooperrider, 84–103. University Press, Stanford, CA.

Mundy, J, (2010). Creating Dynamic Tensions Through a Balanced Use of Management Control Systems. *Accounting, Organizations and Society,* 35 (5), 499–523.

Murillo-Luna, JL, C Garcés-Ayerbe and P Rivera-Torres, (2008). Why Do Patterns of Environmental Response Differ? A Stakeholders' Pressure Approach. *Strategic Management Journal,* 29 (11), 1225–1240.

Nitzsche, P, BW Wirtz and V Goettel, (2016). Innovation Success in the Context of Inbound Open Innovation. *International Journal of Innovation Management,* 20 (2), 1–38.

Noble, CH, RK Sinha and A Kumar, (2002). Market Orientation and Alternative Strategic Orientations: A Longitudinal Assessment of Performance Implications. *Journal of Marketing,* 66 (4), 25–39.

Ozgen, E and RA Baron, (2007). Social Sources of Information in Opportunity Recognition: Effects of Mentors, Industry Networks, and Professional Forums. *Journal of Business Venturing,* 22 (2), 174–192.

Pondeville, S, V Swaen and Y de Rongé, (2013). Environmental Management Control Systems: The Role of Contextual and Strategic Factors. *Management Accounting Research,* 24 (4), 317–332.

Porter, ME and MR Kramer, (2011). Creating Shared Value. How to Reinvent Capitalism - and Unleash a Wave of Innovation and Growth. *Harvard Business Review*, available at: https://hbr.org/2011/01/the-big-idea-creating-shared-value

Pratt, MG, (2008). Fitting Oval Pegs into Round Holes: Tension in Evaluating and Publishing Qualitative Research in Top-Tier North American Journals. *Organizational Research Methods,* 11 (3), 481–509.

Reinartz, W, M Haenlein and J Henseler, (2009). An Empirical Comparison of the Efficacy of Covariance-Based and Variance-Based SEM. *International Journal of Research in Marketing,* 26 (4), 332–344.

Rogers, M, (2004). Networks, Firm Size and Innovation. *Small Business Economics,* 22 (2), 141–153.

Sandino, T, (2007). Introducing the First Management Control Systems: Evidence from the Retail Sector. *The Accounting Review,* 82 (1), 265–293.

Schaltegger, S and RL Burritt, (2000). *Contemporary Environmental Accounting: Issues, Concepts and Practice.* Greenleaf, Sheffield.

Schaltegger, S and M Wagner, (2010). Sustainable Entrepreneurship and Sustainability Innovation: Categories and Interactions. *Business Strategy and the Environment,* 20 (4), 222–237.

Schumpeter, JA, (1934). *The Theory of Economic Development.* Harvard University Press, Cambridge, MA.

Seebode, D, S Jeanrenaud and J Bessant, (2012). Managing innovation for sustainability. *R&D Management,* 42(3), 195–206.

Sharma, JP and S Khanna, (2014). Corporate Social Responsibility, Corporate Governance and Sustainability: Synergies and Inter-relationships. *Indian Journal of Corporate Governance*, 7(1), 14–38.

Simons, R, (1995). *Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal.* Harvard Business Review Press, Boston, MA.

Smith, D and K Langfield-Smith, (2004). Structural Equation Modeling in Management Accounting Research: Critical Analysis and Opportunities. *Journal of Accounting Literature,* 23, 49–86.

Todeschini, BV, MN Cortimiglia, D Callegaro-de-Menezes and A Ghezzi, (2017). Innovative and Sustainable Business Models in the Fashion Industry: Entrepreneurial Drivers, Opportunities, and Challenges. *Business Horizons,* 60 (6), 759–770.

Tracy, SJ, (2010). Qualitative Quality: Eight "Big-Tent" Criteria for Excellent Qualitative Research. *Qualitative Inquiry,* 16 (10), 837–851.

Tsai, W and S Ghoshal, (1998). Social Capital and Value Creation: The Role of Intrafirm Networks. *Academy of Management Journal,* 41 (4), 464–476.

Utterback, JM and A William, (1975). A Dynamic Model of Process and Product Innovation. *OMEGA, The International Journal of Management Science,* 3 (6), 639–656.

Van der Stede, WA, SM Young and CX Chen, (2005). Assessing the Quality of Evidence in Empirical Management Accounting Research: The Case of Survey Studies. *Accounting, Organizations and Society,* 30 (7-8), 655–684.

Van Maanen, J, (1979). The Fact of Fiction in Organizational Ethnography. *Administrative Science Quarterly,* 24 (4), 539–550.

Wallmann, SMH, (1995). The Future of Accounting and Disclosure in an Evolving World: The Need for Dramatic Change. *Accounting Horizons,* 9 (3), 81–91.

Watson, R, HN Wilson, P Smart and EK Macdonald, (2018). Harnessing Difference: A Capability-Based Framework for Stakeholder Engagement in Environmental Innovation. *Journal of Product Innovation Management,* 35 (2), 254–279.

Weiblen, T and HW Chesbrough, (2015). Engaging with Start-ups to Enhance Corporate Innovation. *California Management Review,* 57 (2), 66–90.

Weijters, B, E Davidov and H Baumgartner, (2023). Analyzing factorial survey data with structural equation models. *Sociological Methods & Research*, 52(4), 2050–2082.

Widener, SK, (2007). An Empirical Analysis of the Levers of Control Framework. *Accounting, Organizations and Society,* 32 (7-8), 757–88.

Zhou, KZ, CK Yim and DK Tse, (2005). The Effects of Strategic Orientations on Technology- and Market-Based Breakthrough Innovations. *Journal of Marketing,* 69 (2), 42–60.

Appendix

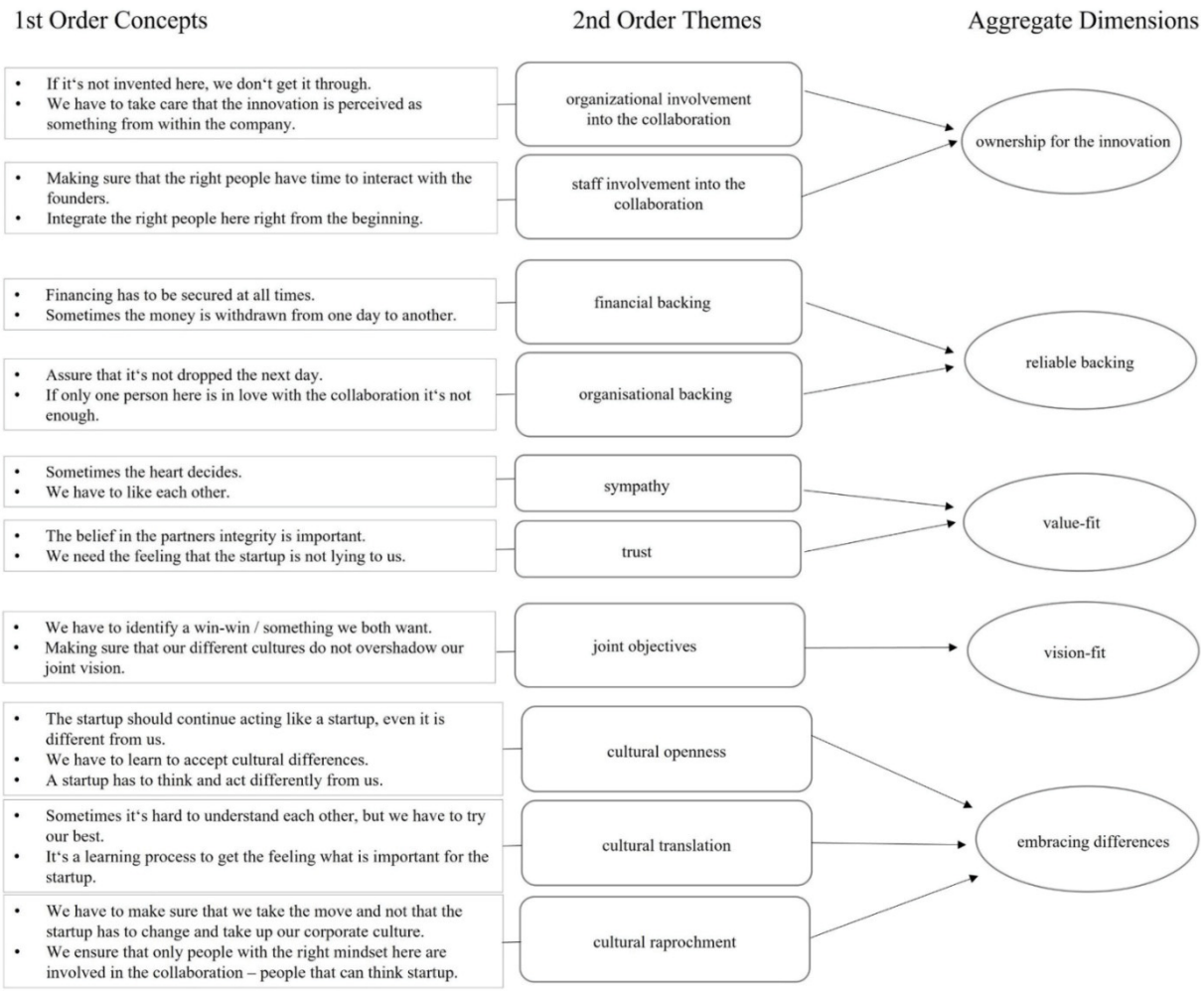


Figure C.3: Inductively elaborated data structure concerning sustainability innovation success factors

Table C.1: Descriptive statistics about the respondents and their companies

Age of the managers	Gender of the managers	Total revenues (2019)	Sector of the companies	Age of the companies
< 35 years: 20 %	Female: 32 %	Mean = € 21,818 million	Automotive/transport: 22.1 %	10 to 24 years: 13 %
35 to 45 years: 43 %	Male: 68 %	Median = € 6,300 million	Information/communication/ media: 18.5 %	> 25 years: 87 %
> 45 years: 37 %		SD = € 29,017 million	Chemical/pharma/health: 13.0 %	
			Services: 12.0 %	
			Energy: 8.9 %	
			Manufacturing: 8.9 %	
			Wholesale/retail: 8.9 %	
			Miscellaneous: 16.6 %	

Table C.2: Measures and their origin

Questionnaire items	Original constructs	Source
Strategic sustainability innovation objective		
Our company focuses more strongly than many of our competitors on the development of new sustainable products and services.	Strategic type	Dyer and Song 1997
Compared to our competitors, we have the image of driving sustainability innovations in the market.	Strategic type	Dyer and Song 1997
Our company plans to enter lucrative new markets by implementing sustainability strategies.	Strategic type	Dyer and Song 1997
Our company plans to increase market share by orienting our current products and services more on sustainability.	Expected competitive advantage from environmental initiatives	Lisi 2015
Our company aims to contribute to securing the lifelihoods of future generations.	Expected competitive advantage from environmental initiatives	Lisi 2015
Our company targets a sustainable growth which considers future generations.	Corporate social responsibility to environment	Farooq *et al.* 2014
Collaboration with startups		
In 2019, together with startups we achieved goals collectively.	Collaboration	Kahn and McDonough, Edward F., III 1997
In 2019, we worked together with startups as a team.	Collaboration	Kahn and McDonough, Edward F., III 1997

Questionnaire items	Original constructs	Source
Sustainability controls		
In our collaboration with startups, we pursue sustainability objectives.	Formal environmental management control system (results control)	Pondeville *et al.* 2013
Sustainability criteria play a role in investment decisions when working with startups.	Formal environmental management control system (results control)	Pondeville *et al.* 2013
A guideline on sustainability aspects is part of our collaboration with startups.	Natural environmental management practices (action control)	Aragón-Correa 1998
For the employees involved in the collaboration, trainings on sustainability issues take place.	Natural environmental management practices (personnel control)	Aragón-Correa 1998
The orientation towards sustainability goals in our collaboration with startups receives the full support of our top management.	Top management commitment (cultural control)	Banerjee *et al.* 2003
Sustainability is an element of our collaboration agreed by contract.	Contractual control	self-developed
Sustainability innovation success		
As a result of our collaboration with startups, our products and services are more sustainable than those of our competitors.	Sustainable innovation performance	Calik and Bardudeen 2016
As a result of our collaboration with startups, our company has redesigned and improved products and services to meet sustainability criteria.	Sustainable innovation performance	Calik and Bardudeen 2016
Our development of new sustainable products and services, together with startups, is much more successful than that of our competitors.	Innovation success	Nitzsche *et al.* 2016
The sustainability level of the new products and services, we develop in collaboration with startups, is significantly higher than that of our competitors.	Innovation success	Farooq *et al.* 2014; Nitzsche *et al.* 2016
From an overall profitability perspective, our collaboration with startups to develop new sustainable products and services is successful.	Relative firm success	Dyer and Song 1997
The overall performance of our collaboration with startups to develop new sustainable products and services have met our objectives.	Relative firm success	Dyer and Song 1997

Table C.3: Information about the interviewees and their companies

Interviewee Code	Position	Sector	Employees
INT1	Head of Innovation & Ventures	Commerce	500.000+
INT2	Head of Business Model Innovation	Information, Communication, Media	100.000+
INT3	Investment Manager	Chemical, Pharma, Healthcare	40.000+
INT4	Senior Venture Architect	Automotive	30.000+
INT5	Agile Lead Innovation & Head of Brand Strategy	Energy	200+
INT6	Head of Innovation	Energy	10.000+
INT7	Manager Service Solutions & Market Excellence	Information, Communication, Media	2.000+
INT8	Investment Manager	Chemical, Pharma, Healthcare	30.000+
INT9	Head of Business Development	Energy	2.000+
INT10	Head of Digital Innovation	Information, Communication, Media	10.000+
INT11	Manager Mergers & Acquisitions, Corporate Strategy & Efficiency	Information, Communication, Media	2.000+
INT12	Global Head of Strategic Development, M&A	Manufacturing	4.000+
INT13	Senior Innovation Manager	Services	1.000+
INT14	Head of Startup Desk and Innovation Board	Chemical, Pharma, Healthcare	3.000+
INT15	Innovation Manager	Chemical, Pharma, Healthcare	3.000+
INT16	Strategy & Global Business Development	Chemical, Pharma, Healthcare	50.000+

INT stands for Interview; M&A stands for Mergers & Acquisitions

Table C.4: Measurement model results

First-order construct	Items	Loadings (λ_i)	Significance (bootstrapping; $n = 500$)
Strategic Sustainability Innovation Objective	Our company focuses more strongly than many of our competitors on the development of new sustainable products and services.	0.753	6.671
Mean = 0.693 SD = 0.147 CR = 0.859 AVE = 0.506	Compared to our competitors, we have the image of driving sustainability innovations in the market.	0.734	6.257
	Our company plans to enter lucrative new markets by implementing sustainability strategies.	0.662	3.238
	Our company plans to increase market share by orienting our current products and services more on sustainability.	0.578	2.841
	Our company aims to contribute to securing the lifelihoods of future generations.	0.779	6.418
	Our company targets a sustainable growth which considers future generations.	0.742	5.641
Collaboration with Startups	In 2019, together with startups we…		
Mean = 0.865 SD = 0.167 CR = 0.891 AVE = 0.804	… achieved goals collectively.	0.898	6.073
	… worked together as a team.	0.810	4.469
Sustainability Controls for Startup Collaboration	In our collaboration with startups, we pursue sustainability objectives.	0.770	14.821
Mean = 0821 SD = 0.057 CR = 0.927 AVE = 0.678	Sustainability criteria play a role in investment decisions when working with startups.	0.820	16.277
	A guideline on sustainability aspects is part of our collaboration with startups.	0.859	17.885
	For the employees involved in the collaboration, trainings on sustainability issues take place.	0.849	17.050
	The orientation towards sustainability goals in our collaboration with startups receives the full support of our top management.	0.800	12.840
	Sustainability is an element of our collaboration agreed by contract.	0.793	8.894

First-order construct	Items	Loadings (λ_i)	Significance (bootstrapping; n = 500)
Sustainability innovation success	As a result of our collaboration with startups, our products and services are more sustainable than those of our competitors.	0.870	27.776
Mean = 0.868 SD = 0.147 CR = 0.951 AVE = 0.765	As a result of our collaboration with startups, our company has redesigned and improved products and services to meet sustainability criteria.	0.871	24.375
	Our development of new sustainable products and services, together with startups, is much more successful than that of our competitors.	0.914	33.715
	The sustainability level of the new products and services, we develop in collaboration with startups, is significantly higher than that of our competitors.	0.913	45.625
	From an overall profitability perspective, our collaboration with startups to develop new sustainable products and services is successful.	0.845	13.949
	The overall performance of our collaboration with startups to develop new sustainable products and services have met our objectives.	0.798	5.925

SD: Standard Deviation CR: Composite Reliability AVE: Average Variance Extracted

Table C.5: Heterotrait-monotrait ratio of correlations

Constructs	1	2	3
(1) Strategic sustainability innovation objective			
(2) Collaboration with startups	0.162 CI900[0.161;0.462]		
(3) Sustainability controls for startup collaborations	0.650 CI900[0.524;0.825]	0.132 CI900[0.132;0.143]	
(4) Sustainability innovation success	0.235 CI900[0.214;0.570]	0.294 CI900[0.140;0.549]	0.689 CI900[0.501;0.850]

Table C.6: Non-hypothesized effects and related control variables

Relations measured	Path coefficients	Significance level
Focus on exploration		
Focus on exploration → sustainability innovation success	0.377	< 0.001 (0.000)
Focus on exploration → collaboration with startups	0.339	< 0.1 (0.084)
Focus on exploration → sustainability controls	0.197	< 0.1 (0.056)
Focus on exploration → strategic sustainability objective	0.386	< 0.1 (0.095)
Focus on exploitation		
Focus on exploitation → strategic sustainability objective	0.493	< 0.001 (0.000)
Strategic importance of collaboration with startups → collaboration with startups	0.355	< 0.05 (0.023)
Strategic importance of collaboration with startups → sustainability innovation success	0.581	< 0.05 (0.018)
Strategic importance of collaboration with startups → sustainability controls	0.253	< 0.1 (0.072)
Trust within the collaboration		
Trust within the collaboration → collaboration with startups	0.520	< 0.001 (0.000)
Trust within the collaboration → sustainability controls	0.288	< 0.05 (0.017)
Social interaction within the collaboration		
Social interaction within the collaboration → collaboration with startups	0.461	≤ 0.001 (0.001)

Table C.7: Related citations of the interviewees

Ownership for the innovation:

Organizational involvement:

"When the innovation was ready, we gave it to a department. That was really the classic point according to the textbook: Not invented here. With all the blood and tears that goes with it. In the meantime, we have also said: "We involve the stakeholders from the beginning."

“It needs drivers. People need to be named; resources need to be provided.”

“[It’s important] that there is a business unit, a department or whatever that feels responsible for this startup because they see a sense behind it, because there are benefits, that they are also involved. To get rid of this not-invented-here syndrome.”

“In other words, we need experts from within the company who can then get to grips with the potential solution providers, i.e., the startups. And for us to really get into the technical exchange and for that to work, it's not just the people with the startup desk who can then deal with this that can exchange ideas with startups, but also the experts on the ground. That means we must give people, for example the doctor, the time to deal with the topic, to be the contact person for the startup, so that such a cooperation can also grow. [Then we] make the processes so that people also find time to work on it.”

Staff involvement:

*"*This means that we make sure that the projects we supervise fit the team members as well as possible."

I often experience that [my own employees] are distant at the beginning, because they have a lot of other things to do. When they ask a few important questions and get very good and convincing answers from this startup company, then the ice is broken and they say, yes I find that exciting.”

“You have to find the right people in the corporate organization in the respective areas who have this mentality.”

Reliable backing:

Financial backing:

"In the beginning, we noticed that when we had a good project, we went to the people who needed it. They then had to give us the budget. Then, of course, you're involved in the whole budget discussion and that doesn't exactly promote innovation. [...] In the meantime, of course, the department has to say that it's good. But as a rule now, we have the budget for it."

"You make a budget at the beginning of the year and have a little buffer. But if something bigger comes along, you must ask the board again. Of course, this is always a procedure that nobody likes. But we got around that by saying: "Okay, we have a budget here, we can go through with this project".

“The strategy should also be anchored in a budget and also in an organization.”

“For me, the absolute most important thing is that the Corporate has enough resources to lead the collaboration.”

“And then this person who wanted to work with the startup and started everything realizes, "Crap I don't have any more money." [...] And then it doesn't go on - that often happened. [...] Because without the resources you will just talk great and think everything is great but in the end nothing comes out of it. And that's damn difficult in a big organization. It's probably easier in smaller companies because the structures are simpler.”

If it doesn't work out, it's bad for the startup and it's also bad for corporate because the startups talk to each other and say, "You don't want to work with this company because they're screwing you over. […] They don't have enough resources.””

“I do believe that it is of course also the willingness to invest money somewhere. At the end of the day, it all costs money and a dedicated contact person.”

Organizational backing:

“You have to distinguish between the desire and the will. Of course, everyone wants a startup to be successful. But when it comes to deciding whether to invest venture capital, someone has to make the decision. If they don't have backing from above, so that they say, "It's okay.

You can invest ten times. If we make three a success, then it's a huge success." If that culture isn't there, that culture of making mistakes, then I'm better served to say no."

"And then he has not his whole organization or the resources that an organization needs, he hasn't really mobilized those. And then the resources internally say you know I don't have time for this. Or the strategy has just changed or a customer calls I have more important things to do or there is a fire or some excuses. [...] This person made the mistake of not informing his organization in time and in detail to explain why the startup is so great. The value of this collaboration with the startup needs to be made clear to his organization."

"And as soon as a club starts, someone in the company is offended. Someone didn't do the job or is fine, we stay with the old, I think."

Value fit:

Sympathy:

*"*We then allocate it and take into account that it fits in terms of content, but also in terms of sympathy."

"In this cooperation it is very much a personal story, on the one hand towards the startup, but on the other hand also often towards the corporation."

"For me, the success [of a startup collaboration] essentially depends on two factors, although I can't say which factor takes precedence. One is the human factor, the person."

Trust:

"I think one very important point is trust. And that is something that is of course very difficult to build up and above all very difficult to build up quickly at the beginning on both sides. [...] But nevertheless, there is always this subliminal fear, for some at least, that you will be taken to the cleaners. [...] And that's why trust, as difficult as it is to build up, is a basic prerequisite for being successful together quickly enough."

"Yes, and a trust goal like that is super hard to grasp, you can't measure it either."

"I think that's something where we're committed to working together as a trusted partner."

"I see more of a problem of having to give the startup confidence: "Watch this, what you're doing is right. Focus on your point."

Vision fit:

Joint objectives:

"I think the most important thing is that it benefits both."

“Win-win situations must be created. If these are not given, then in case of doubt the corporate side must say: Well, we have a business to drive. We have a hospital, we have a performance mandate to fulfill for the benefit of patients, and we can't go on forever.”

"When a party notices that it is being exploited, or that it no longer has any use and is only working on things because it is written in some contract, but you no longer see the wider meaning in it, that is always critical".

"You need a grey zone, which is actually just a guideline, but still definitely says you're also on the right track and that's this art for me, what I learned in the end."

"I think you have to make it clear very quickly at the beginning, from both sides, what the expectations are and what the respective goals are".

"It is also important to have a common agenda and common goals".

“In negotiations with our cooperation partners, we have really juxtaposed the respective values and strategies of how such a mission is implemented.”

Embracing differences:

Cultural openness:

"I have seen both sides and have my own opinion on how two parties, which are actually fundamentally completely different, can play with each other".

"You have to see if the cultures fit together. [...] . And that is usually different. They also have to be different. They have to be different culturally, because they have to work differently. And that is also what we enjoy when we work with them. "

"We don't want them to become like us either. [...] And that despite the differences we find enough common ground to work together sensibly."

You have to give the people working on startups the air and the freedom to do things differently and not shimmy along the process chain towards a goal, rather the opposite is more conducive."

"Which is certainly counterproductive, if at some point the big corporate machine then pounces on a small startup and they are completely defocused as a result. What else must not happen? That these good old learnings from the old world are then automatically transferred to the startup, because you know better anyway. Everything is thought of in terms of structures that can be installed in the same size. That's how you lose the advantages of a startup, in terms of agility, innovative spirit, and so on, also from the working worlds, modalities. I think a very central factor is to get involved in continuing to give this freedom. As I said, that's the fine line while using the core assets that are interesting for the startup."

"I think this cultural aspect, opening up one's culture to the point where I'm willing to accept different cultures, processes, ways of doing things, is very important."

"It should not be divided into the big and the small, those who know better and those who know worse, those who are experienced and those who are inexperienced, or those who pretend and those who execute. It's just different. Accepting that, I think, is a very important issue and that it can happen at eye level. Only then can I get into this feedback and exchange at eye level mode in the first place."

"And then you need those people who can handle it. I think that's the smaller part that can do it. But they can only do that if the company, again, allows the whole thing."

"But it is of course, on the one hand, I think, the openness to other ways of thinking, that is, the calibration of different ways of thinking."

Cultural translation:

"And the challenge is, on the one hand, to speak the same language. To understand the right things among the things."

"I think the most important thing that collaborations often fail on is this translation work. Corporations work differently than a startup. In both, there are certain procedures, processes, compliance regulations, et cetera, or not. And often what's missing here is this understanding of the different speeds, where you have to be this very intermediary between these two worlds. Often there's a lack of understanding."

“You need someone who thinks a little differently than a typical corporate. But if you want to have market access and generate revenue in the end, that means you have to go to the customer. You have to pick up this different kind of thinking. You have a cultural difference between the people who work with startups who are dynamic, they are flexible. less risk adverse, and then you have the people for enabling market access. These are the risk adverse people. Someone has to be able to motivate these risk adverse people and show there is something for you when we work with this startup. It is difficult because he is the link, that is also my job, to the super risky fast thinking startups and the super risk adverse people that you need to enable the market access. He has to be able to play that bridge and not every person can.”

“The experience we certainly have is that there is of course a clash of worlds between the startups, which can always decide everything quickly from one hour to the next. And we have different structures in a corporation. We often have another issue of understanding. We notice that a lot.”

“This means that escalations really do occur often. And if this innovation manager, as I said, whatever his name is now, is not there in between and cannot do the translation work, then a collaboration can also turn negative quite quickly.”

"We see ourselves very much in the role of interpreter for the group. [...] towards the startup you have to translate it differently again."

Cultural rapprochement:

"There needs to be a convergence of mutual cultures. Corporates have structures, are inflexible, have many hurdles, have many hierarchies. Startups are agile, want to decide quickly, move forward. Many collaborations fail because of this cultural mismatch. It is important to find a common culture as to how you want to move forward later, and here, above all, the corporates must adapt to the startups and not the other way around".

“[It’s important] not to crush the startup in the collaboration, i.e. to leave enough room and flexibility. And, on the other hand, to rein in the group, I would call it in a friendly way, so that not all the regulations have to be completely mapped in any form.”

“But I believe that if you want to work together in an entrepreneurial way, there has to be some kind of fit that works as equals and that fundamentally understands and accepts both sides and needs. And that also means that the startup has to accept that, for example, the data

protection officer or compliance officer or someone else brings in completely different perspectives and when the startup says, "Let's test it first, and then we'll see. – this officer says "No, we can't test first, because we're not allowed to do that,". I think it is very important to have a dialogue.”

"We might also have to be a bit faster on our side, make quicker decisions than usually."

D. Study 3: Re-Examining Control Systems for Integrating Sustainability into Corporate Investment Decisions: Derivation of a Transformation Management Compass

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All authors analyzed research.

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Re-Examining Control Systems for Integrating Sustainability into Corporate Investment Decisions: Derivation of a Transformation Management Compass

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Re-Examining Control Systems for Integrating Sustainability into Corporate Investment Decisions: Derivation of a Transformation Management Compass

ABSTRACT

Sustainability has become more than just a trend (Burritt and Schaltegger 2010). For systematic change to occur, we hypothesize that sustainability issues must be integrated into decision-making and reflected within control systems. This research aims to examine how sustainability is incorporated into decision-making today and what might lead to strengthening the successful integration of sustainability into business activities. To this end, 17 in-depth interviews in the context of investment decisions with mostly C-level executives from different sectors and company sizes were conducted. We adopt the research paradigm of analytic induction (Robinson 1951; Znaniecki 1934, p.249), beginning with a tentative definition of a phenomenon or initial framework based on preexisting knowledge of theory (here management control theory and the concept of transformational management). This work identifies the main relevant changes in belief systems and interactive control systems. Success factors for leading a company from transactional management practices towards transformational management approaches can be subsumed as a corresponding value orientation, a certain willingness to pay, openness for risk-taking and innovation, for example, shown in the organizational relevance of research and development, as well as clear responsibilities and advocacy for the integration of sustainability aspects into current business practices.

Keywords: Sustainability; Accounting; Management Control; Strategy; Investment Decisions

JEL Classification: D70, D81, M12, M14, M41, Q56

1. Introduction

Investment decisions are of central importance for economic activity. How an organization decides to spend its money manifests its' strategic orientation, culture, and understanding of values. While sustainability has become a mainstream topic, we are eager to understand if and how it is entering the heart of businesses: their investment decisions.

The introduction of carbon trading schemes, for example, had both short-term and long-term financial implications as these developed (Bebbington and Larrinaga-González 2008: 703). Could similar effects have occurred in the face of the recent introduction of sustainability requirements for firms? Our research aims to identify how sustainability considerations are influencing internal investment decisions and which type of management controls are at the forefront of this influence.

In 2016, Guenther *et al.* examined how internal drivers and managerial processes lead to the roll-out of environmental strategies in companies. While Guenther *et al.* concentrated on the concept of environmental management control systems for simultaneously fostering environmental and financial performance, we examine control systems more generally (i.e., not just environmental controls) but distinguishing different types of controls relevant to making investment decisions. This research approach is in line with Guenther *et al.*'s call for research "to explore which controls co-exist in a rather loosely manner and which controls are interdependent and thus should entail a high degree of internal consistency to be effective." (Guenther *et al.* 2016, p. 167).

As a framework for our analysis, we capitalized on the widely adopted Levers of Control (LOC) framework coined by Simons (1994; 1995). Based on qualitative empirical data, we find evidence for the relevance of all four of its essential components: belief systems, boundary systems, diagnostic control systems, and interactive control systems. Belief systems, especially, seem to be important, including management beliefs and buy-in, the financial backing for business activities in the context of sustainability and potential business cases, and the alignment with the overall (strategic) objectives. Further, changes in time, such as the social discourse on sustainability, subsumed under the concept of belief system change, are considered quite relevant. Interactive control systems seem to be similarly important, including the following subthemes: room for discussion, institutional collaboration, and inter-organizational dialogue.

Further, we identify key indicators for integrating sustainability into decision-making by differentiating between the roles of transformational and transactional management. Here, we uncover the need for a corresponding value orientation, a certain willingness to pay, and openness for risk-taking and innovation, for example, shown in the organizational relevance of

research and development, as well as clear responsibilities and advocacy for the integration of sustainability aspects into current business practices.

The relevance of the topic derives from the grand challenges of climate change, biodiversity loss, and resource scarcity, where the private sector must not only play a less harmful role but proactively contribute to solutions (Schaltegger 2018). Here, an orientation towards absolute sustainability, which refers to taking the global and local environmental capacities into account, is not yet widely applied but is considered highly relevant by scholars who have empirically examined its implementation (Bjørn *et al.* 2020).

2. Conceptual and theoretical background

2.1. Research streams around sustainability and management accounting

In 2012, Gond *et al.* set the scene for research on sustainability management when denoting that traditional management control systems are "limited (…) in addressing environmental and social issues as well as their interrelationships with financial issues" (p. 208). Soon after, Hartmann *et al.* (2013) conducted a literature review on the integration of strategy and sustainability in control systems, while the journal Management Accounting Research published a special issue on "Sustainable development, management, and accounting: Boundary crossing" (Bebbington and Thomson 2013).

In the aforementioned special issue, Rodrigue *et al.* (2013) mapped sustainability-related controls onto the four levers of control dimensions of Simons (1995), which also informed our view on control systems, and which guided our structuring of the information we derived from our interviews. Lueg and Radlach (2016), as well as Johnstone (2019), wrote about so-called sustainability control systems which are "providing information and direction, as well as monitoring and motivating employees to continually develop sustainable practices and procedures for future improved sustainability performance" (p. 34). Nevertheless, having sustainability management controls in place does not ensure that sustainability is successfully integrated into corporate strategy and business activities (Beusch *et al.* 2022).

Therefore, we highlight three essential research streams here. The first is about the assessment of (sustainability) impacts of business activities and how these can be measured and incorporated into decision-making. Here, Cuckston (2013) conducted a literature review on the crossroads of management accounting for carbon and management control, while Pondeville *et al.* (2013) focused on decision-making when examining environmental control systems and the

role of contextual and strategic factors. More recently, Taïbi *et al.* (2020) made use of intervention research to describe accounting mechanisms for strong sustainability.

The second research stream examines whether sustainability objectives conflict with financial objectives. Here, Epstein *et al.* (2010) described the challenge of integrating sustainability into operational and capital investment decision-making. Schaltegger *et al.* (2012) distinguish, on the one hand, between managers which have a collaborative business case frame of mind, which integrates financial, social, and environmental aspects, and rather operational managers, on the other hand, which strive to improve profitability by making incremental sustainability-related improvements to products and processes. In 2020, Siegrist *et al.* developed a conceptual framework embedding environment and sustainability into corporate financial decision-making.

The third related literature stream is based on Crutzen and Herzig (2013) who describe that responding to sustainability requires strategic renewal and extensive organizational learning and change. Rodrigue *et al.* (2013) and Johnstone (2019) underline that companies often fail to enable an effective dialogue between strategic and operating levels to ensure the integration of sustainability into decision-making on all levels. Here, Beusch *et al.* (2022) provide recent evidence that dialogue between managers with different business case frames may hamper subordinating sustainability to financial concerns. The ground for this work was paved by the work of Sharma and Jaiswal (2018), who examined the circumstances in which dialogue mitigates the marginalization of sustainability initiatives.

2.2. Conceptual considerations for focusing on management controls and transformational management

To understand how sustainability is integrated into any business practices, various theoretical approaches are used in scientific publications (for overviews see Connelly *et al.* 2011; Starik and Kanashiro 2013). While the resource-based view, signaling theory, and network theory are mainly used to describe the sustainability activities of a company regarding its competitive environment, here we concentrate on *intra*firm aspects of management. Therefore, taking the view of institutional theory has some advantages to describe the role of sustainability in investment decisions. We see the largest potential for explanation in our research endeavor, though, when applying specific concepts or frameworks, stemming from the management research sphere.

In 1965, Anthony defined management control in general as "[...] the process by which managers assure the resources are obtained and used effectively and efficiently in the accomplishment of the organization's objective" (p. 17). In 1995, Simons (p. 5) emphasized the role

of management controls system by being "[...] the formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities". The LOC framework includes four essential components: belief systems, boundary systems, diagnostic control systems, and interactive control systems. Belief systems are those that establish, communicate, and reinforce the basic values and direction of an organization, while boundary systems establish limits for decision-making. Diagnostic control systems are used to compare current performance against targets. Finally, interactive control systems are those which focus on dialogue between the top management team and lower-level staff members. According to Simons (1995), interactive control systems stimulate organizational learning and the emergence of new ideas and strategies. Together with controls from the area of belief systems, they constitute creating inspirational forces – as opposed to controls related to boundary systems and diagnostic control systems (Simons, 1995, p. 7). A number of qualitative studies have extended the application of the framework to broader organizational issues such as sustainability before and the LOC framework is used more extensively in qualitative studies compared to quantitative studies (Martyn *et al.* 2016).

Transformational leadership (or management), originally coined by Burns (1978), was further extended by Bass (1999), who differentiates it from transactional leadership. Transformational managers (or leaders) recognize and support initiatives that bear the potential to add value to the organization. They are visionary and look towards the future of the company and the larger ecosystem in which it operates. Both types of managers can profit from the use of management control systems but are likely to use them differently. While transactional managers typically use such systems to manage efficiency more effectively, transformational managers can be thought of as using management controls for guiding the organization towards a (common) vision with the target of adding to firm value beyond its' status quo.

3. Method

3.1. Research approach

In this study, we adopt the research paradigm of analytic induction (Robinson 1951; Znaniecki 1934). In this method, authors begin with a tentative definition of a phenomenon or initial framework based on pre-existing knowledge of theory and empirical findings and go on to test this based on findings from explorative interviews.

This research logic is used to guide data collection and analysis and to organize the presentation of findings (Katz 2001): "Its objective is a causal explanation, a specification of

the individually necessary and jointly sufficient conditions for the emergence of some part of social life. Analytical induction calls for the progressive redefinition of the phenomena to be explained" (Katz 2001, p. 484). Authors have previously invoked analytical induction to conduct more rigorous qualitative analyses and to bridge the qualitative-quantitative divide (e.g., Hammersley and Cooper 2012). Examples of such work in management and entrepreneurship literature include Bansal and Roth's (2000) model of ecological responsiveness, Busch's (2011) work on organizational adaptation to disruptions of the natural environment (e.g., climate change), and the analysis of Hoffmann *et al.* (2009) of regulatory uncertainty, investments, and resources.

3.2. Data collection: understanding investment decisions

Our data set comprises 17 semi-structured, multi-sectoral interviews with key-informants from companies and institutions of different sizes and ages. Regarding sample selection, we identify decision-makers with authoritative decision-making positions in companies with headquarters in a German-speaking country. While sampling began with an initial key informant sampling from our professional networks (Deaux and Callaghan 1985), we then expanded our reach to expand the breadth or our sample. We decided on key informant sampling because these are understood to be reliable sources of information on present organizational structures. Homburg *et al.* (2012) demonstrate both the validity and acceptable reliability of key informants.

Whether or not the company's business activities are in a sustainability-related field or known for generally taking sustainability into account was not a criterion for us. Rather, we aimed to reach a broad range of respondents across industries and types of organizations. The interviewees range from CFOs of large manufacturing and services companies, including a company listed on the DAX (stock exchange representing 40 of the top German companies by revenue), an corporate board member of one of the largest German welfare and social institutions, the head of an industrial site development company, representatives of cultural institutions as well as of large energy providers, insurance firms, and leading automotive suppliers to a startup founder developing technology solutions in the energy transition.

Having a sample of managers at different levels and in different functions allows for a robust examination of our research question. Including the perspective of different hierarchical levels is relevant because changes in control practices may take place through a top-down process or a bottom-up process. An example of a bottom-up approach would be a situation wherein individual change agents, committed to sustainability, influence control systems design through having dialogues with strategic-level managers (Johnstone 2019).

While the aforementioned interviewees were asked to talk about their inside views of decision-making in their respective companies, to gain a bird's eye view, we also spoke to a few experts with a broader perspective on business activities like a representative of an institute developing methodologies for sustainability accounting, a university professor, specializing in the field of general controlling and accounting, and a business lawyer with an international background and experiences of being a partner in one of the largest corporate law firms world-wide. For the characteristics of our interviewees see table below:

Table D.1: Interview respondents

Interviewee Code	Title	Position	Sector	Employees	Gender
INT1		CFO	Manufacturing	500-10.000	M
INT2		CFO	Manufacturing	500-10.000	M
INT3		Head of Corporate Development	Energy	500-10.000	M
INT4	Prof. Dr.	Professor	Education	<100	F
INT5	Dr.	Managing Director	Chemicals	500-10.000	M
INT6		Head of Development	Cultural Sector	<100	F
INT7	Dr.	Manager	Energy	500-10.000	F
INT8		CTO	Insurance	500-10.000	M
INT9		Manager	Software	500-10.000	M
INT10	Dr.	Managing Director	Social Services	500-10.000	M
INT11	Dr.	Managing Director	Financial Sector	<100	M
INT12		CEO	Energy	<100	M
INT13	Dr.	Partner	Legal	100-500	M
INT14		VP Strategy	Automotive	500-10.000	M
INT15	Dr.	CFO	Services	>100.000	F
INT16		Head of Financial Markets	Non-Profit	<100	M
INT17		Head of Innovation/Strategy	Consulting	<100	F

INT stands for Interview; VP stands for Vice President

The interviews were conducted 2022 between June 27th and August 19th of 2022, and lasted from 20 to 50 minutes each, for a total length of 487 minutes. Interviews were recorded during personal meetings with the interviewee or during online video calls and fully transcribed before coding the answers with MaxQDA, a software for qualitative and mixed-methods data analysis.

We stopped interviewing once we had a clear feeling of having reached theoretical saturation, the research stage in which collecting and analyzing additional data would probably not significantly change the result of our findings.

During the interviewing process, as suggested for qualitative research processes (Phillippi and Lauderdale 2018), we took field notes. These served to reflect observations and thoughts arising during the conservations. These notes were consulted continuously during the period of interviewing to identify aspects that might have been neglected in the initial phase of the research or that (until this point) appeared to be of greater importance than initially expected. Such secondary analysis was qualitatively documented again using notes. By using this procedure, we follow the well-cited work of Burritt *et al.* (2011) in the accounting context and others.

3.3. Data analysis: Toward systemizing the role of management controls and pathways for transformational management

Following this approach, guided by our previous knowledge of management control theory and transformational management, together comprising the theoretic scaffolding of the study (Wener and Woodgate 2013), interviews were conducted and analyzed iteratively, beginning with an initial set of questions, and following the principle of the hermeneutic circle, to refute, support or further developing the initial framework. The guiding questions used in our semi-structured interviews are displayed in Appendix A.

Following Spence *et al.* (2010, p. 86), we concentrated on observing key activities of managerial decision making to understand the context of investment decisions. We explored the process of information use for investment decision-making, a step which is strongly dependent on the accounting approaches in place. Following the research approach of analytical induction, we categorized the thematic codes along the lines of the initial theoretical framework. That is, we first pulled together essential quotes relevant to the four main components of management control theory, as well as for transactional and transformational management, each as they relate to (sustainability) accounting and decision making in the organizations under observation. Finally, we used these factors and our uncovered interactions between them to derive the framework of a Transformation Management Compass.

4. Results

4.1. Belief systems

According to Simons' (1995) LOC framework, beliefs Systems are those that establish, communicate, and reinforce the basic values and direction of an organization. Regarding belief systems, we identifiy the following relevant clusters: management beliefs and buy-in, the financial backing for business activities in the context of sustainability and potential business cases, an alignment with the overall (strategic) objectives, and changes in time.

4.1.1. Management beliefs and buy-in

First, we find that belief systems can be an important driver of sustainability accounting (or inhibit it). For instance, I1 recounted that "sustainability has always been very important to me. But this is often not lived in a large corporation (I1:3)". Not only can inertia be challenging, but having a vision is quite different than living it. A partial explanation for this can be found in the further remarks of I1. For instance, in the context of harsh daily business reality, I1 remarked that, strikingly, "the people, the managers, they are measured by their royalties (share of the sales) and not by environmental goals (I1:25)". Similarly, an interviewee from the automotive industry stated that: „I think there are only a few who say out of a deep conviction, I'm doing it because that is exactly what would be the best from an environmental point of view. (I14:18)".

Apart from individual beliefs, companies with a strong social background, e.g., based on religious beliefs, clearly link their decisions to collective belief systems: "Our religious and social mission is always designed for sustainability. Because preservation of creation is our approach. All of us who do faith-based work. That is the basis for all of us. Also, of Jewish institutions (I10:8)". Similarly, an interviewee from a very large German company describes their corporate belief as follows: "We do this because we are convinced that it is the right thing to do in the group. And why is it the right thing for us to do? Because we also want to contribute back to society (I15:8)".

These examples show that initially either the mindset or the collective identity of a company is relevant, but that also the setup of incentive systems is crucial for managers' buy-in for moving from vision to actual execution.

4.1.2. Financial backing and business case

A key aspect of any belief system in the business context is the degree to which individual managers or the company at large are purely profit-driven, assuming there is financial slack

available in the first place in terms of budget allocation. An interviewee from a small company providing technical solutions for the energy transition describes their attitude towards profit maximization as follows: “It's not quite in our spirit to say, okay, we want to make a profit at any cost. Just not at any cost. And that also has to do with sustainability (I12:11)“.

Opposingly, some of the interviewees were very clear on admitting that oftentimes a focus solely on money trumps or sidelines nice ideas regarding sustainability (I14:36). Accordingly, I1 remarked that “the economic aspects always took precedence over the environmental aspects (I1: 20)”.

I11 provided some insights into hurdles for integrating sustainability: “The business case must pay off. But the topic of profit and how do I get that together with the topic of sustainability, that's a nut that has to be cracked (I11:15)”. Here, I11 underlines how belief systems can collide - those based on profit vs. social welfare maximization, or rather that having room for sustainability goals requires first meeting the company's basic needs in terms of profitability or even finding a business case for sustainability. Some interviewees, though, recall that taking a strong stance for sustainability may even lead to a business case: “From my point of view, it is mostly companies that, I don't say uncompromising, but are very, very committed in implementing things in this area that have often had a competitive advantage in the end (I14:36)”.

4.1.3. Alignment with overall (strategic) objectives

Beliefs also play a role in that there is a view in which sustainability leads to sales. I2 states that: “So, how can I link a financial KPI to this? I don't know unless I tell myself I can use this as a basis to open up/develop new business areas. I could for instance, believe that doing so (sustainability accounting) will drive up sales since the customers demand it (I2:25)”. For a company that actively supports the energy transitions with its products, the CEO was very clear about the “need to invest into product development for the sustainability transition in general. Our product will support the energy transition in the heat sector. Enlarging our portfolio in this future market is purely sustainable management (I12:25)”. It is also the experience of an interviewee from the automotive supplying industry that “companies which were not exactly uncompromising, but very, very forceful in this (prioritizing sustainability aspects in investment decisions), oftentimes generated a competitive advantage at the end (I14:36)”.

Beliefs are driven by society and by emergent norms, which can build pressure on management to act. I6 recounts that “since it has been constantly discussed in the news; what is true for the whole world, is also true for us. We should take a look at the whole (sustainability

accounting) thing (I6: 10)". Here it becomes clear that media have a strong influence on shaping the norms around sustainability accounting.

Interestingly, I8 remarked that "So we're already doing that. This (green production) is seen as an opportunity. As an opportunity, but also as a social mandate (I8:26)". I11 recounted that: "There are companies that are very advanced, that also internalize very strongly that it's not just about going a bit green, but also about developing a business model from it (I11:2)". Accordingly, one interviewee specified that "it is a main driver to not just act according to regulation on paper and match exactly what is asked for and not more compared to actually differentiating the company by exceeding what is requested (I14:38)". These quotes demonstrate the strong role of societal norms and beliefs in shaping which opportunities are pursued and how.

When aligning strategic objectives with sustainability even organizations that have a larger sustainability concept in place may substantively focus on only one aspect of sustainability, such as the environment. For example, the CFO of a large services company described that "already in 2015, we wanted to set an example in terms of ecological sustainability. There is nothing new for us anymore. Only lately, though, we added the social and governmental aspects (I15:4)".

Incorporating sustainability into one's overall strategy and specifically into one's communication strategy towards external and internal stakeholders can potentially have a positive financial impact. One interviewee pointed out that for investors "the narrative of an equity story can be significantly enriched by showing the efforts towards sustainability leading to an increase in reputation and credibility (I16:15)". Here, another interviewee adds that "access to capital increases and the cost of capital decreases in line with investor's perception of the sustainability transformation a company is devoted to. This is simply because of its strong link to the risk profile of a company, and accordingly influences positions in credit risk ratings (I16:21)".

The interviewed business lawyer even considered the strategic positioning of a company towards sustainability to be mandatory: "Business leaders are prompted to ask themselves how to handle the topic of sustainability? What do we need to decide today to remain competitive in the future? How does the market react to companies which are not considered sustainable, or which are accused of greenwashing? If a business leader is not concerned with these questions, I assume that it would be considered an omission of an essential aspect in breach of duty. And if turnover collapses, for example because of greenwashing accusations, then shareholders will

be allowed to ask whether there have been strategic mistakes or omissions. Especially with regard to ecological aspects (I13:10)".

Considering the role of sustainability in investment decisions, I9 remarked that "all of this will only be implemented once a sustainability strategy is in place (I9:1)". The interviewee from an automotive supply company said laughing: "We defined sustainability to be part of our overall strategy and we are actually intending to implement it (I14:34)". Similarly, I11 states: "I can only say that it works well when it is driven by top management and that this aspect of sustainability is also included in the corporate strategy. This means that it is the North Star that everyone is heading towards (I11:11)". Even the early step of defining a sustainability strategy leads to measurement, which leads to shifting some available slack resources into sustainability accounting. And this presupposes management buy-in and more specifically deep integration of sustainability in decision-making: "I would say it is always a matter of how strongly the ecological goals are part of or central to the firm's overall strategy (I9:15)".

4.1.4. Changes in time

Initially, some companies avoided any contact with questions of sustainability, but then were led or rather, forced, to change: "So our company was not yet as far as to ask the question what do we want to do for the environment and what will it cost us? But rather the opposite thinking was the case, since this new (environmental) regulation will be coming soon, let us quickly produce more so that our inventory will be full (by the time it hits) (I1:16)". The interviewed business lawyer, though, made clear that such behavior would not be accepted any longer, "because as a company manager, you can't talk your way out of it, thinking that this whole sustainability issue is none of your business, that the supply chain issue is none of your business, that you think it's all frippery. And that you don't have to pay attention to all that. And there are still very ignorant people, but that is thinning out because there are more and more cases where such corporate failures are being dealt with in court and by public prosecutors. And I believe this trend will increase enormously in the next few years. To the extent that further cases of greenwashing by large companies are publicly pilloried and also taken up by the authorities (I13:5)." Here, decision-makers need to comply with and to carry out a proper risk assessment, as our interviewee from an institute of developing methodologies for sustainability accounting alludes to: "Because companies are simply aware that a lack of sustainability in decisions, in strategies, significantly increases the risk exposure in the medium to long term. Be it because of physical risks, but above all because of transitory risks that one exposes oneself to. And this awareness

among the companies is something that we are noticing, which has increased enormously. And then also drives the companies to pay very, very strong attention to this (I16:15)".

Regarding these changes in beliefs over time, I1 went on to state that: "I think that a new generation has to grow into this (concept / state of mind) (I1:38)". I6 remarked: "So it's been about 2 years since we have been incorporating this (sustainability) into our decision making (I6:3)". Similarly, an interviewee from the automotive supply industry said: "I think, everyone who is not blind completely knows that we must act now – in all sectors. […] And yes, we are identifying our impacts on stakeholders now. This is nothing we've been practicing for 15 years. Unfortunately, we can't say that now. But better now than never (14:16)". This development was in line with a changing management team that is taking sustainability seriously. "Before, I have to admit, did we consider sustainability merely as a cost driver or as irrelevant. It needs a collective mind shift in the company (I14:18)".

An Executive Board member of an insurance company estimates "that we really must drive this process forward considerably in the next two years because of, among others, regulatory aspects (I8:33)". Earlier in the interview I8 describes his expectations in this direction by saying "that it will all change for sure because we need to begin to report on this (I8:9)". This points to the importance of process implementation and learning new routines within the organization.

This process can take considerable time though. According to I8: "So, I would guess that until 2030, to be brutally honest, it will surely be completely implemented. (I8:32)". Similarly, I9 recounted: "Well, back then, while working at (a top 4 accounting firm), we talked quite a lot about climate risks, with companies and they also quantified them. That means that something like infrastructure investments was affected. But I still think it's a bit far away from being the norm (I9:9)". Cultural changes, which are needed as well, are oftentimes very slow in practice: "You are fighting in a company, there are people who have a strong financial view. And in the past, that was always a big driving force. And until it all manifests itself at some point in the thought processes, so to speak, that it might look like this today and completely different tomorrow, I think a process is underway. But it is certainly not yet complete everywhere. Not with us either (I14:36)".

This again underlines the importance of changing societal norms and their role in providing indirect pressure on managers and companies to change. The influence of public discussions on sustainability and its influence was also described by an interviewee from the social sector who said that "ecological sustainability is a topic where we orient ourselves towards the public discourse. […] Our fundamental adjustments are indicated by the State and by the public

climate debate (I10:8)". In more detail, he explains the difficulties of doing so, looking back at the last ten years: "Ecology and climate protection should be linked to our fields of action. That's not obvious at first. Our services are a service to people and not a service to nature. These are two different things. A person's need for help is first of all robbing nature, to put it crudely. We live mostly at the expense of nature anyway, and far too little with nature. Understanding ourselves as part of nature and bringing that into the regulatory cycles is a development of the last 10 years (I10:13-14)".

I4, from an academic perspective, sees a difference in the value of qualitative information. She describes her observations as follows: "I think that has changed completely, that we also know how important qualitative information is, from which one can also read and see developments […] That there are too many relevant and essential aspects of sustainability that cannot be quantified. And I believe that this has now slowly reached other parties, relevant parties (I4:9)".

4.2. Boundary systems

According to Simons (1995), as explained above, boundary systems establish limits for decision-making. In our context, we identify two related topics in the context of sustainability: negative impact reduction and a focus on regulation. It becomes quite clear, though, that the relevance of belief systems is considered higher than that of boundary systems.

4.2.1. Negative impact reduction

Several of the organizations interviewed described that they are accounting for the environmental impact of their business activities (e.g., on CO_2 emissions, pollution, etc.). I2 remarked: "This means that when we talk about sustainability, it is also important not only to assess everything financially but also to consider what (negative) impact, so to say, we are making (I2:10)". While this is evident from most points of view, it has not determined behavior in one of the interviewee's companies: When talking about investments in protecting the environment and safety, I1 reported how one member of their board said, "that not every investment proposal goes through.' (...) (and I replied) Yes, I can take that (proposal for negative impact reduction) back now, but you must take responsibility for that. That's a potential hazard, I am not doing it for fun (I1:7)". I1 went on to disclose that "If it's not economical, the company tried to just meet the (bare minimum) environmental criteria (laid out by the environmental regulation) (I1:15)". This shows a risk-averse and strongly profit-centered mindset, also highlighted by another quote from the interview: "Do we get the growth strategy in harmony with the environment?

Only to the extent necessary, we don't want to make any advance payments. That's rather the attitude (in the industry) (I1:49)".

Unexpectedly, the code for "negative impact reduction" was only assigned sparsely to the interview material. It seems that reducing the negative impact of business activities is either not seen as well connected with the topic of sustainability, that the authors would doubt, or that negative impact reduction is so inherent in the topic and in sustainability regulations that it has not been an explicitly named as an aspect of investment decisions. It therefore rather seems to be inherent in the reaction of any company toward regulatory requirements and the public sustainability debate.

One of the interviewees, who apart from his entrepreneurial work, considers himself an environmental activist, puts the need for negative impact reduction in the context of preserving the basis of our lives in the long run: "This is ultimately about strengthening intrinsic motivation to recognize future markets and future opportunities for one's own company at an early stage, to reorganize production processes, to adapt production lines, to manage materials and energy not only sparingly, but to increase material and energy efficiency to such an extent that in this way future viability and sustainable preservation of the basis of life for all people, including the direct stakeholders of a company, can be maintained and improved (I11:7)".

4.2.2. Focus on regulation

With increasing regulation in the field of sustainability management, several interviewees mentioned regulations as forcing them to change their internal processes towards sustainability.

Along these lines, a member of the Board of an insurance company stated: "We have to drive change in this direction during the next two to three years, I fear, okay what means fear? I believe change is needed because we will receive audits from BaFin (the German financial regulatory authority) and EIOPA (the European Insurance and Occupational Protection Authority) that will go in this direction (I8:30)". This quote shows concrete examples of regulatory bodies involved at the national and supranational level and that fear of an audit can motivate such organizational change. A Board member of another company recalls a quite cumbersome dealing with regulations in the sustainability field: "If there was a need (strong regulatory pressure) to invest now to comply with the regulations in one- or two-years' time, then that's what we did (otherwise not) (I1:17)". Some identify a need to follow the regulation not only in terms of compliance but to ensure competitiveness: "The requirements that are placed on the (automotive) industry are of course also on our table (of a supply company) at some point. And of course, we try to match that, because otherwise, we are not competitive (I14:38)".

Regulatory changes also change the way value is defined. For real estate investments in the social sector, one board member explained that they developed a new standard to assess the value of a building, "because CO_2-emissions for the whole life cycle of the building have to be calculated. These are the new requirements (I10:4)". The interviewed business lawyer even admitted that "managers are not envied for all the things they have to consider at the moment. And this topic is part of the whole, big area of compliance (I13:10)".

4.3. Interactive control systems

According to Simons' (2015) LOC framework, and interactive control systems are used to stimulate organizational learning and the emergence of new ideas and strategies. Here we uncovered three important subthemes, room for discussion, institutional collaboration, and inter-organizational dialogue. Since these were considered quite relevant by most of our interview partners, we claim interactive control systems are as similarly important as belief systems.

4.3.1. Room for discussion

When asked, where the company enables discussions about investment decisions, one CFO said, that "dialogue is taking place where the topic emerges and is not taken up. This would only consume time (I1:7)." Another CFO said "there has maybe not been the time yet to bring sustainability forward in investment decisions (I2:42)", showing that room for interacting on the topic has not yet been created in his company.

A few companies established specific processes to make sure that interaction between employees of different levels takes place and that different opinions are heard: "(…) we have adapted this in the past by saying that we will make this assessment broader. And that we should also bring together the most diverse views internally as possible, or that we should also enter the discussion (I3:21)". Asked how the (sustainability) evaluation takes place more precisely, the interviewee said: "First, everyone evaluates it separately with a certain number of points and then we discuss (I3:25)". Asked if he believes that this is the right way to handle potential conflicts, he says: "If you don't allow these rooms, the conflicts are still there, right? (I3:42)".

The interviewee of a small company, in contrast, explained that they are "discussing this (sustainability) over lunch, and collecting pros and cons for certain company developments. Finally, the decisions are taken by the executives, though (I12:13)". In the DAX company, the CFO explained that the regular investment committees are the ones where discussions about conflicting objectives in terms of sustainability take place. The level of relevance of an investment decides about which level of the committee is involved: "We are having different levels

of investment committees. And these are decisions we are discussing in the Group Executive Board (I15:38)".

4.3.2. Institutionalized collaboration

To stimulate organizational learning and the emergence of new ideas, employees of a rather small company established a task force for sustainability: "This task force used to be bigger. Then we made it smaller again for reasons of efficiency. And now, in addition to my colleague who primarily maintains the CO_2-calculator, I am the main nag. And then we have a new technical manager who is also very committed to such sustainability issues and can be a real pain in the neck, too (I6:21)". Ideas that are generated in the group, are communicated to the top management and interaction is called upon by the employees. Similarly, in an insurance company, "a working group of employees was summoned to develop indicators for sustainability (I8:25)". Even for companies where something like this does not exist, one interviewee assumes it to be helpful: "In case of doubt, someone at C-level decides. But it would certainly be a nice idea to say that there might be a jury or a panel or a council of some kind (I9:29)". An interviewee from one of the energy companies explained how collaboration within the company on the sustainability topic is organized: "On our platform, we can also transparently read out the extent to which progress is being made by the others. And whether one team perhaps needs something. With this topic (sustainability) we notice that there is more and more need for coordination and cooperation (I3:41)".

Within the company active in the social sector, a communication platform is used to "address all employees concerning the topic of sustainability. Further, we initiated a sustainability steering committee and held several workshops introducing the strategic objective of sustainability. Here we work together with a company named United Sustainability and we employed a full-time sustainability manager who takes care of collaboration between employees and keeping the topic up in general (I10:16)".

4.3.3. Inter-organizational dialogue

One interviewee describes the difficult interaction between her organization and a collaborating partner organization with less sensitivity for sustainability: "We are dependent on dialogue. (…) But you could tell that they weren't immediately and voluntarily getting involved in such issues. (…) Here a great deal of sensitivity is required. It doesn't happen overnight (I6:9)". The working group, established in the insurance company mentioned above, "also decides in which external committees the company should be active. Further, the group members discuss where

to get involved in sustainability apart from our core business. In terms of communication, the group even developed a booklet about sustainability in our company (I8:25)".

In his interview, I11 called for "proactive behavior (which is) needed for transformational change. […] The future of corporate sustainability transformation will essentially be decided by new forms of cooperation because we must form new alliances for sustainable business cultures. Here, too, I have not yet mentioned the need for trans-sectoral cooperation (I11:13)". Similarly, another interviewee expects the following trend: "I believe that one tries to discuss it either within the company or externally with other companies. So, I think it's also very much about networking and collaboration (I17:11)".

4.3.4. Balancing objectives

In one of the companies interviewed, a platform is established where the objectives of the different divisions are monitored. Here, objectives can be tied together and conflicts between objectives are made transparent. "This also has the advantage that, on the one hand, mutual dependencies can be made aware, can be discussed accordingly, and can be clarified (I3:41)".

4.4. Diagnostic control systems

Diagnostic control systems, as one element of Simons' (1995) LOC framework, are used to motivate, monitor, and reward the achievement of specific goals. Here, we find key roles for data management, balancing requirements, setting specific targets, and accounting transparency.

4.4.1. Data management

The monitoring of certain indicators, of course, increases their importance which can be perfectly related to monitoring sustainability. "Because I believe that the impact will be stronger if we can underpin this purpose with actual measurable effects (I2:34)". In this respect, one interviewee describes the importance of being able to say: "Okay, this generates or brings us this and that share in our decarbonization strategy and that's why we made the decision (I3:13)".

Another interviewee pointed out accordingly that facts and figures are quite important in his business context to move the topic of sustainability further: "I work in a company that is very strongly driven by numbers. Where controlling values also have a certain value in a double sense (I3:13)". Here, "it would help to establish true costs, I mean what that really means for the future, if you had those business models or certain processes (I3:47)".

In the following, one of the companies' data managements is described shortly to provide an example of how a medium-sized company is handling sustainability data: "We are now also looking, although admittedly not for very long, at what kind of CO_2 emission behavior is behind it (our investment decisions) (I14:14)". The interviewee further explains that the template for their investment decision includes sustainability topics and that it is important to "track what has been decided (in terms of sustainability enforcement). […] Here, we use a digital system with a review function for each month, even with KPIs, for example for emissions (I14:29)".

Optimistically formulated by I16, there is no actual conflict of objectives but mainly a gain of information which helps companies to improve their decision-making: "However, I believe that this issue of conflicting goals is not so much a conflict of goals, but rather that companies are increasingly seeing the aspect of sustainability less as a conflict and more as additional information that is included in the basket of data information and forecasts that I have to ultimately drive the entire decision. And sustainability is seen less as a conflict and more as an opportunity. And financial decisions are made in such a way that sustainability and return on investment or profit go hand in hand (I16:17)".

4.4.2. Coping with regulatory requirements

An over-regulation or exaggerated focus on diagnostic control systems may hamper actual activities and decision-making for sustainability. One problem is the ever-changing regulation: "At the moment, the situation is simply that many people don't know exactly which standards should be integrated, which means that there is a reluctance to implement or integrate a product or service along a certain standard (I17:7)". Another problem reportedly lies in the quantity of regulation: "That is simply a huge challenge, and it is basically an administrative task to first make that available, and I haven't done anything yet to ensure sustainability. […] (I17:17)". The same tenor was found in the interview with the business lawyer, who explained how companies are challenged by the bureaucracy involved in complying with the current regulations: "The requirements are so bureaucratic and difficult. Everyone groans. It's a lot. So, you must have a large company with experts who deal with it exclusively to get a handle on everything. Not every company can do that. Some are overwhelmed. They don't have the staff for it (I13:24)".

A downside of the increase of regulatory requirements was mentioned by another interviewee who stated that "there are certainly an extremely large number of requirements at the moment and that these many requirements, particularly in the area of disclosure or the report on sustainability performance, are extremely granular requirements that require a great deal of

investment on the part of the company, a great deal of conversion of IT systems, for example, and a great deal of conversion of processes. And these tied-up capacities are then of course not available for other processes, perhaps neither for innovation (I16:33)".

4.4.3. Accounting transparency

One interviewee underlined the need to prevent greenwashing, which from his perspective is encouraged by an insufficient accounting system: "It will be a matter of stigmatizing, combating and legally attacking greenwashing, because through greenwashing, through best in class, through superficial sustainability, the future opportunities of truly sustainable business enterprises, of truly sustainably oriented investments for the coming generation are hindered, damaged and in part made impossible, in which a market regulation grows out of deceit and fraud. Where narratives overtake and consume reality. In this regard, I recommend a visit to a hall of mirrors at one of the regional fun fairs to realize once again what the balance sheets of the present cause in terms of transparency for market actors, but also for customers, politicians, and market observers. A mirage, a distortion of reality (I11:13)". A similar critique was formulated by I7: "Before, it was often like this, yes, self-descriptions, but which were more like a report, without many numbers. Or where you set your own goals. […] Well, the risk of window dressing was already considerable (I7:25)".

In some cases, the companies develop their own standards such as in the case of the company from the social sector, where the board member describes "the development of a valuation standard, or let's say for a sustainability assessment for buildings, which we are using for our retirement homes as well as for our nursery schools (I10:4)". More importantly, the interviewee describes the need for internalizing negative externalities and having transparency of true costs: "For companies, looking at sustainability always means: How do I get that valued? Everything that has so far been externalized, i.e., referred to as external costs in the economy, i.e., CO_2 pollution, water consumption, etc., has to be taken into account. How do I get that into internal cost accounting? Because only when they are internal costs of a company do they become actionable. Economically speaking. Because the more money something costs, the more I have to worry about how I can save the money. In the case of CO_2, for example, it is relatively simple. You can simply (...) assign the CO_2 exchange of the entire group to the individual fields of action (...) If I know the CO_2 emissions of the buildings and certain activities, then I can assign them to a field of action. We are now trying to look at CO_2 as a cost factor in a property and do this (I10:18)".

Here, the interviewee of the institute which develops methodologies for sustainability accounting describes their approach: “It sets out how sustainability, the various aspects of sustainability are to be measured, transferred from input-output to an outcome. Ultimately also to an impact. And then this impact is evaluated in monetary terms (...) a very, very essential step in this methodological approach and ultimately also for integration in decision-making because it makes the issue of sustainability and impacts tangible, I can express it in euros and cents and thus suddenly have it in the same language as my financial aspects, which are also integrated into decision-making. And that means that by creating a common understanding and a uniform language, the impact or the sustainability aspects are much easier to grasp and much easier to integrate into the decision-making process (...) very strongly anchored in the individual companies (I16:7)”. Asked if any aspect of sustainability implementation could be evaluated in monetary terms, the interviewee goes on to state that “a monetary assessment will not replace a qualitative or quantitative assessment. So that will continue to be reported as well. Although the monetary information can then be integrated more tangibly into existing models for calculating returns because it is already expressed in euros or dollars (I16:9)”.

The interviewed business lawyer, on the other hand, describes the difficulties of the current accounting and incentive system as follows: “Whenever business activities in the sustainability context reduce the return of a company, a conflict of interests arises. That is why it is so important that the entire national and international accounting system is reformed and modified. In my opinion, this would be desirable in any case. Important is that corporate decision-makers are not economically penalized for more sustainable business practices. Because as long as they are and possibly their remuneration and bonuses depend on increasing returns, they will not implement these measures. And it is only a mistake to place the return on investment above these aspects if, due to the non-implementation and non-observance of measures, I accept completely different disadvantages to the detriment of the company. And in this conflict of goals, most Board members of stock corporations still decide in favor of their wallets, in favor of not reducing the profit and loss account of their company. So that they can satisfy the shareholders and themselves (I13:12)”. One of the interviewees remarked, though, that the corporate board of her company is incentivized not only by financial indicators but by nonfinancial ones as well (I15:24). Furthermore, they have precise sustainability goals connected to their incentivization (I15:32).

A schematic representation of how the above-described control elements are related to the management controls, systematized by Simons’ LOC framework (1994; 1995), is displayed in Appendix C. In Appendix D, the data structure for analytical induction concerning these

management controls is displayed, depicting some of the 1st-order concepts, the 2nd-order themes as well as the aggregate dimensions.

4.5. Transformational management

Parallel to focusing on control systems, we identify the following three subthemes describing what is needed for companies to step out and leave the sphere of simply operational management towards a higher focus on sustainability aspects in decision-making: value orientation, willingness-to-pay, and risk-taking and innovation/R&D. Further, managers responsible for the topic, who might be considered sustainability advocates, are crucial.

We show evidence of the need for transformational management in the next three subsections. We then close by analyzing negative connotations in the discourse around transactional management, showing evidence for its insufficiencies when considering future business success and positioning in a competitive business environment.

4.5.1. Value orientation

A value orientation presupposes that the value of sustainability is understood commonly. Furthermore, the aspect of what is considered material in terms of sustainability is partly connected with defining sustainability. One of the interviewees strongly criticizes the definitional differences as follows: “I think what is very, very crucial in this topic is that we get a uniform understanding of the term sustainability. In my opinion, that is one of the major shortcomings or inadequacies that still exist. The taxonomy, of course, is just trying to create a framework or a uniform understanding of what sustainability is. But there are still a lot of question marks there because of the many different other frameworks. That is one thing, so the clear definition, clear understanding. Above all, the understanding that when you talk about green, it does not mean that it is sustainable. But that green is a partial aspect of sustainability. That’s one thing that I often find missing in many dialogues (I16:25)”. In terms of “the double materiality debate, or the value to society component, I wish for a lot more clarity. It’s material to understand what influence the company has on the environment and society, but then also the dependencies, how this in turn affects the company. So, the financial materiality and the social and ecological materiality. The two belong together. But this also requires clear, uniform standards to ultimately provide stakeholders, investors, and rating agencies with the necessary clarity. They, in turn, also demand this sustainability information. And if this uniform understanding is also there, it is easier for companies to make targeted and better-informed strategic decisions because they can build on a uniform understanding (I16:27)”.

Apart from these definitional foundations, we identify a general value orientation, apart from financial aspects, to be part of several of our interviews. Value orientation was named by one of our interviewees who stated: “I don’t want to call it, maybe idealistic, but something like this is considered apart from strictly financial terms (I2:26)”. Next to strategic orientation, personal beliefs seem to be important for decision-makers to act apart from fixed and solely financial criteria: “One managing director in the past said: I want it this way. This is what I want to leave behind when I am gone (I2:48)”. When asked for other solutions to include sustainability into decision making, the same interviewee said: “I see relatively few ways out at the moment, except simply this intrinsic business conviction that it’s the right thing for the business and also for the economy because we’re simply doing something for ourselves in the long term (I2:60)”. Another interviewee adds that „if the understanding, the self-perception (of being a company that cares for the environment) is there, then ways are identified, and decisions are made. Then people find additional finances for investments in the environment (I1:25)”. Accordingly, one interviewee said “we are not looking for profit at any cost. This is what we call sustainability (I12:11)”.

The question, of how such a value orientation accrues, was not within the scope of our study. Only one of our interviewees described his opinion on the topic as follows: “It’s not, according to a best-in-class procedure, believing that being less bad than the others is good. This is where a paradigm shift is needed and this seems to me, with a few exceptions, only to have been anchored intellectually and methodically in the younger generations in their real understanding of what business is and what purpose business should serve (I11: 7)”.

4.5.2. Willingness-to-pay

Only one of the companies interviewed had a dedicated extra (sustainability) budget in place to enable taking environmental aspects into account in investment decisions. The CFO even stated that “of course, these decisions are discussed openly, but for now, no investment was turned down because including sustainability aspects led to a higher investment sum (I15:36)”. The interviewee adds that “every investment which benefited from this extra budget is tracked and reported separately underlining the sustainability effort of the company (I15:12)”.

Most interviewees, though, talked about a situation where there is no willingness to pay for environmental aspects. Other than the lack of an extra budget, the following was criticized: “No one clearly says that it is worth it to put one percentage point of return into the environment. (I1:25)”. Similarly, another interviewee pointed out that he believes such a willingness to pay

"must come from the very top, (…) saying that x percent of the companies' investments or division must be ESG measures, where there is no business case or meeting a KPI needed (I2: 52)".

What became clear in the interviews, too, is the fact that there is a large difference in terms of willingness to pay attached to the type of investment, and of course, the cost. If taking environmental aspects into account in your core business and if it means that you cannot go for the best option for your customers, it's less likely that this decision is made (I6:5). One interviewee from the cultural sector described this restriction in the following words: "We would never claim that we only book regional artists coming by bike, either for the sake of cost or for the sake of sustainability. If we did that, we'd be out of business tomorrow (I6:11)". Another constraint is described by some of the interviewees if business partners, subcontractors or funding entities would have to be convinced, which they describe to be not often successful (I6:7/19).

Some interviewees explained that accepting extra costs would not be possible because sustainability is "not part of the value-added" and "no single contract more is signed" (I8:19). The willingness to pay is higher, on the other hand, if decisions are made under high uncertainty already, which is, for example, the case in most R&D projects, and where the entrepreneurial freedom is higher.

4.5.3. Risk taking and innovation/R&D

Whenever investments are made to enter new businesses, sustainability may play a larger role compared to short-term investments or so-called maintenance investments. "The economic viability must also be given, otherwise the money is not tackled, but then other criteria come into play. You ask yourself how sustainable the product is because the profitability threshold for this investment is only crossed in several years. (…) Sustainability is then a big point because a product that does not comply with sustainability cannot be economical in the future. Yes, these are such criteria (I5:9)".

For a startup company in our sample, developing new products involves both general sustainability considerations and specifically the transition to renewables: "If it works out, we will enlarge our portfolio sustainably. And we believe that the product is needed because it will support the energy transition in terms of sustainable heat generation (I12:25)". The interviewee added, though, that the incentives provided by the government or by funding institutions are not designed properly for a successful implementation of the energy transition (I12:37). Concerning financial incentives for the integration of sustainability, the business lawyer made clear that "a company that doesn't inform itself doesn't teach decision-makers about what's

possible… There are quite substantial funds that are being made available. And it can be considered a breach of duty not to apply for available incentives – oftentimes for R&D activities and innovations (I13:16)".

In Appendix D, the data structure for analytical induction concerning transformational management is displayed, showing some of the 1st-order concepts, the 2nd-order themes as well as the aggregate dimensions.

4.6. Shortcomings of transactional management

When remaining within the sphere of transactional management, which stands for incremental changes, operational management, business-as-usual, and harvesting the so-called "low-hanging fruits," long-term positioning may fail in competitive business environments. This critical reflection was formulated by various interview partners. For example, a management consultant with insight into many companies describes that she perceives "a very strong heterogeneity […] and that only some of the companies are advanced, which also very strongly internalizes that it is not only about becoming a bit greener but also about developing a business model from this (I17:3)". This is considered relevant because "due to a lack or simply an absence of ESG aspects or sustainability in decisions and strategies, the risk exposure increases significantly in the medium to long term. Be it due to physical risks, but above all also due to transitory risks to which one is exposed (I16:15)". Acting in a transactional manner alone might not be sufficient for staying competitive and might even have legal consequences, as the interviewed lawyer states: "How do the markets react to companies that might be classified as operating in an unsustainable manner or are called greenwashers? In my opinion, if a company manager does not deal with this at all, then that is an omission of an essential aspect in breach of duty (...) because there are more and more cases where this kind of corporate failure is then also being dealt with in court and being dealt with by public prosecutors. And I believe this trend will increase enormously in the next few years. (I13:10)". The aspect of better positioning the company in the competitive context by leaving the sphere of transactional management was also described in the following quote: "Well, I would like to expand it [our investment templates] more deeply in the direction of ESG impact, to go towards everything that goes beyond the guidelines. Because that's where I see great opportunities for companies to position themselves to say we're not waiting to be told you must do it. (I2:28)".

Even though the need to go beyond transactional management was formulated repeatedly, there was much evidence for the uncertainties and incapabilities of companies to change their decision-making and their respective management activities toward transformational

management. One interviewee describes “the common concern that you also manage this balancing, from the old world to the new world. (I17:7)”. The traditional focus on financial outcome was described as one restraining effect: “But in the end, of course, the problem is mostly monetary [...] But you are fighting in a company, some people have a strong financial view (I14:36)”. Along similar lines, one interviewee underlined the remaining focus on short-term gains, which are related to the incentive structures of the company: “The managers are measured by their royalties and not by environmental goals. And in the end, they say we only spend what we must, where we have to, and where we are otherwise liable. But then we don't make any advance payments that would be at the expense of my bonus. Why should we now release a 2 million extra budget for things that we don't have to take? I never say that happens (I1:19)“. Even though this is considered a reality in some companies, the business professor in our sample made clear that remaining in such a narrow corridor of investment decisions is “a little outdated: That people say, okay, I can only control or generally only deal with what I can also measure and quantify. In other words, we can see that it will pay off sooner or later, even if I can't quantify it in monetary terms yet (I4:9)”.

Short investment horizons are another aspect that hampers transformational management, as was stated in the following quote: “Another major problem is that long-term operational financial planning and medium- and long-term profit and loss planning in companies are at odds with the expectations of capital investors. So, these are, so to speak, opposed to each other. On the one hand, clear forecasts for three to five-year periods are expected to reflect the profits, i.e. sales, profits, losses, and liquidity of a company as precisely as possible. And on the other hand, many of the transformation investments that committed companies want to make, require time, in some cases many years, extending well beyond 10 or 15 years, with corresponding payback periods. And these are then at odds, so to speak, with the expected short- and medium-term targets in terms of profits and losses and their predictability (I11:9)”. Similarly, another interviewee subsumed that “oftentimes there are more investments needed (9:21)”. Especially the complexity of decision making outside the transactional management sphere is quite challenging: “So that means the weighing of costs and sustainability, that's just super difficult to weigh. You must have someone who decides at that moment what is more important. So, the decision-making framework is probably relatively difficult (I9:21)”.

When heading toward transformational management, time is considered an important factor, too, showing that going beyond transactional management is nothing that happens overnight: "And that's why I think this will develop to the point where companies will also become more courageous in reaching for the so-called high hanging fruits. But I think we're talking

about a period of at least five years if not ten years. Because they're just starting now, I think (I4:9). Asked why it is taking so long, the interviewee named the speed of new regulation requests which must be answered, and which mostly fall into the sphere of transactional management: "And now they are trying to keep up with what has to be done. [...] So we have a speed. And I think it's still more the case that people tend to reach for these low-hanging fruits. Of course, they can be reached more quickly. And now, I think it's like that because it's already such an effort for the companies to achieve these minimum regulatory measures for the time being (I4:9)". Here, we see this as only one explanatory aspect, but one which warrants follow-up in future research.

4.7. Advocacy and clarifying responsibilities

Finally, another key aspect for implementing sustainability in companies' decision-making and a success indicator for transformational management is having a responsible caretaker, either in a position of power or well-integrated and closely connected to the executive committee. One example of a strong sustainability commitment from the highest level was described by our interviewee who is leading a large company in the social sector: "We decided in the Board of Management to focus on ecology. De facto. The two of us. Then, many years ago, we took the apparatus with us, if you will. Five or six years ago, we took that swing and decided: We have to take up this discussion now. Then we made it a strategic focus […] And now we evaluate every activity considering the Sustainable Development Goals, we are having a working group in place, support from a sustainability consultancy and a full-time sustainability manager (I10:8,16)". When asked who initiated the remuneration according to non-financial indicators, as stated above, the CFO said that "of course, it's been the corporate board itself. Who else should decide something like this? We are the committee of the highest level. […] And we will roll out this agreement to the lower levels as well. Our (sustainability) objectives need to be broken down, too, and it's an effective instrument to encourage implementation of certain objectives (I15:28,30)".

Another interviewee describes that they have "restructured the organization to the effect that they established a special department, which is still very small and being built up. We are keeping a close eye on it to see what kind of environmental balance sheet the company has and how our sustainability situation looks like. […] To be honest, I believe that it's hard to get around setting up such an entity nowadays (I14:30,34)".

Further, in a smaller company observed, the employees decided to build a working group themselves concerning sustainability topics. They are presenting solutions to the executives and see their role in pushing and nagging (I14:22).

To put the above findings on the roles of control systems and transformational management in sustainability accounting decision-making, into practice, we call on Knowles' (2022) multidimensional definition of purpose. Knowles compartmentalizes purpose into three subdimensions: competence, culture, and cause. Competence is the function that a company's product serves, culture is the intent with which managers run a business, and cause is the social good to which management aspires. Human action, including managerial decision making related to sustainability, occurs within boundary systems set by institutions. Cultural norms and causes are derived from belief systems of a given society that function within these boundaries. Similarly, transformational management necessitates cultural norms. Ultimately, we as human beings are bounded by our need for survival; given limited resources, the transition to sustainability with the help of management control systems is inevitable if we are to survive. Considering the multidimensionality of purpose, and to help managers navigate this transition, in the following, we develop a Transformation Management Compass.

5. Implications for research

We add empirical evidence to the discussion on how sustainability is incorporated into managerial decision-making today and how simultaneously all four levers of control are relevant. From the material gathered, we conclude that all four types of controls are relevant and that not one of them can be considered more relevant than another one. They were further identified to co-exist in a rather loosely manner, but still not being independent of each other (a question called upon by Guenther *et al.* 2016). Several quotes show the interdependencies, making clear that a certain degree of internal consistency should be assured by the ones responsible for management control to be an effective instrument to link a company’s strategy with its specific impacts. Only recently, Hahn *et al.* (2023) underlined the need to think sustainability management through, all the way towards the impact on social and ecological systems. This is something not many interviewees mentioned. Hahn *et al.* focus on nonfinancial reporting as a starting point, but what is relevant for our research as well is the connection of any management instruments to outputs (e.g. nonfinancial reports in their research context), outcomes (in terms of social and ecological performance), and finally impacts (on social and ecological systems). Here, further research is needed to systematically relate the usage of different types of management control toward "real sustainable change”, as Hahn *et al.* (2023) call it.

While identifying changing belief systems and individual engagement as relevant, we did not analyze the reasons for these. Here, future research might link the concept of organizational citizenship behavior, which characterizes deliberate behavior at the workplace beyond organizational tasks, with the relevance of certain management controls at the company level. As a basis for making this connection, Lülfs and Hahn (2014) proposed a model where the ethical motives influencing the single member of an organization influence the organization as a whole. This is in line with recent research suggesting that developing the skills and competencies of the individual employee is key to affecting a sustainable change over time and space (Johnstone 2019). Further, it would be useful to learn about how management accounting and management control systems may even encourage changing awareness and attributes toward more decision-making in favor of sustainability (Albelda 2011).

We structure particularly the second part of our research implications by using a so-called Transformation Management Compass for the transformation of strategic decision-making in the business context (Figure D.1 below). The dimensions of the compass stand for the *environmental*, *social,* and *governance* aspects in decision-making in the context of sustainability, and for the fourth, *financial* dimension.

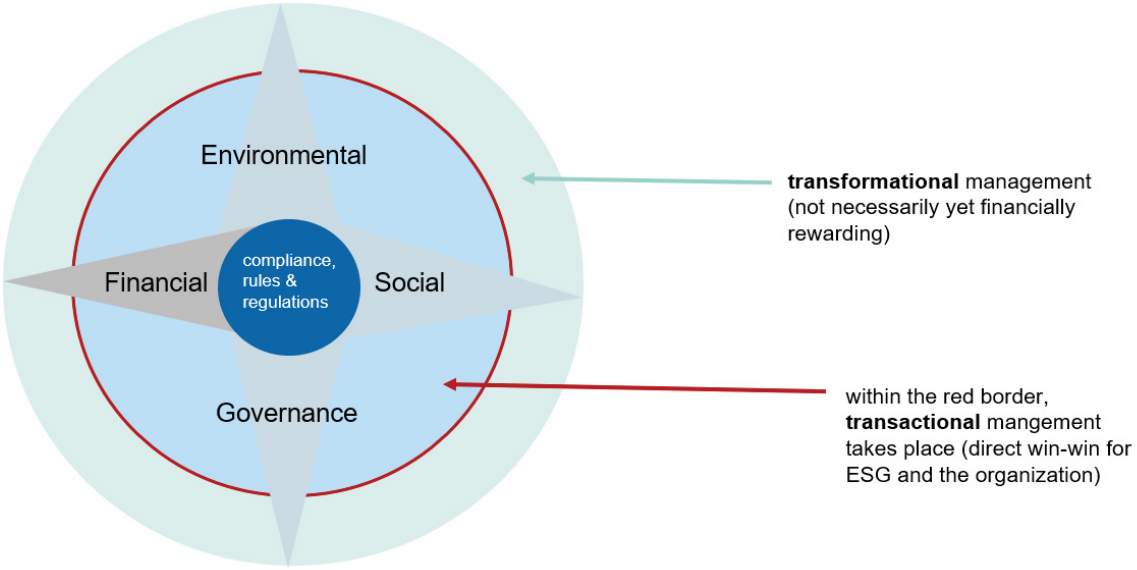

Figure D.1: Transformation Management Compass

The Transformation Management Compass constitutes different layers of management/decision-making described from the centre to the outer layers. The general basis for management (in the centre of the compass) is rules and regulations, as well as compliance, the minimal baseline for activities. The in-between layer represents transactional management (e.g., driven by common processes and objectives, by the classical operational implementation). Decision-

making in this area stands for an immediate win-win perspective in terms of all dimensions of the compass. Any activities in this sphere are relatively easy to integrate into the existing decision-making metrics, as well as into established accounting and controlling practices. In terms of control systems, this layer is characterized by boundary systems and diagnostic control systems. Interactive controls pave the ground for crossing the line toward transformational management. Finally, the outer layer stands for transformational management (e.g., driven by open and more holistic, innovative thinking). Here, the so-called "high-hanging fruits" (Wickert and Risi 2019, p. 8), which mean systematic and impactful change, are considered. This outer layer is characterized by the above-described belief systems and interactive controls. Different from oftentimes short-term expectations stemming from a classical shareholder perspective, decision-making in this sphere does not take place automatically (Rausch 2011). In terms of environmental impact, this could mean striving towards a net positive worth for the environment, without the security of immediate or short-term financial rewards.

Business activities in the outer layer can be distinguished from activities within the red circle by applying the Sustainability Zeroline coined by Dahm (2019). Considering inter alia the planetary boundaries by Rockstroem *et al.* (2009), from which a large body of academic literature around the term 'absolute sustainability' has recently emerged (Downing *et al.* 2019), the zeroline marks the status where neither a positive nor a negative impact is derived from a certain endeavor. While it might be the primary objective of a company to do the least harm possible, it would, even if not necessarily financially rewarding short-term, probably strengthen its competitive advantage and take up its role in being part of the solution of our grand challenges best if its activities are based above the Sustainability Zeroline.

While this study focuses on environmental sustainability, the Transformation Management Compass as well as the Sustainability Zeroline apply equally to social and governmental aspects. The Sustainability Zeroline not only concentrates on the biosphere but also the anthroposphere, including indicators for freedom, human rights, and dignity, cultural diversity, common welfare, labor, employment, etc. (Dahm 2019, p. 168). There is evidence that the mechanisms for incorporating social and governmental aspects, which means taking the anthroposphere into account, can be assumed to be similar. Here, future research is needed to determine similarities and differences. We identify differences in decision-making related to sustainability which derive from the types of investments and diverse strategic backgrounds.

The second part of our research, therefore, is about describing pathways to incorporate transformational management for changing business activities towards *deep* or *strong* sustainability, both being terminus technici for an approach stating that "critical parts of the natural

capital must be preserved as to guarantee present and future human wellbeing" (Buriti 2018). Here, we showcase on the one hand which hurdles characterize the endeavors to move from transactional to transformational management; on the other hand we are guiding decision-makers describing which type of management control might be valuable to cross the red line between transactional and transformational management and to capitalize on the so-called "high-hanging fruits" of sustainable business practices.

From our understanding, "high-hanging fruits" encompass both changing business models instead of incremental change as well as tackling material sustainability instead of immaterial sustainability. While Maniora (2018) calls for general attention to the sustainability materiality determination process, we did not distinguish the level of the materiality of the sustainability issues described by our key informants. While not having enough insight into the single companies to judge the materiality level of the sustainability issues mentioned, we are aware of its relevance and suggest that future research examine such a connection.

Similar to the findings of Kühnen *et al.* (2022), we find interviewees seldomly spoke about sustainability as the basis for competitive positioning or positive business developments. Kühnen *et al.* (2022) use the concept of positive sustainability performance, which has been difficult for their key informants to identify. From this, the authors deduced that the current framing of sustainability performance in corporate practice appeared to be stuck in negative frames which tend to be "stickier" than positive frames (Sparks and Ledgerwood 2017). Going deeper into asking interviewees about positive sustainability impacts and how they might be achieved could reveal further support for concentrating on transformational management.

Further, a few interviewees mentioned a need for interorganizational learning and collaboration. For reasons of scope, we did not dive any further into this topic but assume that this might be an interesting aspect to tackle in future research. The following quote underlines this perspective: "The realization and facilitation of synergies and complementarity […] can only succeed in cooperation between the market players, since we must form new alliances for sustainable business cultures. Cooperation here, too, which I have not yet mentioned, will have to be trans-sectoral (I11:13)".

In line with Beusch *et al.* (2022), we call for future studies which more strongly incorporate stakeholder influences for integrating sustainability into investment decisions. This study could be extended by finding a way to measure how far away current decision-making practices are from a scientifically based measurement of companies' environmental impact, i.e., the need to identify patterns and business practices that facilitate or impede a resulting net positive worth for the environment. Furthermore, our findings only peripherally offer assistance on how to

overcome the difficulty of conflicting objectives between financial, environmental and social issues perceived by many corporate managers (Porter and Kramer 2011). Here we encourage further research to concentrate on control practices tackling this specific challenge.

6. Implications for practice and limitations

Our study also has practical implications. First, decision-makers can use the framework of our Transformation Management Compass as a simple visual tool to better address sustainability in a holistic and multi-dimensional manner and to aid when implementing corresponding management controls for transforming business practices towards sustainability. Further, the framework and system can help organizational decision-makers realize that striving for sustainability does not only mean doing less harm, but reaching a net positive worth for the environment, and putting the right processes in place to control for sustainability. By providing a current snapshot of the implementation of sustainability controls and systematizing key themes experienced by managerial decision-makers involved in corresponding decisions (e.g., Appendix B, Figure D.2), the study has practical value for institutional actors such as local and federal government (e.g., the European Union) and non-governmental organizations that must decide how to regulate sustainability accounting and motivate its' implementation while keeping employment and economic considerations in mind.

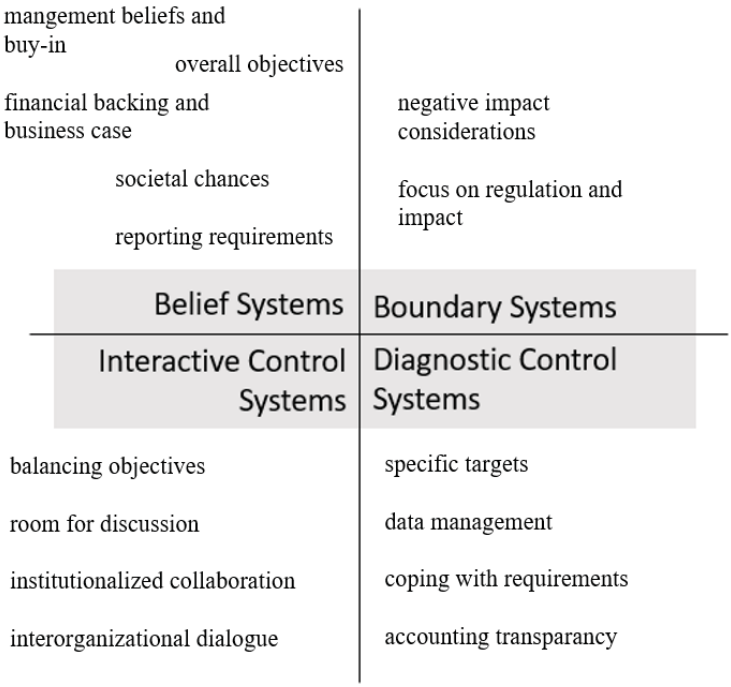

Figure D.2: Resulting themes categorized by levers of control

This study also has limitations. While our interviewee sample is comprised of experts from different sectors and firm sizes, they all come from German-speaking countries (specifically, Germany and Austria); therefore, in terms of external validity, our study's results may not be fully generalizable to other countries with starkly different national cultures or economies. Also, we do not derive differences in sustainability decision-making that result from firm sector or size, which we leave to future research.

References

Albelda, E, (2011). The role of management accounting practices as facilitators of the environmental management: Evidence from EMAS organisations. *Sustainability Accounting, Management and Policy Journal*, 2(1), 76–100.

Anthony, RN, (1965). *Planning and Control Systems. A Framework for Analysis*. Harvard University Press, Boston, Massachusetts.

Bansal, P and K Roth, (2000). Why Companies Go Green: A Model of Ecological Responsiveness. *Academy of Management Journal*, 43(4), 717–736.

Bass, BM, (1999). Two Decades of Research and Development in Transformational Leadership. *European Journal of Work and Organizational Psychology*, 8(1), 9–32.

Bebbington, J and I Thomson, (2013). Sustainable development, management and accounting: Boundary crossing. *Management Accounting Research*, 24(4), 277–283.

Bebbington, J and C Larrinaga-González, (2008). Carbon Trading: Accounting and Reporting Issues. *European Accounting Review*, 17(4), 697–717.

Beusch, P, JE Frisk, M Rosén and W Dilla, (2022). Management control for sustainability: Towards integrated systems. *Management Accounting Research*, 54, 100777.

Bjørn, A, C Chandrakumar, A-M Boulay, G Doka and K Fang, (2020). Review of life-cycle based methods for absolute environmental sustainability assessment and their applications. *Environmental Research Letters*, 15(8).

Buriti, R, (2018). "Deep" or "Strong" Sustainability. In: WL Filho, ed. *Encyclopedia of Sustainability in Higher Education.* Springer International Publishing, Basel.

Burns, JM, (1978). *Leadership*. Harper & Row, New York.

Burritt, RL, S Schaltegger and D Zvezdov, (2011). Carbon Management Accounting: Explaining Practice in Leading German Companies. *Australian Accounting Review*, 56(21), 80–98.

Burritt, RL and S Schaltegger, (2010). Sustainability accounting and reporting: fad or trend? *Accounting, Auditing & Accountability Journal*, 23(7), 829–846.

Busch, T, (2011). Organizational adaptation to disruptions in the natural environment: The case of climate change. *Scandinavian Journal of Management*, 27(4), 389–404.

Connelly, BL, DJ Ketchen and SF Slater, (2011). Toward a “theoretical toolbox” for sustainability research in marketing., 39, 86-100. *Journal of the Academy of Marketing Science*, 39, 86–100.

Crutzen, N and C Herzig, (2013). A review of the empirical research in management control, strategy and sustainability. In: L Songini, ed. *Accounting and control for sustainability.* Emerald, Bingley, 165–195.

Cuckston, T, (2013). Bringing tropical forest biodiversity conservation into financial accounting calculation. *Accounting, Auditing & Accountability Journal*, 26(5), 688–714.

Dahm, JD, (2019). *Benchmark Nachhaltigkeit. Sustainability Zeroline: Das Maß für eine zukunftsfähige Ökonomie*. transcript Verlag, Bielefeld.

Deaux, E and JW Callaghan, (1985). Key informant versus self-report estimates of health behavior. *Evaluation Review*, 9, 365–368.

Downing, AS, A Bhowmik, D Collste, SE Cornell, J Donges, I Fetzer, T Häyhä, J Hinton, S Lade and WM Mooij, (2019). Matching scope, purpose and uses of planetary boundaries science. *Environmental Research Letters*, 14(7), 73005.

Epstein, MJ, AR Buhovac and K Yuthas, (2010). Implementing Sustainability: The Role of Leadership and Organizational Culture. *Strategic Finance*, 4, 41–47.

Feder, M and BE Weißenberger, (2019). Understanding the behavioral gap: Why would managers (not) engage in CSR-related activities? *Journal of Management Control*, 30(1), 95–126.

Gond, J-P, S Grubnic, C Herzig and J Moon, (2012). Configuring Management Control Systems: Theorizing the Integration of Strategy and Sustainability. *Management Accounting Researh*, 23, 205–223.

Guenther, E, J Endrikat and TW Guenther, (2016). Environmental management control systems: a conceptualization and a review of the empirical evidence. *Journal of Cleaner Production*, 136, 147–171.

Hahn, R, D Reimsbach and C Wickert, (2023). Nonfinancial Reporting and Real Sustainable Change: Relationship Status—It's Complicated. *Organization & Environment*, 36(1), 3–16.

Hammersley, M and B Cooper, (2012). Analytic induction versus qualitative comparative analysis. In: Cooper Barry, J Gaessner, R Gomm and M Hammersley, eds. *Challenging the Qualitative-Quantitative Divide: Explorations in Case-focused Causal Analysis.* Continuum Publishing Corporation, London.

Hartmann, F, P PEREGO and A Young, (2013). Carbon Accounting: Challenges for Research in Management Control and Performance Measurement. *Abacus*, 49(4), 539–563.

Hoffmann, VH, T Trautmann and J Hamprecht, (2009). Regulatory Uncertainty: A Reason to Postpone Investments? Not Necessarily. *Journal of Management Studies*, 46(7), 1227–1253.

Homburg, C, M Klarmann, M Reimann and O Schilke, (2012). What Drives Key Informant Accuracy? *Journal of Marketing Research*, 49(4), 594–608.

Johnstone, L, (2019). Theorising and conceptualising the sustainability control system for effective sustainability management. *Journal of Management Control*, 30, 25–64.

Katz, J, (2001). Analytical Induction. In: NS Smelser and PB Baltes, eds. *International Encyclopedia of the Social and Behavioral Sciences* (first edition). Elsevier BV, Oxford, U.K., 480–484.

Kühnen, M, S Silva and R Hahn, (2022). From negative to positive sustainability performance measurement and assessment? A qualitative inquiry drawing on framing effects theory. *Business Strategy and the Environment*, 31(5), 1985–2001.

Lueg, R and R Radlach, (2016). Managing sustainable development with management control systems: A literature review. *European Management Journal*, 34(2), 158–171.

Lülfs, R and R Hahn, (2014). Sustainable Behavior in the Business Sphere: A Comprehensive Overview of the Explanatory Power of Psychological Models. *Organization & Environment*, 27(43-64).

Maniora, J, (2018). Mismanagement of Sustainability: What Business Strategy Makes the Difference? Empirical Evidence from the USA. *Journal of Business Ethics*, 152(4), 931–947.

Martyn, P, B Sweeney and E Curtis, (2016). Strategy and control: 25 years of empirical use of Simons' Levers of Control framework. *Journal of Accounting & Organizational Change*, 12(3), 281–324.

Phillippi, J and J Lauderdale, (2018). A Guide to Field Notes for Qualitative Research: Context and Conversation. *Qualitative Health Research*, 28(3), 381–388.

Pondeville, S, V Swaen and Y de Rongé, (2013). Environmental management control systems: The role of contextual and strategic factors. *Management Accounting Research*, 24(4), 317–332.

Porter, ME and MR Kramer, (2011). The big idea: creating shared value. *Harvard Business Review*, January-February, 62–77.

Rausch, A, (2011). Reconstruction of decision-making behavior in shareholder and stakeholder theory: implications for management accounting systems. *Review of Managerial Science*, 5(2-3), 137–169.

Robinson, WS, (1951). The Logical Structure of Analytic Induction. *American Sociological Review*, 16(6), 812–818.

Rockstroem, J, S Will, K Noone and Å Persson, (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, 14(2).

Rodrigue, M, M Magnan and E Boulianne, (2013). Stakeholders' influence on environmental strategy and performance indicators: A managerial perspective. *Management Accounting Research*, 24(4), 301–316.

Schaltegger, S, (2018). Linking Environmental Management Accounting: A Reflection on (Missing) Links to Sustainability and Planetary Boundaries. *Social and Environmental Accountability Journal*, 38(1), 19–29.

Schaltegger, S, FL Freund and EG Hansen, (2012). Business cases for sustainability: the role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development*, 6(2), 95–119.

Sharma, G and AK Jaiswal, (2018). Unsustainability of Sustainability: Cognitive Frames and Tensions in Bottom of the Pyramid Projects. *Journal of Business Ethics*, 148(2), 291–307.

Siegrist, M, G Bowman, E Mervine and C Southam, (2020). Embedding environment and sustainability into corporate financial decision-making. *Accounting & Finance*, 60(1), 129–147.

Simons, R, (1995). *Levers of Control: How Managers Use Innovative Control Systems to Drive Strategic Renewal.* Harvard Business School Press, Boston, Massachusetts.

Simons, R, (1994). How New Top Managers Use Control Systems as Levers of Strategic Renewal. *Strategic Management Journal*, 15(3), 169–189.

Sparks, J and A Ledgerwood, (2017). When good is stickier than bad: Understanding gain/loss asymmetries in sequential framing effects. *Journal of Experimental Psychology*, 146(8), 1086–1105.

Spence, C, J Husillos and C Correa-Ruiz, (2010). Cargo cult science and the death of politics: A critical review of social and environmental accounting research. *Critical Perspectives on Accounting*, 21(1), 76–89.

Starik, M and P Kanashiro, (2013). Toward a Theory of Sustainability Management: Uncovering and Integrating the Nearly Obvious. *Organization & Environment*, 26(1), 7–30.

Taïbi, S, N Antheaume and D Gibassier, (2020). Accounting for strong sustainability: an intervention-research based approach. *Sustainability Accounting, Management and Policy Journal*, 11(7), 1213–1243.

Wener, P and RL Woodgate, (2013). Use of qualitative methodological scaffolding process to design robust interprofessional studies. *Journal of Interprofessional Care*, 27(4), 305–312.

Wickert, C and D Risi, (2019). *Corporate Social Responsibility*. Cambridge University Press, Cambridge.

Znaniecki, F, (1934). *The Method of Sociology*. Rinehart & Company, New York.

Appendix

Appendix A. Interview Questions

Criteria

1. What kind of investment decisions are you familiar with in your company?
2. When preparing investment decisions, are there fixed criteria that are decided upon in advance?
3. Do these criteria also include non-financial key figures?
4. How are environmental sustainability aspects incorporated?
5. Does the consideration of ecological impacts go beyond regulatory aspects?
6. Where do the requirements come from?
7. Is the issue of environmental sustainability perceived as a risk or an opportunity?

Hurdles

8. What hampers a stronger anchoring of ecological aspects?
9. Is there a distinction in terms of the type of investment (maintenance, innovation, etc.)?
10. Are there differences depending on the temporal orientation of the investment (long-term vs. short-term)?
11. What role do the increasing reporting obligations play?
12. What role does environmental sustainability play in the strategic orientation of the company?
13. Is the strategic orientation reflected in investment decisions?

Spaces

14. Where do you discuss which criteria to be applied?
15. Where are conflicting goals discussed?
16. Who discusses them?
17. Is there sufficient space for discussion/reflection on non-financial indicators?

Appendix B: Data structure (control systems)

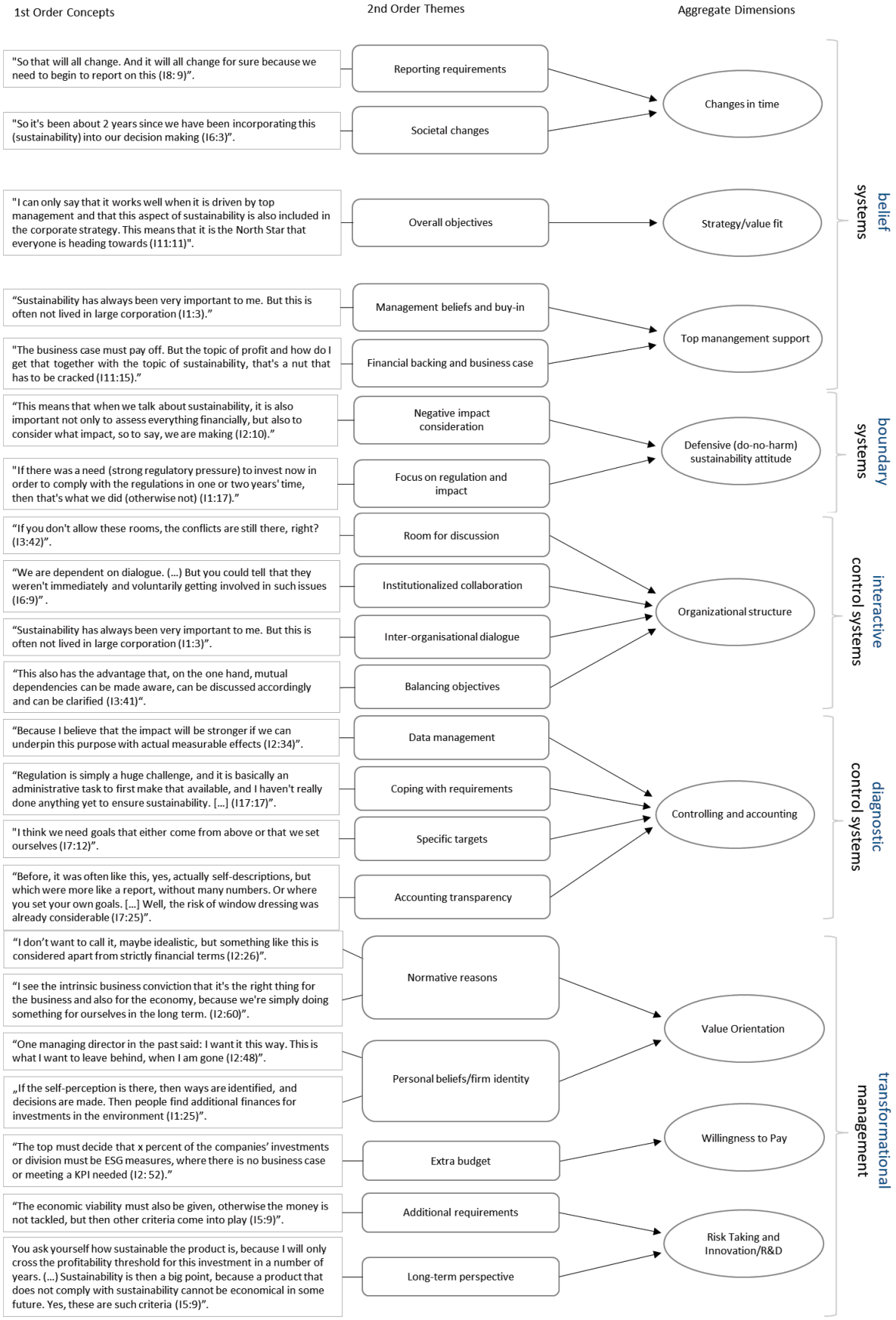

Figure D.3: Inductively elaborated data structure concerning the integration of sustainability into investment decisions

E. Study 4: Striving towards an Integrated Sustainability Accounting: A Constellation Analysis Based on Interdisciplinary Knowledge Sharing

Authors and relative contributions:

Anna Katharina Meyer (60 %)

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J. Daniel Dahm (10%)

All authors designed research.

All authors performed research.

All authors analyzed research.

Anna Katharina Meyer and Hannes Matt wrote research.

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Striving towards an Integrated Sustainability Accounting: A Constellation Analysis Based on Interdisciplinary Knowledge Sharing

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Striving towards an integrated Sustainability Accounting:
A Constellation Analysis Based on Interdisciplinary Knowledge Sharing

ABSTRACT

More severely than in the past, the business community is confronted with the need for integrating sustainability into their economic practices. Decision-makers are becoming increasingly aware of the shortcomings of how environmental and social aspects have been considered so far and seem to have a more open attitude than in the past to learn about how sustainability could be integrated into future management accounting and controlling practices. To do so, it is crucial to understand the interrelations between a company's externalities and their origins within the company, i.e., through which activities these externalities arise. To analyze current and possible future approaches to better integrate sustainability effects, an interdisciplinary research approach is key. Doing so, based on a constellation analysis (Ohlhorst and Schoen 2015), we develop the fundamentals of a corporate Integrated Sustainability Accounting (ISA). The *target constellation*, which displays the elements of influence, including actors, concepts, and scientific baseline, is based on the concept of the Sustainability Zeroline (Dahm 2019) and is in line with a strong sustainability approach (Doering 2004; Doering and Ott 2001), stating that economies must operate within the planetary boundaries (Rockstroem *et al.* 2009; Steffen *et al.* 2015).

Keywords: corporate sustainability accounting; environmental accounting; true cost accounting; corporate social responsibility; Constellation Analysis; interdisciplinary research

JEL-Classification: M

> *"Sustainable change depends on the extent to which 'integrated thinking' and* ***'integrated accounting'*** *can confront, challenge, and colonize the 'unintegrated thinking' and 'unintegrated accounting' that dominates contemporary business."*
> Zyznarska-Dworczak (2020, p. 13)

1. Introduction

Sustainability in the business context for long has been reduced to a reporting topic. Information gathering and sharing have been mainly motivated by the need to satisfy stakeholders and for the publicity-effective creation of an image as a responsible firm (Bebbington and Larrinaga 2014). Longstanding scientific discourses, though, based on interdisciplinary approaches, identify a need to change management and accounting practices to control for sustainability-relevant business practices (Gray *et al.* 1993). Additional to the content-related requirements for an effective accounting system, it needs to provide information for management and decision-making, instead of solely serving the means of documenting and reporting. When sustainability aspects are included into decision-making along the full range of its biogeoecological, socioeconomic and cultural impacts, we speak of an *integrated* accounting approach, initially brought into the debate by Dahm in the context of a regenerative agricultural economy and the need for a level-playing field for a sustainable entrepreneurial competitive environment (Dahm 2013). Also considering Bebbington and Larrinaga's (2014) analysis of the interaction between accounting, nature, and society, we agree that doing business in line with the needs of future generations and long-term economic success relies on a consistent corporate Integrated Corporate Sustainability Accounting (ISA)[6].

This study *aims* to identify the fundamentals of an effective corporate ISA, describing a constellation of elements (i.e., actors, regulation, scientific foundations, etc.) enabling its implementation. Here, the term *effective* stands for covering scientific needs of integrating negative as positive climate-ecological externalities in a way that is reasonable and feasible in its implementation for the valuation of economic activities and corporate decision-making. While the voluntary internalization of externalities oftentimes leads to disadvantages in economic monetary outcomes – the financial performance – of businesses (Dahm 2020), there is a need to achieve internalization of externalities from a social welfare point of view, as well as from

[6] The corporate ISA we are referring to in the research herein is not to be confused with the International Standards on Auditing, which is also called ISA for short.

the climate-environmental sustainability lens, and in terms of an economy contributing to our social as ecological resilience and future viability as a society.

Therefore, identifying constellations to better incorporate costs and gains of business practices along the broadness of environmental and social factors, are leading to a better basis for strategic decision-making in companies. Desirable constellations can also be described as elements of governance to create and enforce the legal and regulatory, as well as the institutional and international frameworks that will make a life- serving future possible.

2. Defining corporate integrated sustainability accounting

Gray *et al.* (1993, p.56) state that "a sustainable organization is one which leaves the biosphere at the end of the accounting period no worse off than it was at the beginning of the accounting period". At the time of publication, though, sustainability accounting was neither part of corporate practice nor part of the academic field of accounting. It rather served to open a space for new, mediating representations between "conventional" accounting literature / practice and "alternative" critiques / theories. It thus represented, and still does, a gap in the scientific literature for discussion and mutual learning.

Unlike traditional financial accounting and reporting, where the content of reporting directly follows the rules of accounting, this has not been true of sustainability reporting (Barker and Eccles 2018). Rather, the methods of sustainability reporting have been guided by a broad variety of frameworks and guidelines, that in general do not require or follow a consistent data basis. As a result, sustainability reporting and sustainability accounting have largely been unconnected fields in the past.

Lehman (1999) describes sustainability accounting as measures to verify the impact of, among other things, the costs of plant closures, emission levels, waste levels, and pollution levels. This corresponds to the focus of sustainability debates in politics and business at the time, which was primarily concerned with national environmental protection (Bluehdorn 2020).

The first publications linking accounting with sustainability on the organizational level (micro level), focused on the deficiencies of conventional accounting (Gray 1992; Mathews 1997; Schaltegger and Burritt 2000), as well as the limits of the underlying philosophy of accounting, which conventionally focuses on monetary, quantitative measures of corporate economic activities (Maunders and Burritt 1991; Lehman 1999; Mathews 2001). With Spence *et al.* (2010), objectives beyond the external accountability focus were considered.

Schaltegger and Burritt (2000) popularly theorize sustainability accounting as a strategy and management tool, placing it on par with sustainability reporting. They argue that the

development of sustainability accounting and reporting should be oriented more toward improving management decision-making. For taking up this role, they identify a lack of methodological maturity in accounting standards as well as common management practices. Understanding sustainability accounting to be a management tool, Chen and Roberts (2010) analyze related business practices in the context of various socioeconomic theories, such as legitimacy theory, institutional theory, resource dependence theory, and stakeholder theory.

One of the most cited papers in the context of sustainability accounting (Wood *et al.* 2015) examines the methodology of EXIOBASE, a database intended to serve as the empirical basis for the United Nations System of Environmental-Economic Accounting (UN SEEA). It measures the supply and use, respectively input and output of ecosystems, their impacts on natural capitals, and services. Since the 2010s, based on complex environmental and earth system modeling and satellite imagery (as well as their computer / machine learning analysis) and the increased computational power, various systems for Natural Capital Accounting or Environmental Accounts have developed, most prominently UN's SEEA. The aim was (and still is today) the linking of human economic activities with the natural prerequisites required for these activities (broadly summarized under the terms natural capitals and ecosystem services) as well as the measurement of their state. This idea goes back at least to the early 1990s, some authors argue, back to the 1970s (Hopwood *et al.* 2010).

However, the linkage provided by SEEA, and comparable systems is at the macro (nation-state) level. Only in individual (often particularly urgent and overt) cases is this refined to the meso- and micro-level for the observation of specific natural capitals and their use by different economic agents and other stakeholders, for example in the context of freshwater use. Only recently, new initiatives arose for the alignment between public and private sector natural capital accounting and a roadmap for business accounting in the context of SEEA.

Considering the measurements used for sustainability accounting as such, Burritt *et al.* (2002) distinguish three different types: monetary measures such as an organization's waste disposal costs, non-monetary physical measures such as greenhouse gas emissions in tons or energy consumption in kilowatt-hours, as well as qualitative measures. Qualitative measures may be relevant if no methodological approach applies to a quantitative assessment. This is oftentimes the case in the above-described context defining the value of ecosystems: "Despite the crucial role of ecosystems and their services for society, there is no established and regular measurement of ecosystem extent, condition and their change over time, nor of the quantity of services these ecosystems supply" (Vysna *et al.* 2021). While there is no price tag on certain services, there is neither a price tag on the harm business activities cause to them. This is

especially true for singular business activities which may be tracked in terms of financial accounting but for now still underperform in terms of sustainability accounting.

3. Literature overview

This paper is written in the context of different literature streams, but mainly environmental and ecological economics and sustainability accounting.

Since the late 1990s, the discourse on natural capital accounting has been based on the question of how to assess the impact of economic activities on nature. GDP, as a measure of economic activity, is one of the most important measures for assessing macroeconomic activity. If one follows the standards of national accounting, the current measurement of GDP is "reasonably accurate" (Samuelson 1998). GDP is considered equal to the sum of the monetary values of all consumer and capital goods, government expenditures, and net exports to other countries (Samuelson 1998). Question marks arise when Samuelson describes further that in a well-functioning market economy, prices reflect the relative satisfaction that consumers experience from each good (Samuelson 1998). This assumes that each good is also priceable, i.e., monetizable. Giarini and Liedtke (1998), therefore, formulate that any freely available good, such as fresh air, has no price and therefore, according to traditional economic theory, no value.

Since the national product only statistically measures goods and services that can be valued in money, alternatives to and supplements to GDP are increasingly being sought. Some important supplements are summarized by Douthwaite and Diefenbacher (1998). Thus: 1. the distribution of material wealth and of income and wealth should be included in GDP; 2. an expanded understanding of capital should be reflected in GDP. This should specifically include the factor of consumption of natural resources and human capital; 3. the informal part of the economy (by this is not meant the informal economy in the sense of the shadow economy according to Sassen (2000), self-help, civic work and especially also domestic work should be taken into account; 4. the 'services' of nature should not be considered as gratuitous. Neither their properties as 'sources' nor as 'sinks' are considered. Ecological consequential costs must also be included here; 5. GDP distinguishes between welfare enhancing and diminishing goods and services; 6. Include the value of immaterial welfare components, such as the value of leisure time, but also the aesthetic value of an undestroyed landscape, the extent of noise pollution, and the like. All in all, it is to be stated that what is recognized as valuable is essentially determined by the standards of productivity in the previous sense. Everything that cannot be quantitatively monetized is not assigned any value. Friedrich August von Hayek, as a representative of economic liberalism, vehemently distanced himself in his speech in 1974 on the occasion of the award of the Nobel

Prize for Economics from the disastrous fiction and tendency of modern economics to regard only that which can supposedly be measured and quantified as well as mathematized as 'scientific' and thus relevant, and for this reason to exclude from the outset complex socio-economic phenomena which can only be assessed qualitatively on the basis of our everyday experience and for which at best approximate development patterns can be predicted. Biogeoecologically, this is also opposed by the planetary limitation. A steady and continuous increase of the total economic production - at least as fast as the labor productivity per worker increases - presupposes the possibility of unlimited economic expansion. Since an unlimited supply of natural space and resources does not exist globally, unlimited economic growth can only be guaranteed on a regionally limited basis if the consequential costs of the overexploitation of natural and, linked to this, socio-economic foundations are externalized continuously and increasingly. It is increasingly recognized that externalizations in a globally limited and, above all, developed natural and cultural area indirectly flow back into national accounts - mostly first spatially, then with a time lag. Against this background, the operational recording of biogeoecological effects, of economic practice, i.e. the microeconomic effects on natural capital in accounting, is the logical complement to the "old" business performance measurements.

Zyznarska-Dworczak (2020) analyzed the most cited articles concerning sustainability accounting research from 1996–2019. Doing so, she concludes that “neither in theory nor in practice has the role of sustainability accounting been clearly stated or standardized. [...] Accounting is not keeping up with the rapid development of sustainability reporting, including not developing our own generally respected accounting principles in assessing the achievement of sustainable development goals” (p. 11). This is, from our perspective, partly the case because of the disconnection of academic disciplines, which may even be considered silos, and the malfunctioning of an interdisciplinary public discourse concerning the topic – both being relevant factors for the constellation analysis following this chapter of literature overview.

Wood *et al.* (2015), takes an approach to sustainability accounting that is merely influenced by environmental policy objectives. In the second most cited work in the context of sustainability accounting, Burritt and Schaltegger (2010) distinguish two streams of research, both solely from a microeconomic perspective: the critical path and the managerial path of sustainability accounting literature and practice. The critical path follows the assumption that sustainability accounting is of little use for tackling sustainability problems (e.g.: Gray and Milne 2002) while the second emphasizes the use of sustainability accounting to support corporate decision-making (Burritt *et al.* 2002). In both cases, there has not been any consideration of the time dimension of sustainability accounting. Taking the *time dimension* of sustainability into

account means an understanding of the impact of activities related to its moment in time and its consequences, for example for future generations. Such an understanding is based on the definition of the UN World Commission on Environment and Development (the so-called Brundtland commission), which distinguishes between inter- and intragenerational justice. While intragenerational justice refers to sustainability within a single generation, intergenerational justice focuses on "development that meets the needs of the present without compromising the ability for future generations to meet their own needs" (Brundtland *et al.* 1987, p. 14). A literature review by Guenther *et al.* (2016) underlined that the intergenerational perspective (opposed to the intragenerational perspective of economic behavior) seemed to be "generally unexplored [and that] the general management control literature as well as research on environmental management control systems have ignored this issue so far" (p. 166).

Dahm stipulates 2015 that "future sustainability requires intact and strong commons for resilient economies, high quality sustainable agroforestry productivity, long term resource availability, social and political peace, and a just and livable future." (p. 314) Above this, he argues that "the previous (numerical) measures of economic development, such as GDP/year are inadequate to adequately reflect the qualitative target dimensions of the economy." (p. 323) In order to be able to empirically analyze and evaluate the concrete impact of economic and social activities, their energy and resource intensity, but also the human labor involved, a transparent and, above all, as complete as possible input-output measurement of economic enterprises, national economies and entire economic regions is correspondingly necessary. It forms the analytical basis for identifying necessary improvements and transformation requirements and for responding to them politically, strategically, and entrepreneurially. "Economic capital is created only through the interaction of capitals. This requires an integrated view of the various interactively linked concepts of capital, which in their different phenomenology, qualities and assets as natural capital, social capital, cultural capital, institutional capital, infrastructural capital, and financial capital describe the breadth of the planetary basis of life and production. [...] For the reorientation of the objective of enterprises and investments, the following is necessary: A.) Establishment of a sustainability benchmark to promote transparency for customers, partners and consumers in order to be able to measure, present and evaluate the effects of companies, economic activities, production and products in a binding manner; B.) Establishment of an integrated business performance measurement to expand publication transparency, including all environmental and cultural impacts and risks for investors, companies and issuers of financial market products; C.) Methodical expansion of the risk-return analysis and performance measurement of capital investments with the integration of ecological and social-cultural

criteria in order to be able to arrive at new evaluations and strategies of asset allocation" (Dahm 2015, p. 331).

In 2019, Adams and Larrinaga updated their 2007 published paper on improved sustainability accounting and performance, again in the *Accounting, Auditing & Accountability Journal*. In their literature review, they describe the development of the academic discourse in selected accounting journals over the period of 11 years. Their focus on engagement research is well related to the focus of the paper herein because it aims at improving sustainability accounting and performance to inform practice and policy developments in parallel. According to the authors, for long, there has been "a lack of cross-fertilization of research on social and environmental issues across accounting, management, and policy journals" (Adams and Larrinaga 2019, p. 2368). As an example, the accounting literature on motivations for corporate social responsibility disclosure has been disconnected from the management literature on motivations for corporate social responsibility (Gray *et al.* 2014). While this situation, which has been the underlying assumption for establishing the *Sustainability Accounting, Management and Policy Journal* in 2010, only describes the disconnections within the management and accounting discipline.

With the paper at hand, we tackle the even greater gap of connection between the academic disciplines of economics, political sciences, and natural sciences. In line with Adams and Larrinaga (2019), we believe that social science should not accept being reduced to an existence in the so-called ivory tower, detached from the social and ecological problems organizations and society faces. Furthermore, we share the claim of the forementioned authors that the academic discourse has to "move beyond acknowledging the existence of gaps to a more penetrating analysis of the lived experiences of sustainability accounting and its implications" (p. 2369).

The paper herein is also corresponding to the research calls of Cooper and Coulson (2014), Malsch *et al.* (2011), and Neu *et al.* (2001) requesting researchers to engage in current social and ecological struggles by identifying alternative social arrangements. This is exactly what we aim for: the identification of relevant constellations of actors, concepts, and scientific baselines which define the fundamental requirements for a corporate ISA.

The academic discipline of accounting, as well as its professionals, play a crucial role which is not only based on the methodological developments of a new accounting standard but also in its mediating role between the other spheres of science and society (Gray *et al.* 1993). This, though, requires not only the extension of existing accounting standards to include ecological (and social) aspects, but also, according to Soll (2014) negotiation of these across society, or at least a broad understanding of the purpose and methodological foundations of

accounting. And where such negotiation processes about accounting practices are not conducted constructively, and accordingly there is no shared understanding about the nature and scope of fiduciary duty of companies and financial market actors, trust in companies as well as in politics erodes, social change is inhibited, and financial crises become more frequent and more difficult to manage.

4. Theory

Screening 154 papers in the context of sustainability accounting, making use of an engagement research approach, Adams and Larrinaga (2019) identify for example the following theories of receiving significant coverage in the scientific journal *Accounting Organizations and Society:* legal constructivism, institutional theory, and legitimacy theory. In the *Accounting, Auditing and Accountability Journal,* the topic is merely connected to stakeholder theory, legitimacy theory, institutional theory, and discourse analysis. Even though the wide range of theoretical foundations seems to cover everything needed for insightful analysis to derive from, Adams and Larrinaga (2019) confirm Unerman and Chapman's (2014) observation that an increase in complexity and unpredictability of relationships between relevant phenomena requires new theorizations. For the work herein, no new theorization was developed. We analyze the increasing complexity of relationships by tying a well-known theory (Actor-Network Theory) to a new methodological approach of analysis: constellation analysis.

In their literature review on the effect of Actor-Network Theory in accounting research, Justesen *et al.* (2011) find that since the early 1990s, Actor-Network Theory, particularly Latour's (1996) work, has inspired accounting researchers and led to several innovative studies of accounting phenomena. Herein, we explain the fundamentals relevant to understand why we believe in the need to identify the key influencing factors in shaping the future of an effective corporate ISA and to identify relevant elements and their connections to define a target constellation for this objective. In line with Actor-Network Theory, we are taking the understanding that the networks relevant for the research herein are neither limited to individual actors nor to technology. We are aiming for considering the status quo as well as a target constellation with all the different elements of influence. What we mean by target constellation, and which target our analysis is trying to achieve will be explained in the following chapter.

Even though the research herein is not developing or employing a new theory (considered level one and level two theorizing by Llewelyn (2003), we are aiming at providing the reader with an understanding of what needs to change, how solutions could look like and how the constellation of actors and other influencing elements needs to change. Llewelyn (2003)

calls the introduction of new concepts level three theorizing, representing new ways of thinking and acting which allows practical developments facing sustainability problems. Llewellyn's level four theorizing further offers linking solutions to problems in different contexts considering the complexity and interdependency of sustainability problems, which is what the multidisciplinary co-author team of the research herein is aiming at. Parallel to an understanding of level four theorizing, our research approach is subsumed under research paradigm of design science (Simon 1996). According to a seminal paper of Hevner *et al.* (2004), design sciences capitalize on design theory as one of five types of theories in Gregor's (2006) taxonomy. Different from the other types of theory in Gregor's taxonomy, design theory is considered prescriptive instead of descriptive knowledge, meaning that this type of theory gives prescriptions for design and action, which shows how something is done. The underlying justification knowledge which includes informal knowledge from the field and experience of practitioners is especially relevant for our work of analyzing sustainability accounting systems (Kuechler and Vaishnavi 2008). Hevner describes its contribution quite simply by the following statement: "Design-science research addresses important unsolved problems in unique or innovative ways or solved problems in more effective or efficient ways" (Hevner *et al.* 2004, p.81). The research project herein defines efficient as an improved integration of ecological, social, and governmental aspects in accounting practices.

5. Research strategy

Due to the interdisciplinary nature of the study, we decided to make use of the methodological framework of constellation analysis. This approach to innovation research was coined in 2004 by Schoen *et al.*, a working group at the Center for Technology and Society (Zentrum Technik und Gesellschaft, ZTG) at the Technical University of Berlin.

Constellation analysis aims at understanding shifts in socio-technical systems in the context of technology, sustainability, and innovation (Ohlhorst and Schoen 2015). In a bottom-up approach, constellations are described based on their heterogeneous factors of influence and their impacts on and within innovation processes as well as their relationships with each other (p. 259). Constellation analysis considers innovation processes as social phenomena, or more precisely, phenomena of social change, by extending the concept of social actors and relations to (not exclusively human) actors, like the approach taken by Actor-Network Theory. We, therefore, describe the influence of different socio-technical systems, as well as material and non-material elements on innovation processes. Thereby, constellation analysis allows for bringing together insights from different disciplines, in particular natural sciences, and

management sciences (which in many aspects have fundamental differences in their scientific methods and their scientific culture and tradition), that would usually tend to hierarchize factors through their scientific lenses and would be less open to recognizing factors foreign to their disciplines as well as their reciprocal cross-disciplinary influences and interdependencies.

Contrarily, a fundamental assumption of constellation analysis is the importance of a balanced view between the so-called "empirical societal objects of investigation" (Ohlhorst and Schoen 2015, p. 259). For the context of the research at hand, this means balancing management models and control systems currently applied in the business context with scientific fundamentals like, for example, planetary boundaries. Aiming for the identification of fundamentals of a corporate ISA, describing a target constellation of influencing elements, we identify what is intended by the most influential players in favor of a corporate ISA and what is needed for its implementation. Here, we follow the concept that these fundamentals are both technical as well as societal in nature. Understanding an ISA as an innovation, a "new normality" (Rammert 2010, 34) with new rules that, though still in the making, increasingly prove to be a guiding solution to the current problems and obstacles of the transformation to a sustainable economy. Constellation analysis can help to outline the elements, relations, and functional conditions necessary for the desired outcome (Ohlhorst and Schoen 2015, p. 259).

The elements and relationships displayed in our constellation analysis are influenced by discourses, concepts, and practices, as well as changes in institutional practices such as new regulations, and relevant societal changes such as changes in public opinion. The underlying assumption in choosing these is the need for integrating not only environmental (and social) aspects but also normative and quantitative benchmarks oriented to the natural sciences of sustainability (see: Dahm, 2019) in management practices.

We are structuring the data by looking for superordinate patterns in the framework of constellation analysis: patterns of synchrony or asynchrony, of integration or isolation, of consistency or inconsistency of objectives, strategies, or steering impulses (Ohlhorst and Schoen, 2015). Typically for using this methodological approach, the analysis of the research herein is twofold: retrospective and prospective. With a *reconstructive* analysis perspective, we examine the interplay of different factors of influence, reconstructing how constellations have changed. Here, we identify which complementary developments (social, economic, scientific, etc.) benefited, supported, or enabled the perception that there is a need for an effective sustainability accounting. With a *strategic* analysis perspective, on the other hand, we focus on the state of sustainability accounting, which is desirable, knowing that is still in the midst of a formation process, which is considered "niche" by Ohlhorst and Schoen (2015, p. 260), or which has not

yet become established. Based on this perspective we examine the methodological approaches that a commonly accepted ISA might make use of. Further, when defining a target constellation, we present the relevant elements in a new order, showing what has a favorable effect for an ISA to be accepted and implemented, and which complementary impulses are needed.

Typically for constellation analysis, we visualize various elements like actors or concepts and their interaction within specific constellations. This graphical mapping, first capturing the field in all its complexity, is used as a basis for gradually reducing the data through interdisciplinary discussions to the essential elements and relations. Within the framework of constellation analysis, according to Schoen *et al.* (2007) four types of elements are distinguished in the format displayed in Figure E.1.

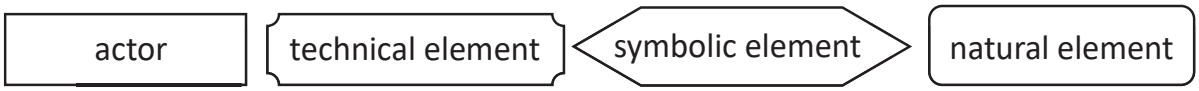

Figure E.1: Types of elements in constellation analysis

As commonly practiced in constellation analysis, the core of the constellation is designated with a circle. The proximity and distance show how close or loose the relations between the elements are: they might be simple, directed, incompatible, conflictual, or undetermined. As a conflictual relation, Ohlhorst and Schoen (2015) describe the relation between elements that explicitly and intentionally act against each other. Incompatible relations are described as those, which offer passive, not explicated resistance to the expectation or attribution of others. The relationships are shown by corresponding lines or arrow types (see Figure E.2).

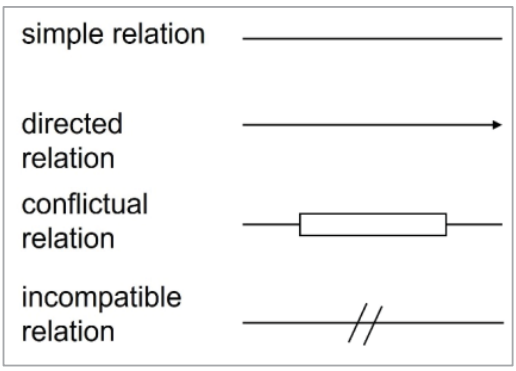

Figure E.2: Types of relations in constellation analysis

Mapping the relations and mutual influences of the different elements, in general, is considered an important step in constellation analysis and is taken place through discourse (Ohlhorst and

Schoen 2015). For the means of the research at hand, we consider the following working step to be more relevant: determining principles according to which the constellation functions (functional principles) and the features and particularities it displays (characteristics). Here, a determining principle for the implementation of corporate ISA is the integration of scientific knowledge about the Earth's natural capacities used in a specific business context and the costs of its regeneration. As a characteristic then, we consider the well-balanced description of business practices in terms of impact. As common in constellation analysis, the research team prepared the constellation and the associated descriptive text in parallel.

6. Analysis

6.1. Elements of influence

We identify the elements of influence by analyzing and evaluating empirical sources (primary and secondary literature) and gathering information collectively with an interdisciplinary team.

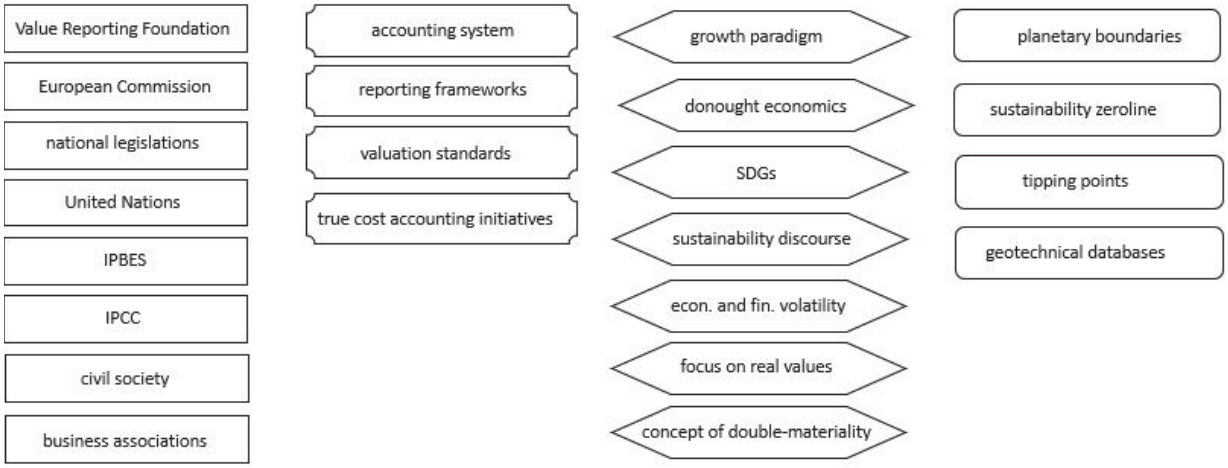

Figure E.3: Elements of influence

Alluding to the commonly analyzed types of elements used in constellation analysis (Schoen *et al.* 2007, p. 18) the participating experts define the following "actors" (e.g. institutions) relevant for approaching the research question of the paper at hand: The International Financial Reporting Standards Foundation (IFRS) consisting of the International Accounting Standards Board (IASB) and the newly in November 2021 founded International Sustainability Standards Board (ISSB), the Value Reporting Foundation (VRF), a 2021 merger of the International Integrated Reporting Council (IIRC), publisher of the Integrated Reporting (IR) Framework and the Sustainability Accounting Standards Board (SASB), publisher of the SASB Standards and the Global Reporting Initiative (GRI), the European Commission, national legislations, the United

Nations, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Intergovernmental Panel on Climate Change (IPCC), civil society and business associations.

As “technical elements” in the context of this research, among other things, the current accounting system, standard reporting frameworks, and valuation standards like the Integrated System of Ecosystem Accounts for the EU (INCA), the Natural Capital Protocol, the UN System of Environmental Accounting (SEEA) and the System of National Accounts (SNA) were considered.

As “symbolic elements" CA considers narratives, ideological factors, and concepts such as the perceived need for economic growth, economic utility, and prosperity (Solow 1974; Stiglitz 1974), as well as concepts of acting in line with nature (Raworth 2012) like the so-called ‘doughnut economics’, the 17 Sustainable Development Goals developed as objectives of the United Nations, the sustainability discourse in general, economic and financial volatility, a multi-capital focus (financial/social/ecological), as well as the concept of double-materiality. The concept of double-materiality was first formally proposed in 2019 by the European Commission in the Guidelines of Non-financial Reporting: Supplement on Reporting Climate-related Information. It underlines “the extent necessary for an understanding of the company’s development, performance and position [...] in the broad sense of affecting the value of the company” (p. 6). A recent summary of research on double-materiality and essential implications for policymakers emphasizes the importance of “considering material impacts […] of the organization on sustainable development before considering the implications on the enterprise value or the financial statements” (Adams *et al.* 2021).

“Natural elements” were defined as factors that need to be taken into consideration by the methodology of every future system of an ISA. Here, relevant elements are scientific baselines defining the risk of exceeding ecological limits (planetary boundaries) and reaching tipping points, which built the foundation for defining the Sustainability Zeroline[7], introduced by Daniel Dahm from 2011 on, and firstly published 2019. Further, a relevant element for any effective sustainability accounting system is geotechnical databases (i.e., Copernicus Earth observation program).

[7] As a starting point and basis for a regenerative economy, which is measured against the living potential of the Earth and its biocapacity, the Sustainability Zeroline defines the fictitious state of a total balance between the global biocapacity and the global ecological footprint as a Zeroline yardstick – as a minimum requirement for sustainability – which, however, is obviously not fulfilled so far.

6.1.1. Significant events and changes

Important for constellation analysis is the description of relevant events and changes paving the way for discussions on the need for a jointly accepted, and integrated, sustainability accounting. With integrated sustainability accounting, we mean accounting practices, are well-attached to the current accounting practices and, at the same time, in line with the need of taking sustainability into account in a holistic and interdisciplinary way. More precisely, it means integrating externalities into business activities and corporate decision-making. During the expert discussions and further research, we identify the introduction of ESG and corporate social responsibility criteria, the formation of related standards for reporting, particularly the GRI Standards, the ongoing legislation processes concerning the EU Taxonomy, as well as a stronger sense for the need to understand economic practices on a broader than just the financial level.

Recent developments from the regulatory side have led in this direction and will be described in more detail after describing the status-quo constellation in our digression concerning deforestation issues. The most recent valuable step in this direction has been the introduction of the Kunming-Montreal Global Biodiversity Framework (GBF), which has been adopted at the end of 2022 during the COP15 of IPBES, held under the United Nations Convention on Biological Diversity. GBF requests transnational companies and financial institutions to monitor, assess and disclose the impact on biodiversity of their operations, supply chains, and portfolios.

It is important to note that these are only the most recent events and changes. However, these events and changes build on a long-standing development and thus emerged from a certain constellation, which constitutes their present configuration. The analysis of these would be independent research for each of the mentioned events and changes, which, however, is beyond the scope of this work.

Concerning research that actively looks into management practices, there has long been a concern of researchers that companies would “use such research to influence their own agendas” - a process referred to as “managerial capture” (Adams and Larrinaga 2019). This is not the case, though, for the research herein because of the disconnection between the ones practicing the constellation analysis and the people applying current accounting practices. Furthermore, the identification of significant events and changes as well as the definition of actors, elements, and their relationship is not considered diving deep into management practices but rather taking a macro look at the picture.

6.1.2. Status quo constellation

Figure E.8 shows the relevant actors and their current connections – always in the context of our research: the establishment of a corporate ISA. Relationships between the actors and different types of elements are, as usual in constellation analysis, not necessarily "hard" in the sense of measurability but display the current situation as closely as possible. Showcasing all the relevant elements in current accounting practices, the status quo constellation helps to display the variety of influencing factors focusing on a few relationships which are conflictual or even incompatible.

We identify conflictual relationships between civil society and business associations, meaning that oftentimes objectives are conflicting. Even more challenging are incompatible relations which we identify between all the natural elements and current practices as well as with the institutions IPBES and IPCC whose role is to display scientific information about climate- and biodiversity-related developments. We identify directing relations by political institutions of all levels, as well as the IFRS Foundation. Influencing symbolic elements seem to be the growth paradigm, a weak sustainability discourse, as well as economic and financial volatility, which is considered the new normal in recent times. As undetermined relationships were considered the Sustainable Development Goals, true cost accounting initiatives, the concept of double-materiality, 'doughnut economics', and a multi-capital focus. The United Nations were not considered relevant for current accounting practices.

In response to the need formulated most recently at the Global Climate Conference COP26, as well as from institutional investors all around the world, decisive steps towards harmonizing existing standards for high-quality sustainability disclosure, steps have taken place: The IFRS foundation announced the foundation of the ISSB; Under the lead of the IFRS foundation, the newly launched VRF merged with the Climate Disclosure Standards Board (CDSB).

Back in September 2020, SASB, IIRC (GRI), the Carbon Disclosure Project, and CDSB already agreed to work together to develop a comprehensive corporate reporting system. While the increased cooperation between these organizations is welcome from our perspective, it must also be observed critically because of the institutions' strong focus on reporting and disclosure rather than on accounting. The arguably most important of these organizations, the IFRS, determines the principles according to which financial statements of companies are prepared for the international capital markets. From the perspective of the requirements of an ISA, it is therefore important that their efforts are also accompanied by the endeavor to provide a profound expansion of the quantitative basis, which means including the natural capacities and boundaries of the earth and its ecosystems, on which this reporting and disclosure must take place.

Describing the status quo, we cannot display a reliable relationship between current practices and planetary boundaries, related tipping points, and the overarching concept of the Sustainability Zeroline. Geoinformation databases to understand some of the impacts of certain business activities are not broadly considered either. Seeing the shortcomings of current relationships which would be relevant for the implementation of a corporate ISA, we would like to describe how recent developments in the context of reducing deforestation have taken a significant leap in the direction of integrated sustainability accounting, even though very much reduced to the aspect of deforestation.

6.2. Regeneration: the example of reducing deforestation

Internationally, there is a strong consensus on the need to reduce deforestation. Before describing the general target constellation resulting from our analysis, we herein describe how the target of reducing deforestation is currently integrated into business practices - based on a complex network of actors, as well as natural, symbolic, and technical elements.

On a global scale, the UN Secretariat of the Convention on Biological Diversity is the main actor setting the agenda and defining some of the scientifically proven natural elements in the context of deforestation, e.g., during COP15, the Conference of the Parties to the Convention on Biological Diversity, which 2nd part took place in Montreal, Canada, in December 2022.

Within the context of a single company in Germany, following the newest regulation, data in the sense of technical elements must be generated to ensure deforestation-free sourcing. If along the value chain, harming forests cannot be excluded, market access is denied. This is the result of the EU Regulation on Deforestation-Free Products which includes Europe's main trade agreement for Forest Law Enforcement, Governance and Trade (EU FLEGT). The document proposing the legislation names several symbolic elements (e.g., Article 191 of the Treaty on the Functioning of the European Union (TFEU) related to the protection of the environment).

Transparency of business practices is to be achieved by applying the EU Taxonomy from which the Corporate Sustainability Due Diligence Directive (CSDDD) and the Corporate Sustainability Reporting Directive (CSRD) arise. As a methodological standard for data generation, the European Sustainability Reporting Standards (ESRS) try to ensure transparency of financial investments while the Sustainable Finance Disclosure Regulation (SFDR) is meant to lead to financial devaluation of products that are produced in the context of deforestation.

As influential actors apart from government bodies, several private sector initiatives were initiated: "Nature Action 100" by several actors of the financial sector like AXA

Investment Managers, Columbia Threadneedle Investments, BNP Paribas Asset Management, and "Business for Nature Coalition", which supports strong regulation for disclosure and started their "make it mandatory"-campaign together with 330 large, international companies and conservation organizations.

6.2.1. Crossing the boundaries from science to standardized methods

The examples of efforts to reduce deforestation needs to be understood considering the bigger context of biodiversity conservation. For this topic, at large, several developments on an international scale are taking place which will be explained in more detail in the next chapter when describing which of the current standard-setting institutions are paving the ground for a corporate ISA and which ones are having a rather impeding role on the topic. Before doing so, though, we would like to showcase a self-developed illustration, underlining the importance of thinking from scientific fundamentals (displayed in the core of the illustration) towards the outer layers. The layer at the periphery of the illustration is showing a collection of standardized methods to gather and report on data characterizing a company's business activities.

In the area of climate change, multilateral agreements like the Paris agreement as well as national and sectoral emission limits exist. As a standardized method, the Greenhouse Gas Protocol is a viable tool for emission calculation. While mechanisms to handle climate-relevant emissions are quite elaborated, we consider climate change as only one prominent symptom of the current life-threatening transformation (Dahm 2022).

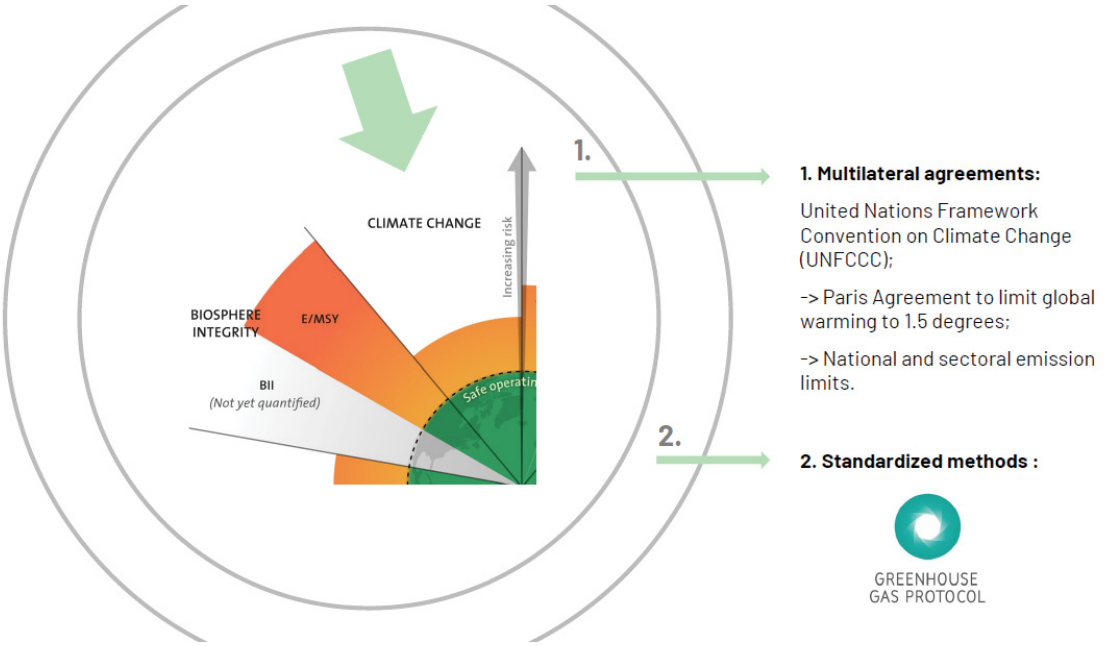

Figure E.4: Illustration of the planetary boundaries as a basis for multilateral agreements and standardized methods (focus on climate change)

Source of visual of the boundaries: PIK 2022, based on Wang-Erlandsson et al. 2022, Persson et al. 2022, Steffen et al. 2015

In terms of biosphere integrity, the United Nations Convention on Biological Diversity is relevant as well as the only lately signed Kunming-Montreal Global Biodiversity Framework (once termed the 'Post-2020 Global Biodiversity Framework'), which will be described in more detail in the following chapter. In the context of biodiversity though, no standardized method is yet established and several initiatives, which are as well described in more detail below, are taking up this important topic.

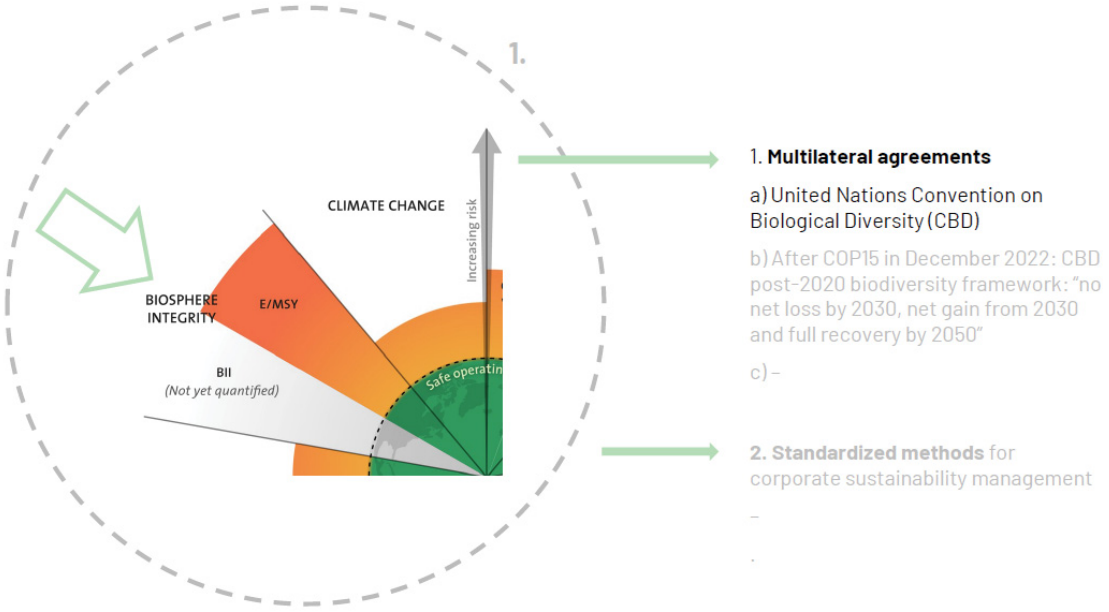

Figure E.5: Illustration of the planetary boundaries as a basis for multilateral agreements and standardized methods (focus on biosphere integrity)
Source of the visual of the boundaries: PIK 2022, based on Wang-Erlandsson et al. 2022, Persson et al. 2022, Steffen et al. 2015

The following figure gives an overview of how, according to our analysis, the planetary boundaries are yet translated into standardized methods for sustainability management.

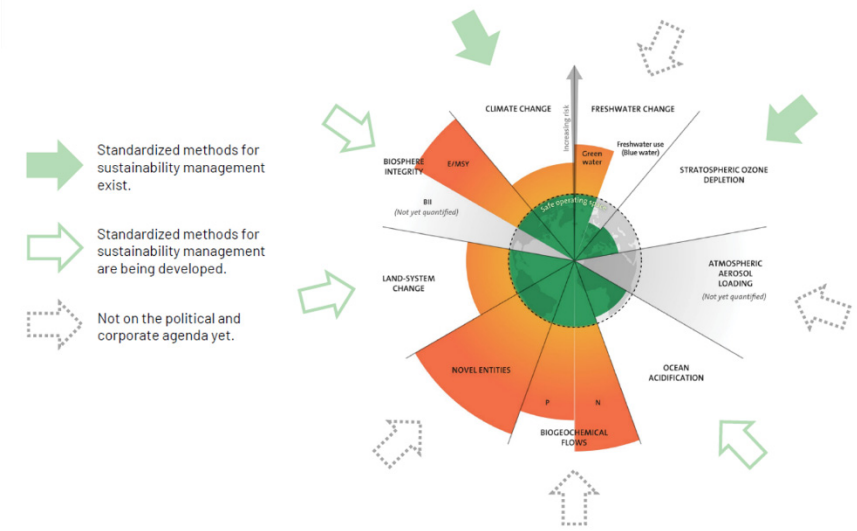

Figure E.6: Illustration of the planetary boundaries as a basis for multilateral agreements and standardized methods (showing for which of the planetary boundaries standardized methods exist)
Source of the visual of the boundaries: PIK 2022, based on Wang-Erlandsson et al. 2022, Persson et al. 2022, Steffen et al. 2015

Of course, we do not want to stop at a consideration of the status quo. It is the declared aim of this work to show possible target constellations, apart from the existing situation by integrating the changes for effective sustainability management in the entrepreneurial context. These are crucial to pave the ground for the establishment of a corporate ISA as described above.

According to Ohlhorst and Schoen (2015), the target constellation is "a projection of the status quo constellation onto a desired future time period" (p. 269).

6.2.2. Target constellation

The following figure shows the result of our analysis, displaying all the relevant elements influencing the introduction of a corporate ISA.

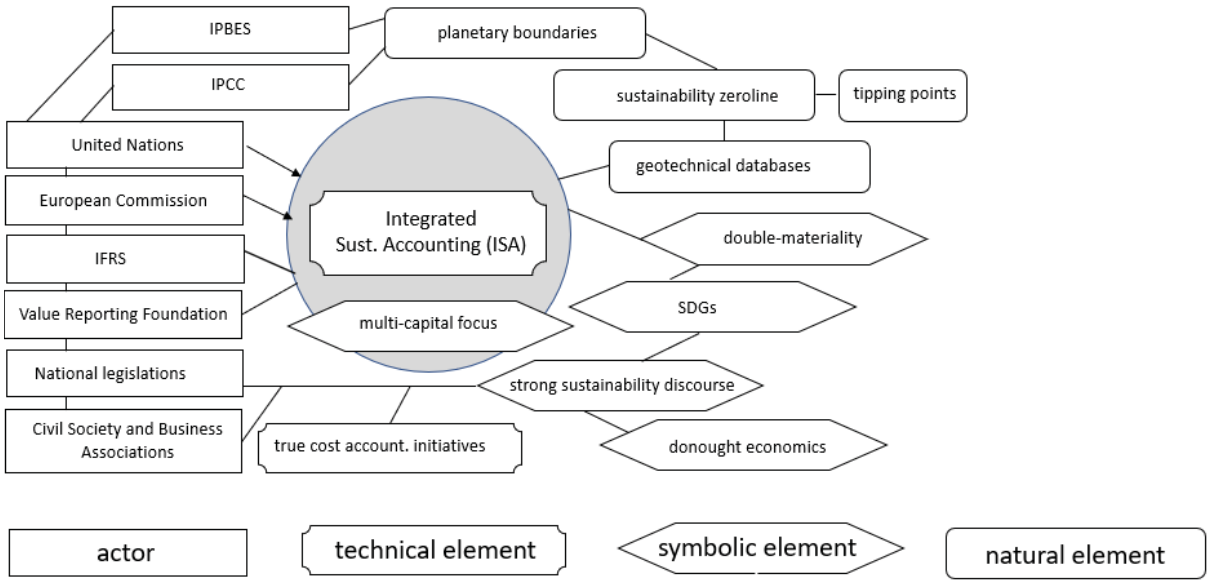

Figure E.7: Target constellation: ISA

As an important difference between the status quo and the target constellation, we define the shifting towards focusing on a normative baseline according to the Earth's and its ecosystem's natural capacities and boundaries, named "multi-capital" in our constellation (see: Adams 2017; Helm 2015).

This focus as one of the symbolic elements must, for an ISA to be implemented, move towards the center. Further, the target constellation shows all the natural elements, as well as related institutions, like the IPBES and the IPCC, surrounding the core of an ISA, all being connected and in proximity to the center. The political institutions are considered still relevant, with the United Nations and the European Commission in the prominent position of having a directing connection to ISA. Symbolic elements like a strong sustainability discourse, the principles of the so-called 'doughnut economics' as well as the Sustainable Development Goals, and the technical element of true cost accounting initiatives are well-connected having a direct relationship with ISA through the concept of double-materiality.

At the „actor"-level, this means that current efforts by IFRS and collaborating organizations are well-advised to open up their collaborations to IPBES and IPCC. And these collaborations must build on the relevant bodies of knowledge that symbolize the "natural elements", particularly the Planetary Boundaries and the Sustainability Zeroline (Dahm 2019).

In our target constellation civil society and business associations no longer have a conflicting relationship, which does not mean that they are following the same objectives, but that they perceive an ISA as capable of enabling their respective targets.

Applying sustainability accounting in the business context in a harmonized way seems to be possible as long as the target constellation or at least parts of it comes into practice. Efforts towards this direction are requested by many authors (see: Gray *et al.* 2014; Taïbi *et al.* 2020; Unerman *et al.* 2018; Russell *et al.* 2017). SEEA can provide a methodological starting point for this. Other methodological starting points are provided by the EU-funded Transparent Project with the participation of the WBCSD, the Value Balancing Alliance, and the Capitals Coalition. The Natural Capital Coalition is also editor of the Natural Capital Protocol (2016), one example though of the various documents published in the context of Natural Capital Accounting (also see: UNEP Finance Initiative 2012) that has not yet been linked to sustainability accounting in the business context.

While a few years ago this field was characterized by an almost unmanageable multitude of actors and frameworks (Accountancy Europe 2020), it has recently narrowed down to three key players that are shaping the current and likely future development of corporate sustainability reporting, and will thereby have a strong influence on corporate ISA: The ISSB of the IFRS Foundation, the European Financial Reporting Advisory Group (EFRAG), and the GRI. On March 31, 2022, the ISSB published drafts of the standard "IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information" (IFRS Foundation 2022b) and "IFRS S2 Climate-related Disclosures" (IFRS Foundation 2022a). EFRAG has developed the European Sustainability Reporting Standard (ESRS) on behalf of the European Commission, which will be the mandatory reporting standard in the European Union in the future following the adoption of the new Corporate Sustainability Reporting Directive (CSRD) on October 11, 2022.

The GRI, respectively the Global Reporting Initiative Sustainability Reporting Standards (GRI SRS), are therefore still relevant for the field of corporate sustainability reporting, as both EFRAG and the IFRS Foundation cooperate with the GRI in the development of their standards, demonstrating the outstanding importance of the GRI for the development of the field so far (Oprean-Stan *et al.* 2020).

Reducing the group of central standard setters to three is first a step forward, as it is conducive to the unification of their data basis. More importantly, though, is the question of how binding the standards defined by GRI, ESRS, and ISSB are: „In order to have substance, a standard [for sustainability reporting] must be discriminating and prescriptive. In other words, it must be possible to demonstrate whether a standard has been met. A set of principles, or a general framework, is insufficient in this regard. To illustrate the difference, a standard for carbon reporting, if developed, would have much the same 'look and feel' as a financial accounting standard: it would set out which carbon emissions should be recognized [...]; it would also set

how they should be measured, presented and disclosed; and it would require consistent, auditable compliance across all reporting entities.“ (Barker and Eccles 2018).

Furthermore, the question of materiality would have to be answered by the standard setters. From the perspective of strong sustainability, sustainability accounting would also require that the question of materiality be based on ecological and social criteria, i.e., that it answers the question of how exactly and comparably the reporting company affects natural and social capital.

According to our analysis, ESRS as well as GRI are in a direct, potentially supportive relation to a corporate ISA, while the IFRS standards are in a conflicting relation. This result is based on answering two questions in particular: (1) Do the reporting standards introduced by the actor follow the principle of dual (environmental and social) materiality and (2) do they refer to concepts of ecological boundaries, thresholds, or limits such as the planetary boundaries? Looking at ESRS and GRI, a positive answer was given to both questions, while the IFRS standards do neither. We write ‘potentially supportive’ because it is not possible yet to determine how the application of the GRI and the ESRS standards will play out in practice. The ESRS will not enter into force until the first of January 2024, while the new GRI-2021 guidelines not until January 1, 2023. The GRI is uncertain as to how bindingly it will answer the two questions in practice. Furthermore, the new GRI standard is not very explicit on the question of double materiality, but introduces the concept of shifting materiality, which includes the concept of “becoming financially material in the future”. Materiality shifts will occur in all sectors. They are major shifts in the boundaries between financial and non-financial materiality. A public relations scandal involving an industry player, a geopolitical event, a supply chain bottleneck, or a regulatory adjustment may be decisive (WEF 2020). We witnessed this with the Paris Agreement 2015 and the rise of the low-carbon economy.

Challenging about materiality shifts is that they lie beyond the traditional horizon of corporate risk management in the realm of uncertainty, which firms often struggle to deal with. Their associated costs (including opportunity costs) can usually not be quantified sufficiently. Their management, therefore, requires a fundamental strategic adjustment away from short-term optimization and viewing risks purely in terms of profitability to treating all environmental and social impacts and dependencies along the entire supply chain as potentially material: “While most, if not all, of the impacts that have been identified through this process, will eventually become financially material, sustainability reporting is also highly relevant as a public interest activity and is independent of the consideration of financial implications. It is therefore important for the organization to report on all the material topics that it has determined using

the GRI Standards. These material topics cannot be deprioritized based on not being considered financially material by the organization." (GRI 2021b).

The GRI refers to planetary boundaries via the concept of 'sustainability context': "To apply the Sustainability Context Principle, the organization should: draw on objective information and authoritative measures on sustainable development to report information about its impacts (e.g., scientific research or consensus on the limits and demands placed on environmental resources); [...]" (GRI 2021a). We clearly define the target of incorporating concepts like these – knowing that even though the concept of 'sustainability context' has been specified since the second generation of the GRI Standards in 2002, only a negligible proportion of the reporting companies referred to ecological boundaries (Bjørn *et al.* 2017; Landrum and Ohsowski 2017). Accordingly, only the future corporate sustainability reporting practice will display how the new GRI-2021 standards are applied.

Regarding the ESRS, both questions are answered more clearly: „The undertaking shall disclose its plans to ensure that its business model and strategy are compatible with the transition to achieve no net loss by 2030, net gain from 2030, and full recovery by 2050. The principle to be followed under this Disclosure Requirement is to provide an understanding of the transition plan of the undertaking and its compatibility with the preservation and restoration of biodiversity and ecosystems in line with the Post-2020 Global Biodiversity Framework and the EU Biodiversity Strategy for 2030. The undertaking shall disclose its plans for its operations and throughout its upstream and downstream value chain." (EFRAG 2022). The clarity of the ESRS is diminished only by the fact that in the Kunming-Montreal Global Biodiversity Framework (once termed the 'Post-2020 Global Biodiversity Framework') the proposal by WWF, IUCN, and others (IUCN 2020) to formulate quantitative targets of nature-positivity ('no net loss', 'net gain', 'full recovery') were not included in the final version.

The IASB's standards currently have two weaknesses in striving towards the introduction of strong sustainability: they do not refer to planetary boundaries and they are guided solely by the concept of financial materiality (IFRS Foundation 2022a). Since the purpose of sustainability accounting is also to quantify the impact of business activities on their environment (not just their dependencies), we believe this is a strong barrier to the emergence of a corporate ISA.

This is not surprising at first. After all, the IFRS Foundation sets global (financial) accounting standards. It is therefore initially concerned with financially material issues or rather is obligated to financially interested stakeholders (investors, insurers, and creditors of all kinds). Nonetheless, the IASB's proposals have been sharply criticized by accounting professionals for this (see e.g.: Michelon *et al.* (2022), and diverge from the growing consensus that double, and

not solely financial materiality must be the backbone of sustainability management (see e.g.: TNFD 2022).

In the context of defining materiality, actors from the financial sector are the driving forces for change. Here, another difficulty emerges: if drivers for reform are from the financial sector pushing companies to define and display material information, though, they are playing the role of an external supplicant, not being in the position to apply changes fully and transparently. Furthermore, recent risk analysis (WEF Risk Report; ECB Climate Stress Test) suggests actors relying on dynamic materiality, which then would include the consideration of all relevant impacts. Most of the stakeholders as well as the shareholders of a company wish for this process to be as objective as possible. In an online article of EC Newsdesk by Donato Calace (Calace 22.02.2019), he uses the headline "Materiality process: a shift from art to science". Marjella Alma, CEO of Dataran, is cited in the article explaining that "we believe, alongside our clients and other leading companies, that materiality analysis should be evidence-based and backed up by solid objective data, rather than being a representation of someone's opinion. [...] This is a serious exercise that influences corporate strategy, there shouldn't be room for subjectivity." Even though objectivity is trying to be achieved, the topic is quite complex and needs to be considered a relevant element in the context of our target constellation.

Summarized as true cost accounting initiatives, some various methods and frameworks are in line with a corporate ISA or the associated issues from different perspectives. It is not within the scope of this paper to consider all methods and frameworks individually, but the central ones will be briefly mentioned and their relationship to corporate ISA described in more detail. They are not displayed individually in Figure E.9, showing the target constellation for the implementation of a corporate ISA, because they are part of an underlying level, going much more into detail about possible approaches.

SEEA (UN *et al.* 2012) is a statistical standard adopted by the United Nations in 2012 to measure the ecological performance of economies. It builds on the SNA and measures, in a way that is compatible with it, natural assets, their material flows, and the monetary flows, such as protection expenditures, that are associated with them. In addition to SEEA, there is the SEEA Ecosystem Accounting (EA) (UN *et al.* 2021), which extends the methodology to quantify ecosystem extends, conditions, and services, and provides a methodology to monetize their economic values and credit them to their beneficiaries.

A future corporate ISA would likely need to build on the SEEA and SEEA EA methodologies to be truly viable, as these are the internationally accepted methodologies, and, for example, existing national accounts are based on them. Key international research projects dealing

with natural capital and ecosystem accounting also build on SEEA, including the two World Bank projects "Global Program for Sustainability" and "Wealth Accounting and the Valuation of Ecosystem Services".

What SEEA and SEEA EA do not do, at least so far, is exactly the purpose of the corporate ISA: The crediting of ecosystem stocks and flows, respectively the associated value creation potentials to individual economic actors, their business activities, and goods via a corporate balance sheet. For this purpose, the UN has launched the "Natural Capital Accounting and Valuation of Ecosystem Services Project" (NCAVES), which explores the link between SEEA EA and corporate accounting and tries to establish compatibility here. The NCAVES project is a particularly important synergistic technical element since it combines forces of the actors in the field of corporate natural capital accounting, which is compatible with SEEA and SEEA EA.

The UN's main collaborative partner is the Capitals Coalition, which issues the most relevant frameworks for natural and multi-capital accounting at the corporate level, the Natural Capital Protocol (Natural Capital Coalition 2016) and the Social & Human Capital Protocol (Social and Human Capital Coalition 2019), respectively (see: Project Transparent 2021). These two frameworks, on the national economic level the UN SEEA and SEEA EA, and the NCAVES project, are the three most relevant methodological approaches (technical elements) in the field of corporate ISA.

Another approach that must be mentioned here comes from the field of Life Cycle Analysis and is called Absolute Environmental Sustainability Assessment (AESA): "An absolute environmental sustainability assessment addresses whether a production or consumption activity can be considered environmentally sustainable in an absolute sense. This involves a comparison of its environmental pressure to its allocated environmental carrying capacity." (Bjørn *et al.* 2018; for an overview of existing AESA methodologies see: Bjørn *et al.* 2020). AESA pursues the same goal as natural capital or ecosystem accounting – quantifying the effects of entrepreneurial activities on different ecological systems – but attempts to operationalize this not through the concept of natural capital and ecosystem services, but through the principles of environmental carrying capacities and environmental pressures. The latter calculates the 'pressure' that the production of an economic good generates on the natural environment. The carrying capacities are measured against the planetary boundaries. All in all, AESA indicates the extent to which the planetary boundaries are pushed to the limit by the entrepreneurial activities required to produce a certain economic good (for AESA methodology that considers all planetary boundaries see: Butz *et al.* 2018). The methodology is relevant for a corporate ISA because it takes the same methodical starting point, the micro-level of entrepreneurial activity. The fact

that it does not work with the concept of natural capital is not problematic per se. Both concepts, that of natural capital and that of environmental carrying capacities could be harmonized in a future corporate ISA, respectively be unified in a common methodology.

Currently, the European Commission is supporting the Capitals Coalition and the Value Balancing Alliance in developing, testing, and promoting the first 'E-GAAP'[8], which can be aligned with the SEEA. In addition, the Capitals Coalition's "Combining Forces" initiative was developed to serve as an overarching platform for dialogue bringing together the public and private sectors.

Accounting professionals have not yet played a major role in the discussion about integrating sustainability into business practices and are not displayed in our target constellation. Nevertheless, we want to point out their good fit "by constructing the reality of what is recognized, measured and accounted for" (Miles 2019) and "their technical expertise, key reporting competencies, and ability to analyze and translate data into accessible measurements" (Williams 2015, p. 281). On the other hand, Wenzig *et al.* (2022) describe accountants to be motivated mainly by "financial priorities and incremental improvements driven by top management" (p. 1) and therefore "focus on rules and priorities concerning financial outcomes, while sustainability issues are only included to the extent they are perceived to be explicitly related to immediate financial outcomes." (p. 12). Therefore, with the understanding that they would have the competences to implement any accounting reform, changes in their current role are needed to define accounting professionals as a supporting factor for the emergence of a corporate ISA.

7. Results

The target constellation described, is, of course, nothing that must and will occur shortly. It mainly helps to describe what an ideal situation would look like and what changes are needed for its approximation. Parallel to the description of nascent standards, approaches, and regulations, explanations for the target constellation's characteristics are given in detail in the chapters above.

We identify a clear lack in the current scope of natural capital accounting and comparable systems: the connection between the capacity of natural capital in general and economic consideration of the meso- and micro levels, i.e., a need for linking the overall consumption capacity of natural capital with individual companies and their activities. Relevant questions in

[8] 'Environment - Generally Accepted Accounting Principles' (E-GAAP) is a term that has emerged in the natural capital accounting community when calling for standardized principles and guidelines similar to those underpinning financial accounting and reporting.

this context concern the flow of natural capital into the production of products and services, as well as the consumption of natural capital by individual organizations. Therefore, the empirical basis for an extended value measurement of companies along their ecological production bases, for true cost accounting of products and services, and strategic management is to be developed. Therefore, Zyznarska-Dworczak (2020) concludes that "despite many utilitarian premises, little is known about the successful adoption of sustainability accounting, and using accounting to identify, measure and disclose information about sustainability development goal achievements." This indicates the need for an effective accounting system, which integrates "the variety in information about sustainability with the differentiated unitary information effects between the dimensions of sustainable development, at various corporate management levels and for various management functions, like strategy development and operations".

It is precisely this linking of the use of natural capital and ecosystem services to the level of the individual company that a corporate ISA is meant to do. It does this by breaking down the macroeconomic usage of natural capital to the different activities of a company, applying the cost of restoration to it, and accordingly integrating them into the company's balance sheets.

Hereinafter, based on the academic discussion so far and the integration of knowledge of experts in the field, we would like to add a few aspects describing what else is needed for the implementation of a corporate ISA.

Especially the interdisciplinary approach of linking management practices with requirements defined by natural sciences and demands for aligning economic behavior with intergenerational needs. The Brundtland Commission defined sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland *et al.* 1987). As Guenther *et al.* (2016) put it: "[...] taking the topic of sustainability seriously, the long-term impacts of corporate activities, potential conflicts between present and intergenerational aspects [...] must be taken into account." (p. 166).

We further ask for an accounting system that does recognize the economic concept of an externality, which means the costs and benefits incurred by an unrelated third. Several publications provide various solutions that have still not been applied in practice, like true cost accounting, full cost accounting, input–output analysis, natural capital inventory accounting, triple-bottom line accounting, and others. Here, we request, together with Zyznarska-Dworczak (2020) the implementation of uniform principles and rules in an integrated approach.

Until now, sustainability accounting seems to be somewhat practical if information flows can be described by common monetary measures. Exemplarily, accounting for carbon requires sustainability accounting tools that will need to include accounting for short-term

financial implications resulting from purchased carbon allowances, recognition of subsequent assets, matching of actual emissions with allowances and liabilities, effects of tax and reporting significant amounts of this information externally (Bebbington and Larrinaga-González 2008). This is not the case, though, for many other natural capitals. Having solely the three classical types of direct measures (qualitative, quantitative, physical) available (Burritt *et al.* 2002), seems insufficient for taking sustainability aspects into account for decision-making. By this we mean, that whenever something cannot be measured directly quantitatively, like the value of a green field that is about to give place for the building of a parking space, considering the basis of decision-making measured qualitatively, calling it an intangible, non-financial part of the accounting system, is insufficient. Felber *et al.* (2019) still focused on measures to capture the non-financials of social and environmental value creation. Differently, an ISA has to offer answers on how to measure and integrate information that cannot be described by common measures because it is impossible to define the complex value of natural capital. We, therefore, suggest attaching the costs of consumption to the restoration costs of natural capital.

8. Discussion and conclusion

It has long become clear that sustainable development or, as Adams and Larrinaga (2019) formulate it, "the lack of it [sustainable development], is rapidly becoming a significant business problem [...] which requires radical, rather than marginal transformations in the accounting and accountability model" (p. 2368) of today's business practices. This is an increasingly urgent topic even though the fact that sustainable development is needed for a future worth living has settled in most people's minds (Dahm 2022).

With the research at hand, we walk the talk of Llewelyn's (2003) level three theorizing to the glimmering level four theorizing. While not making a halt at the introduction of new ways of thinking and acting (considered as level three theorizing), we offer solutions to problems considering the complexity and interdependency of sustainability problems. For this, the multi-disciplinary co-author team, comprising a sociologist, a business economist, as well as a geologist, together with experts in the respective fields, were able to define the target constellation needed for the effective implementation of a corporate ISA.

From several *principles* relevant to the implementation of an ISA, we want to highlight the need for the integration of scientific knowledge about the natural capacity used in a specific business context and the costs for its regeneration. As a *characteristic,* we consider the well-balanced description of business practices in terms of real impact.

Modeling constellations does not reflect reality, but rather the understanding of the participating perspectives on that reality. The constellation approach thus promotes an inter- and transdisciplinary understanding of a topic which is oftentimes discussed in a quite technical way, far away from interdisciplinary discourses.

Our research enriches the management accounting and control literature by presenting an interdisciplinary identified target constellation as well as the draft of a corporate ISA. Both may be used as a basis for further discussion. What we are adding to the discourse is the linking of the overall consumption capacity of natural capital with individual companies and their activities. Similarly, it is the breaking down of the use of natural capital and ecosystem services to the level of the individual company. In principle, our work underlines that the economic concept of an externality, which means the costs and benefits incurred by an unrelated third, must be translated in restoration costs of natural capital. By doing so, business activities would align economic behavior with intergenerational needs.

Our research is also subject to certain limitations, which may for others provide the basis for further investigations. Here, future research projects could dive deep into the different roles of each element of influence. They could also define in more detail how the new relationships may be strengthened. While the research at hand describes a target constellation, the principles, and the objectives of a corporate ISA, the following research path could lie in designing new accounting standards and testing these in concrete business contexts. It is in our interest to learn, for example, what keeps current decision-makers from not implementing accounting practices based on the principles stated above.

Apart from the relevance of an ISA for the business environment, we would like to highlight its value from a macroeconomic point of view. To better understand sources of value creation in their ecological interconnectedness and dependence, a widely incorporated ISA can support decision-making in businesses, and on the macro-level, feed economic simulations to improve policy advice, etc.

Summing up our findings, we provide important insights about the relevance of a corporate ISA to support a strong and pluralistic economy, in which the diversity of capitals, instead of counteracting each other, can mutually grow and dynamically stabilize themselves (Dahm and Koch 2021). The research herein is a helpful source for facing one of the grand challenges of our time: truly sustainable development.

Through the strategic use of integrated rating and accounting methods, embedded in a political regulatory framework with appropriate legal steering instruments, and a reform of social and cultural norms and role models, the invention and use of ecological, social, and

technical solution innovations, and with the active involvement of the community of all stakeholder groups, a systematic pumping of financial capital into natural, social and infrastructural capital can be achieved. An end to global overshoot and a gradual, long-term compensation of the degradations of the last decades and centuries could succeed through a constructively competitive interplay of market actors in favor of the biosphere and resource availability on the planet.

References

Accountancy Europe, (2020). *Interconnected Standard Setting for Corporate Reporting*, Brussles.

Adams, CA, A Alhamood, X He, J Tian, Le Wang and Y Wang, (2021). *The double-materiality concept. Applications and issues: GRI White Paper*.

Adams, CA and C Larrinaga, (2019). Progress: engaging with organisations in pursuit of improved sustainability accounting and performance. *Accounting, Auditing & Accountability Journal*, 32(8), 2367–2394.

Adams, M, (2017). Emerging integrated reporting practices in the United States. In: J Guthrie, J Dumay, F Ricceri and C Nielsen, eds. *The Routledge Companion to Intellectual Capital.* Routledge, Abingdon, 365–379.

Barker, R and RG Eccles, (2018). *Should FASB and IASB be responsible for setting standards for nonfinancial Information?*, Oxford, UK.

Bebbington, J and R Gray, (1993). Corporate accountability and the physical environment: Social responsibility and accounting beyond profit. *Business Strategy and the Environment*, 2(2), 1–11.

Bebbington, J and C Larrinaga, (2014). Accounting and sustainable development: An exploration. *Accounting, Organizations and Society*, 39(6), 395–413.

Bebbington, J and C Larrinaga-González, (2008). Carbon Trading: Accounting and Reporting Issues. *European Accounting Review*, 17(4), 697–717.

Bjørn, A, N Bey, S Georg, I Røpke and MZ Hauschild, (2017). Is Earth recognized as a finite system in corporate responsibility reporting? *Journal of Cleaner Production*, 163, 106–117.

Bjørn, A, C Chandrakumar, A-M Boulay, G Doka and K Fang, (2020). Review of life-cycle based methods for absolute environmental sustainability assessment and their applications. *Environmental Research Letters*, 15(8).

Bjørn, A, K Richardson and MZ Hausschild, (2018). A Framework for Development and Communication of Absolute Environmental Sustainability Assessment Methods. *Journal of Industrial Ecology*, 23(4), 838-854.

Bluehdorn, I, (2020). The legitimation crisis of democracy: emancipatory politics, the environmental state and the glass ceiling to socio-ecological transformation. *Environmental Politics*, 29(1), 38–57.

Brundtland, G, M Khalid, S Agnelli, S Al-Athel, B Chidzero, L Fadika and M Singh, (1987). *Our Common Future: Brundtland report*, New York, USA.

Burritt, RL and S Schaltegger, (2010). Sustainability accounting and reporting: fad or trend? *Accounting, Auditing & Accountability Journal*, 23(7), 829–846.

Burritt, RL, T Hahn and S Schaltegger, (2002). Towards a Comprehensive Framework for Environmental Management Accounting - Links Between Business Actors and Environmental Management Accounting Tools. *Australian Accounting Review*, 12(28), 39–50.

Butz, C, J Liechti, J Bodin and SE Cornell, (2018). Towards defining an environmental investment universe within planetary boundaries. *Sustainability science*, 13(4), 1031–1044.

Calace, D, (22.02.2019). Materiality process: a shift from art to science, https://www.reutersevents.com/sustainability/materiality-process-shift-art-science, accessed January 10, 2023.

Chen, JC and RW Roberts, (2010). Toward a More Coherent Understanding of the Organization–Society Relationship: A Theoretical Consideration for Social and Environmental Accounting Research. *Journal of Business Ethics*, 97(4), 651–665.

Cooper, C and AB Coulson, (2014). Accounting activism and Bourdieu's 'collective intellectual' – Reflections on the ICL Case. *Critical Perspectives on Accounting*, 25(3), 237–254.

Dahm, JD, (2013). *Zum Bedarf der Internalisierung externer Kosten.* Lecture at: Conference „Nachhaltigkeit –Verantwortung für eine begrenzte Welt", 22. – 24.11.2013, Georg-August-Universitaet Goettingen.

Dahm, JD (2015): Corporate Sustainable Restructuring (CSR). Die planetaren Commons konstituieren Zukunftsfähigkeit. In: Depping, A and D Walden, eds. *CSR und Recht. Juristische Aspekte nachhaltiger Unternehmensfuehrung erkennen und verstehen*. Springer, Berlin.

Dahm, JD, (2019). *Benchmark Nachhaltigkeit. Sustainability Zeroline: Das Maß für eine zukunftsfaehige Oekonomie*. transcript Verlag, Bielefeld.

Dahm, JD, (2020). The Sustainability Zeroline - a severe standard for a truly sustainable, a Regenerative Economy. In: T Goydke and G Koch, eds. *Economy for the Common Good. A Common Standard for a Pluralistic World? Studies in International Management, Politics and Economies.* tredition GmbH, Hamburg, 31–38.

Dahm, JD, (2022). Regenerative economy: The embedding of circularity. In: H Lehmann, C Hinske, V Margerie de and AS Nikolova, eds. *The Impossibilities of the Circular Economy. Separating Aspirations from Reality* (first edition). Routledge, London, 233–244.

Dahm, JD and G Koch, (2021). Precursors of an economics for the Anthropocene. In: FJ Carrillo and G Koch, eds. *Knowledge for the Anthropocene. A Multidisciplinary Approach.* Edward Elgar Publishing, 132–144.

Diefenbacher, H and R Douthwaite (1998): Jenseits der Globalisierung. Handbuch fuer lokales Wirtschaften. Mainz.

Doering, R, (2004). *Wie stark ist schwache, wie schwach starke Nachhaltigkeit?*, Greifswald.

Doering, R and K Ott, (2001). Nachhaltigkeitskonzepte. *Zeitschrift für Wirtschafts- und Unternehmensethik*, 2(3), 315–342.

EFRAG, (2022). *Exposure Draft: ESRS E4. Brüssel: EFRAG.*, Brussles.

European Commission, (2019). *Guidelines on non-financial reporting: Supplement on reporting climate-related information*.

Felber, C, V Campos and JR Sanchis, (2019). The Common Good Balance Sheet, an Adequate Tool to Capture Non-Financials? *Sustainability*, 11(14), 3791.

Giarini, O, Liedtke, P. M. (1998): Wie wir arbeiten werden. Der neue Bericht an den Club of Rome. Heyne Verlag, München.

Gray, R, CA Adams and D Owen, (2014). *Accountability, social responsibility and sustainability*. Pearson Education Limited.

Gray, R and MJ Milne, (2002). *Sustainability Reporting. Whos Kidding Whom?*

Gray, R, J Bebbington and D Walters, (1993). *Acccounting for the Environment*. Markus Wiener Publishing, London.

Gray, R, (1992). Accounting and Environmentalism: An exploration of the challenge of gently accounting for accountability, transparency and sustainability. *Accounting, Organizations and Society*, 17(5), 399–425.

Gregor, S, (2006). The Nature of Theory in Information Systems. *MIS Quarterly,* 30(3), 611–642.

GRI, (2021a). *GRI 1: Foundation 2021*, Amsterdam.

GRI, (2021b). *GRI 3: Material Topics 2021*, Amsterdam.

Guenther, E, J Endrikat and TW Guenther, (2016). Environmental management control systems: a conceptualization and a review of the empirical evidence. *Journal of Cleaner Production*, 136, 147–171.

Helm, D, ed., (2015). *Natural Capital. Valuing the Planet*. Yale University Press, Yale.

Hevner, A, S March, J Park and S Ram (2004). Design Science in Information Systems Research. *MIS Quarterly,* 28(1), 75–105.

Hopwood, A, J Unerman and J Fries, eds., (2010). *Accounting for Sustainability. Practical Insights*. Earthscan, London.

IFRS Foundation, (2022b). IFRS S1 General Requirements for Disclosure of Sustainability-related Financial Information: Exposure Draft.

IFRS Foundation, (2022a). IFRS S2 Climate-related Disclosures: Exposure Draft.

IUCN, (2020). IUCN views on the Zero draft Post-2020 Global Diversity Framework.

Justesen, L, J Mouritsen, CR Baker and E Chiapello, (2011). Effects of actor-network theory in accounting research. *Accounting, Auditing & Accountability Journal*, 24(2), 161–193.

Kuechler, W and V Vaishnavi, (2008). On Theory Development in Design Science Research: Anatomy of a Research Project. *European Journal of Information Systems*, 17, 489–504

Landrum, NE and B Ohsowski, (2017). Identifying Worldviews on Corporate Sustainability: A Content Analysis of Corporate Sustainability Reports. *Business Strategy and the Environment*, 27(5).

Latour, B, (1996). On actor-network theory: A few clarifications. *Soziale Welt*, 47(4), 369–381.

Lehman, G, (1999). Disclosing new worlds: a role for social and environmental accounting and auditing. *Accounting, Organizations and Society*, 24(3), 217–241.

Llewelyn, S, (2003). What counts as "theory" in qualitative management and accounting research? Introducing five levels of theorizing. *Accounting, Auditing & Accountability Journal*, 16(4), 662–708.

Malsch, B, Y Gendron and F Grazzini, (2011). Investigating interdisciplinary translations. *Accounting, Auditing & Accountability Journal*, 24(2), 194–228.

Mathews, MR, (2001). Rejoinder: Some thoughts on social and environmental accounting education. *Accounting Education*, 10(4), 379–382.

Mathews, MR, (1997). Twenty-five years of social and environmental accounting research. *Accounting, Auditing & Accountability Journal*, 10(4), 481–531.

Maunders, KT and RL Burritt, (1991). *Accounting and Ecological Crisis*. Emerald Group Publishing Limited.

Michelon, G, S Cooper, Z Guo, B Giner and B O'Dwyer, (2022). Subject: Open letter about the Materiality Debate.

Miles, S, (2019). Stakeholder Theory and Accounting. In: JS Harrison, JB Barney, RE Freeman and RA Phillips, eds. *The Cambridge Handbook of Stakeholder Theory.* Cambridge University Press, 173–188.

Natural Capital Coalition, (2016). *Natural Capital Protocol*.

Neu, D, DJ Cooper and J Everett, (2001). Critical Accounting Interventions. *Critical Perspectives on Accounting*, 12(6), 735–762.

Ohlhorst, D and S Schoen, (2015). Constellation Analysis as a Means of Interdisciplinary Innovation Research – Theory Formation from the Bottom Up. *Historical Social Research*, 40(3), 259–278.

Oprean-Stan, C, I Onicioiu, IC Iuga and S Stan, (2020). Impact of Sustainability Re- porting and Inadequate Management of ESG Factors on Corporate Performance and Sustainable Growth. Sustainability, 12(20), 8536. *Sustainability*, 12(20), 8536.

Project Transparent, (2021). *Corporate Natural Capital Accounting – From building blocks to a path for standardization. Understanding the landscape, leading applications, challenges and opportunities*.

Rammert, W, (2010). Die Innovationen der Gesellschaft. In: J Howald and H Jacobsen, eds. *Soziale Innovation.* VS Verlag für Sozialwissenschaften, Wiesbaden, 21–51.

Raworth, K, (2012). *A Safe and Just Space for Humanity: Can we live within the doughnut?: Discussion Paper*. Oxfam, Oxford, UK.

Rockstroem, Johan, Steffen, Will: Noone, Kevin and Å Persson, (2009). Planetary Boundaries: Exploring the Safe Operating Space for Humanity. *Ecology and Society*, 14(2).

Russell, S, MJ Milne and C Dey, (2017). Accounts of Nature and the Nature of Accounts: Critical reflections on environmental accounting and propositions for ecologically informed accounting. *Accounting, Auditing & Accountability Journal*, 30(7), 1426–1458.

Samuelson, P, Nordhaus, W, (2010). Volkswirtschaftslehre. mi-Wirtschaftsbuch, Wien.

Sassen, S, (2000): Machtbeben. Wohin führt die Globalisierung? Deutsche Verlagsanstalt, Stuttgart.

Schaltegger, S and RL Burritt, (2000). *Contemporary Environmental Accounting: Issues, Concepts and Practice*. Greenleaf, Sheffield.

Schoen, S, S Kruse, M Meister, B Noelting and D Ohlhorst, (2007). *Handbuch Konstellationsanalyse: ein interdisziplinäres Brückenkonzept für die Nachhaltigkeits-, Technik- und Innovationsforschung*. oekom Verlag, München.

Schoen, S, B Noelting and M Meister, (2004). *Konstellationsanalyse. Ein interdisziplinäres Brückenkonzept für die Technik-, Nachhaltigkeits- und Innovationsforschung: Discussion paper Nr. 12/04*.

Simon, H, (1996). *The Sciences of the Artificial* (3rd ed), MIT Press, Cambridge, MA.

Social and Human Capital Coalition, (2019). *Social & Human Capital Protocol*, Den Haag.

Soll, J, (2014). *The Reckoning: Financial Accountability and the Rise and Fall of Nations*. Basic Books, New York, NY.

Solow, RM, (1974). Intergenerational Equity and Exhaustible Resources. *The Review of Economic Studies*, 41, 29–45.

Spence, C, J Husillos and C Correa-Ruiz, (2010). Cargo cult science and the death of politics: A critical review of social and environmental accounting research. *Critical Perspectives on Accounting*, 21(1), 76–89.

Steffen, W, K Richardson, J Rockstroem, SE Cornell, I Fether, EM Bennet, R Biggs and …, (2015). Planetary boundaries: Guiding human development on a changing planet. *Science*, 347(6223), 736–786.

Stiglitz, J, (1974). Growth with Exhaustible Natural Resources: Efficient and Optimal Growth Paths. *The Review of Economic Studies*, (41), 123–137.

Taïbi, S, N Antheaume and D Gibassier, (2020). Accounting for strong sustainability: an intervention-research based approach. *Sustainability Accounting, Management and Policy Journal*, 11(7), 1213–1243.

TNFD, (2022). *The TNFD Nature-related Risk & Opportunity Management and Disclosure Framework. Beta v0.1 Release. Executive Summary*, Basel.

UN *et al.*, (2012). *System of Environmental-Economic Accounting – Central Framework*.

UN *et al.*, (2021). *System of Environmental-Economic Accounting - Ecosystem Accounting*.

UNEP Finance Initiative, (2012). *The Natural Capital Declaration: A commitment by financial institutions to mainstream natural capital in financial products and in accounting, disclosure and reporting frameworks*.

Unerman, J, J Bebbington and B O'dwyer, (2018). Corporate reporting and accounting for externalities. *Accounting and Business Research*, 48(5), 497–522.

Unerman, J and C Chapman, (2014). Academic contributions to enhancing accounting for sustainable development. *Accounting, Organizations and Society*, 39(6), 385–394.

Vysna, V, J Maes, J-E Petersen, A La Notte, S Vallecillo, N Aizpurua, E Ivits-Wasser and A Teller, (2021). *Accounting for ecosystems and their services in the European Union (INCA): Final report from phase II of the INCA project aiming to develop a pilot for an integrated system of ecosystem accounts for the EU* twentiethtwenty-first edition. Publications Office of the European Union, Luxembourg.

WEF (World Economic Forum), (2020). *Embracing the New Age of Materiality. White Paper*, Cologny/Geneva, Switzerland.

Wenzig, J, A-K Nuzum and S Schaltegger, (2022). Path dependence of accountants: Why are they not involved in corporate sustainability? *Business Strategy and the Environment*, 1-22.

Williams, B, (2015). The local government accountants' perspective on sustainability. *Sustainability Accounting, Management and Policy Journal*, 6(2), 267–287.

Wood, R, K Stadler, T Bulavskaya, S Lutter, S Giljum, A de Koning, J Kuenen, H Schütz, J Acosta-Fernández, A Usubiaga, M Simas, O Ivanova, J Weinzettel, J Schmidt, S Merciai and A Tukker, (2015). Global Sustainability Accounting—Developing EXIOBASE for Multi-Regional Footprint Analysis. *Sustainability*, 7(1), 138–163.

Zyznarska-Dworczak, B, (2020). Sustainability Accounting—Cognitive and Conceptual Approach. *Sustainability*, 12(23), 1–24.

Appendix

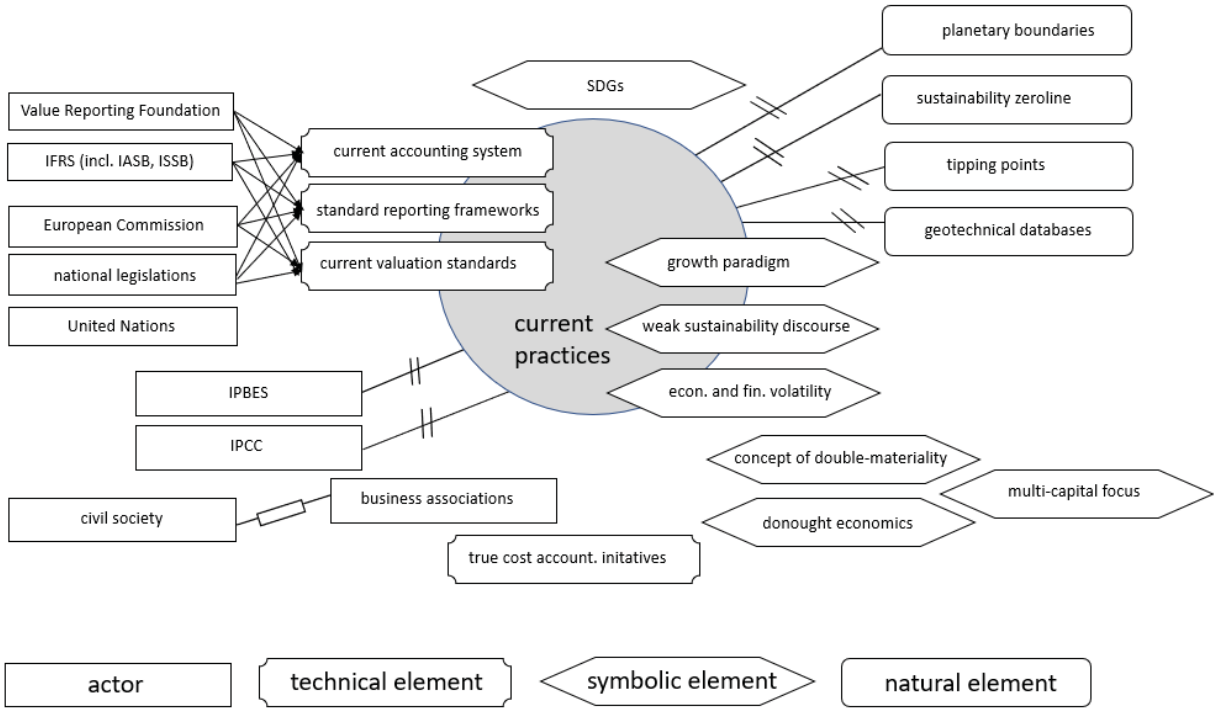

Figure E.8: Status quo constellation: current accounting practices

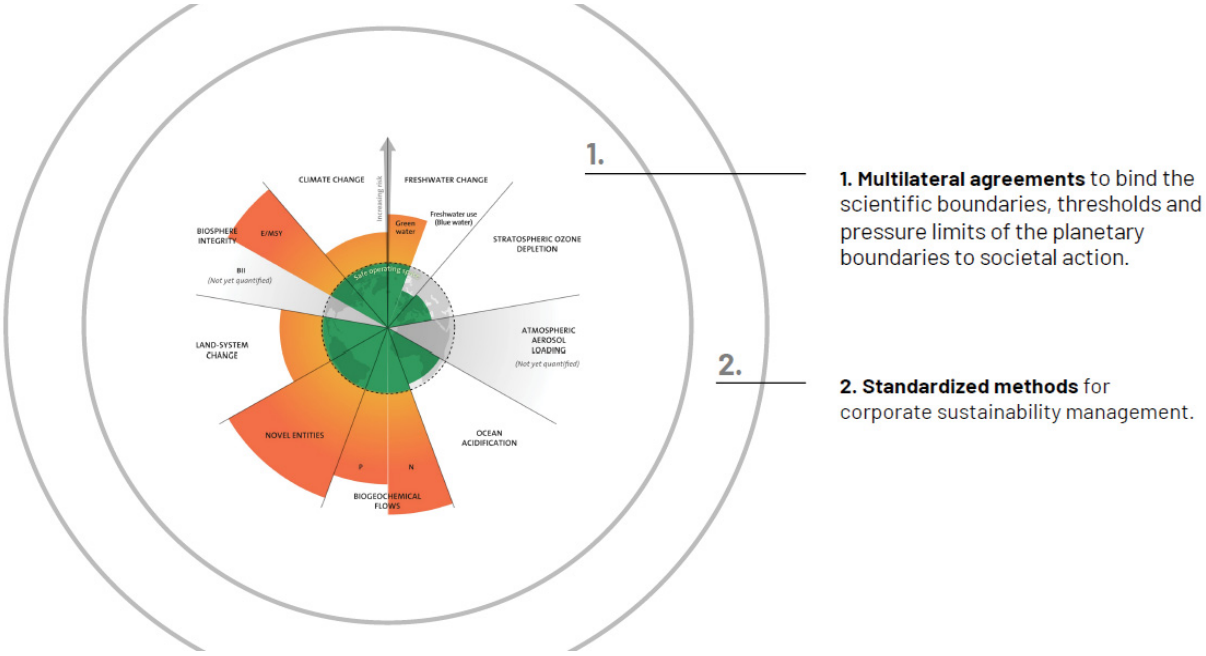

Figure E.9: Illustration of the planetary boundaries as a basis for multilateral agreements and standardized methods (general)
Source of the visual of the boundaries: PIK 2022, based on Wang-Erlandsson et al. 2022, Persson et al. 2022, Steffen et al. 2015

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Nicht zuletzt möchte ich meiner Dissertation selbst danken. Sie hat mir – so flexibel sie war – erlaubt, nicht nur wissenschaftlich zu wachsen: Ich konnte stillen, umziehen und ein Haus kaufen, die Covid-Pandemie überstehen, die Klimawette initiieren, bei United Sustainability einen Nachhaltigkeitsfonds mitgestalten und meinen Vater in den Tod begleiten. Fünf Jahre sind eine lange Zeit, und jeden Tag hat sie mich zu Höchstleistungen aufgefordert in Sachen Prioritäten setzen und Balance halten.

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G. Affidavit

Ich erkläre hiermit, dass ich die vorgelegten und nachfolgend aufgelisteten Aufsätze selbstständig und nur mit den Hilfen angefertigt habe, die im jeweiligen Aufsatz angegeben sind. Bei den von mir durchgeführten und in den Aufsätzen erwähnten Untersuchungen habe ich die Grundsätze guter wissenschaftlicher Praxis, wie sie in der Satzung der Heinrich-Heine-Universität Düsseldorf zur Sicherung guter wissenschaftlicher Praxis niedergelegt sind, eingehalten.

Düsseldorf, 16. April 2024

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Anna Katharina Meyer

Titles of the four studies constituting the dissertation:

Study 1: How to Make the Honeymoon Last: Effectiveness of different types of Management Controls for Innovation Success in Corporate Startup Collaborations

Study 2: Good Intentions Do Not Change the World: The Role of Sustainability Management Control for Startup Collaborations in the Relationship between Strategy and Innovation

Study 3: Re-Examining Control Systems and Pathways for Transformational Management by Integrating Sustainability into Corporate Investment Decisions

Study 4: Striving towards an Integrated Sustainability Accounting: A Constellation Analysis Based on Interdisciplinary Knowledge Sharing