Understanding the heterogeneity of corporate entrepreneurship programs

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To my family, my partner, and the friends who supported me throughout my academic career

Preface

The last three decades have been marked by profound changes brought about by the global spread of the internet, the advent of the smartphone, and many other technological developments. These new technologies have fundamentally changed the way we live our lives. As a digital native, I have witnessed these changes from a young age and have always been fascinated by the new opportunities that technology has brought. During my studies, I was interested early on by lectures on innovation and entrepreneurship. The book "The Innovators Dilemma" by Clayton M. Christensen inspired me to better understand why in particular established companies struggle to develop these more radical types of innovation and what new approaches are needed to succeed in a digitalized and globalized world.

Guided by my interest and curiosity, I decided to start a doctoral thesis on entrepreneurship in established companies – primarily known as Corporate Entrepreneurship – as an external Ph.D. candidate at the Leiden Institute of Advanced Computer Science (LIACS) of the University Leiden, later continued at the Leiden Centre of Data Science (LCDS) that was hosted by LIACS. Together with the Institute for Strategic Innovation and Technology Management (IST Institute) at the University of Applied Sciences Konstanz, I was able to explore and experience entrepreneurship in multiple facets.

Early in my research, I learned that the dynamics in the industry, as reflected in the emergence of a variety of new programs and organizations to promote entrepreneurship and innovation, was not reflected in the same breadth in the research on corporate entrepreneurship (CE). The discrepancy between research and practical reality motivated me to understand it in more detail in my thesis. For this purpose, I have conducted more than 130 interviews over the past six years whereof a total of 67 interviews from 54 established companies are the basis for this thesis. The results contribute to a better understanding of the heterogeneity of CE programs regarding their organizational designs and their value creation.

During this exciting time, I had the opportunity to work with many inspiring researchers and practitioners in the field of innovation and Corporate Entrepreneurship and I am thankful for all the support I have experienced on my journey.

Christoph J. Selig, Konstanz, September 22, 2021

Content

List of Abbreviations

The list below shows the abbreviations used in this thesis. Standard lexical abbreviations, such as “e.g.” or “i.e.”, are not listed.

CE	=	Corporate Entrepreneurship
CEO	=	Chief Executive Officer
CDO	=	Chief Digital Officer
CTO	=	Chief Technology Officer
CV	=	Corporate Venturing
DACH	=	Deutschland, Austria, Confoederatio Helvetica
HR	=	Human Resources
IT	=	Information Technology
KPI	=	Key Performance Indicator
NAICS	=	North American Industry Classification System
PS	=	Problem Statement
R&D	=	Research & Development
RQ	=	Research Question
VC	=	Venture Capital

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List of Definitions

1 Entrepreneurial activities in established companies

Established companies are facing many challenges in today's volatile world. Profound developments such as digitalization, globalization, and the shift towards more sustainability are drivers of the dynamic and radical changes that characterize the start of the 21st century. For instance, industries such as automotive or telecommunications industries experience or have experienced fundamental changes. The changes are often caused by innovations that are introduced by new market entrants, e.g., Skype and WhatsApp in the telecommunication industry and Tesla with its electric cars.

It seems that the more radical type of innovation, which shows a broad range of manifestations, e.g., business model innovation (see Foss & Saebi, 2017) and disruptive technological innovation (Christensen et al., 2018; Markides, 2006), pose a fundamental challenge for nearly all established companies. At the same time, startups and other new market entrants (often big tech companies, which can be seen as *digital natives*[1]) benefit from disruptive innovation. Even stronger, they drive the fast and radical changes by many times being the first to introduce the innovations. They form the new disrupting market parameters (e.g., Tesla with its electric and software-centered cars) and create new markets (e.g., Apple with its iPad).

Thus, it is not surprising that the subject of *entrepreneurship* is experiencing increasing interest from various actors, such as politicians, investors, and established companies. While politicians see startups as one key element in creating a digital economy, investors are attracted by the rising number of unicorns[2], i.e., the startups valued more than one billion Euro, without being public yet.

For established companies, three prevailing questions are (1) how to collaborate with startups? (2) How to invest in startups? And (3) how to integrate startup-like structures into their own organization?

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[1] The basic concept behind digital natives comes from social science and describes the generation that has been raised with digital technologies. Transferring this concept to the world of companies, digital natives can be understood as companies, which are "raised" with a digital technology in the core of their organization, e.g., Google with its search engine or Amazon with the online shop and cloud services.

[2] The number of tech-intensive startups that can be classified as unicorns has nearly quadrupled within six years from 30 in 2014 to 112 in 2020 (Casartelli et al., 2020).

As a result, the topic of entrepreneurship within established companies is experiencing an increase of interest from researchers and practitioners (Hill & Georgoulas, 2016). The development can be seen as one *managerial tool* that addresses the challenges that come along with the ongoing digital transformation. The radical changes are taking place in nearly all industries.

Comparing the European industry landscape to the U.S., one key difference can be observed when it comes to digital innovation. It is the digital dominance of American companies. European companies are among the world's leading companies in traditional businesses such as automotive, mechanical engineering, and oil/gas industry. In contrast, many digital businesses in the western world are dominated by U.S. companies such as Google, Apple, Microsoft, Amazon, or Facebook (see Barwise & Watkins, 2018). Moreover, most of these companies have in common that they are still comparably young and have scaled in a short period of time from a small startup to a global player.

Established companies face the challenge that they must excel in their current core business while simultaneously creating new, often digital competencies and businesses in order to ensure their competitiveness in a digitalized future. However, there are several reasons why established companies often emphasize focusing on their core business (see Benner & Tushman, 2003; March, 1991). Two examples are: (1) the perception of the higher urgency of day-to-day business and (2) the high level of uncertainty when investing in more radical innovation projects. This leads to the circumstance that they typically excel in creating *process innovation* and *incremental product innovation*, which are strongly related to their current core business. However, established companies struggle with the development of more radical types of innovation that are fully new to the company. Hence, they come along with a higher level of uncertainty and risk (see, e.g., McDermott & O'Connor, 2002; Chandy & Tellis, 2000).

My study is investigating how established companies can effectively use formalized entrepreneurial activities (a) to support their organizational transformation and (b) to maintain their competitiveness in a highly volatile and digitalized market environment (see Teece, 2016; Kuratko et al., 2015). In summary, they both (a) and (b) deal with entrepreneurial activities within an established company. The structure of this chapter is as follows.

Section 1.1 discusses our motivation for the implementation of *entrepreneurial activities*, followed by the relevance of discontinuous innovations in Section 1.2. Then we formulate our problem statement in Section 1.3 and our research questions in Section 1.4. Subsequently, we describe the intended objectives and research methodology in Section 1.5. Finally, we complete the chapter by giving the structure of the thesis in Section 1.6, the managerial relevance in Section 1.7, and the scientific relevance in Section 1.8.

1.1 Motivation for conducting this research

In my research, I am motivated by the continuous changes and progress in our world today. The digital transformation is, in my opinion, more than "just" the 4th industrial revolution. It is a fundamental renewal of our society, which affects every aspect of the private and professional life (see, e.g., Livari et al., 2020; Vial, 2019; Pappas et al., 2018)

Since the second half of the last century, Europe and Germany, as my home country, have experienced continuous growth of prosperity, education, and largely stable political systems. Much of this progress is rooted in its strong industrial landscape, innovative power[3], and economic strength. However, the last two decades (2000 – 2020), which have been marked by ongoing digitization, seem to be running counter to this development (see, e.g., Ambrosia et al., 2020)

As described at the beginning of this chapter, the majority of the companies are leading the digital transformation, e.g., by creating (a) dominant platforms and (b) highly scalable business models. Nowadays, these are startups (or scale-ups), which are less than 20 years old, are primarily based outside of Europe. This crucial role of entrepreneurship and entrepreneurial behavior fascinates me and drives my interest. In this vein, I aim to understand how entrepreneurship can play a role in our European industrial landscape and how it can support a successful transformation of established companies and hence of the entire economy.

1.2 Managing different types of innovation

Innovation is widely recognized as an essential driver of economic growth and the creation of wealth. For companies, innovation is a prerequisite for long-term success and vital to adapt to changing market conditions. However, innovation has multiple facets, and the different types

[3] For example, "Made in Germany" as a global informal standard for quality and innovativeness.

of innovation require different treatments (see Salerno et al., 2015). Established companies typically have their sweet spot when implementing *process innovation* or incre*mental product innovation*. These types of innovation are strongly related to challenges in the core business, e.g., reducing costs or offering improved products. Therefore, they are often referred to as *continuous innovation* as they build on existing competencies and know-how. For reasons of context, we provide a definition of continuous innovation below.

> **Definition 1.1** *Continuous innovation* is defined as all types of innovation that are mainly building on improving or reconfiguring existing competencies, which is mainly reflected in incremental improvements of products and processes.

Continuous innovations can either take place within the organization (process innovation) or on the product level (incremental innovation). The implementation of these continuous innovations typically comes in hand with an improvement or enhancement of the current competencies of an organization.

Besides innovations that count to the "continuous type", there are several additional innovation manifestations, e.g., *business model* innovation, *disruptive* innovation, and *radical* innovation, which have in common that they are different from the innovation in a companies' core business. In some cases, the innovation shows little or no relatedness to the core business, whereas in other cases, the innovations even have the potential to cannibalize current businesses and threaten the viability of the organization. Examples are digital photography for Kodak and the smartphone for Nokia (see Laamanen et al., 2016; Lucas & Goh, 2009). These so-called *discontinuous innovations* are becoming more important as new technologies are applied in the markets that provide functionalities in an entirely different way. The development demands established companies to develop new capabilities and new ways to address or create new types of innovation.

> **Definition 1.2** *Discontinuous innovation* is defined as covering the types of innovation characterized by a higher level of novelty and uncertainty, which mainly requires developing new competencies for their successful implementation.

In contrast to the continuous type of innovation, discontinuous innovations often do not fit into the existing structures and competencies within the company. Moreover, they require a transformation of the organization (or parts of it) for a successful implementation. This *competence-destroying* characteristic is one of the major challenges in the successful implementation (see, e.g., Gatignon et al., 2002). However, here we remark that the competence-destroying characteristic is not linked with the radicality of technical innovation per se, since even rather simple digital services, e.g., changing the sales process and hence impacting the business model, can lead to this competence-destroying effect. In some cases, rather radical technological innovations do not affect the current competencies, e.g., Apple's iPhone or Amazon's smart voice assistant Alexa.

In addition to the competence-destroying effects of discontinuous innovation, the *different types of learning* behind continuous and discontinuous innovations are posing another challenge for established companies. The creation of continuous innovation is mainly based on optimizing existing knowledge. In contrast, discontinuous innovations require a much higher level of knowledge to be explored. That level is at least new to the company or even new to the world. On top of this development, the underlying learning modes of exploitation (optimizing existing knowledge) and exploration (creating new knowledge) are mutually incompatible and demand different management styles and organizational environments (see Raisch et al., 2009; Benner & Tushman, 2003). These contrasts make it even more difficult for established companies to implement discontinuous innovation parallel to the innovations in their core business.

In general, established companies are largely confronted with innovation regarding products, services, or business models. To cope with these types of innovation, companies must drive organization innovations to adapt and transform current structures and processes. However, the increasing relevance of discontinuous innovations demands much more from established companies. In the end, established companies should become capable of implementing both continuous and discontinuous innovation simultaneously.

The parallel implementation of two different types of innovation requires different types of management (see Junarsin, 2009; Bessant, 2008). The most convincing reason is that companies need to pursue different, sometimes conflicting ways of working, e.g., trial and error vs. accurate planning. These new ways of *managing and organizing* innovation processes within an established company will be the focus of our study. In particular, we focus on how entrepreneurial activities can be effectively used to (1) explore new knowledge, (2) develop discontinuous innovation, and (3) support the organizational transformation since these aspects seem to be a major challenge for established companies.

1.3 Relevance of corporate entrepreneurship

The difference between the two types of innovation (continuous and discontinuous) motivated me to perform further research about the management of different types of innovation and the role of entrepreneurial behavior. I believe that we live in a fascinating world, which is in the middle of a fundamental transition, and I would like to investigate how companies can use entrepreneurial approaches to create both continuous and discontinuous innovations in order to ensure their competitiveness.

Companies are implementing different types of entrepreneurial activities, *inside* and *outside* their organization, which is frequently discussed using the notion of *Corporate Entrepreneurship (CE)***.** The concept of CE is experiencing increasing interest from practitioners and researchers as it is recognized as one valid managerial tool to handle the challenges that arise with the ongoing globalization and digital transformation. Obviously, globalization and transformation pose fundamental challenges for established companies. Various studies have highlighted the relevance of CE in order to create new businesses or to support organizational transformation (see Kuratko, 2009; Guth & Ginsberg, 1990).

> **Definition 1.3** *Corporate Entrepreneurship* is defined as all formalized activities within an established company with an entrepreneurial focus, aiming to create new businesses or support the organizational transformation.

The definition reflects the understanding that (1) different processes / different organizational designs of CE exist and that (2) a variety of different outputs (either related to the creation of innovation(s) or to the renewal of the core organization) can be pursued through CE. Thus, CE can be seen as a set of managerial tools that can support companies in their transformation and create new, promising businesses.

1.4 Problem statement

With the increasing interest in Corporate Entrepreneurship, it can be observed that an increasing number of companies started to experiment with (a) new types of organizational designs, hereinafter named *CE forms*, and with (b) new fields of application for the various CE forms. Depending on the intended output(s), some CE forms seem to be better suited to achieve them than others. However, with the emergence of new CE forms in practice and the various application areas of CE, choosing a suited CE form is a major challenge for the management of established companies (see Hill & Georgoulas, 2016; Keil et al., 2009).

> **Definition 1.4** A *CE form* describes CE activities that are bundled in a certain organizational unit. CE forms are characterized by specific design elements and can be distinguished from each other.

As shown in Figure 1.1, research on CE can be divided into (a) the venture level, which focuses on specific corporate ventures (see Definition 1.5), (b) the program-level, focusing on CE programs and their activities (see Definition 1.6), and (c) the firm-level, whereby research focuses on a company's overall activities in CE and high-level impact (Narayanan et al., 2009).

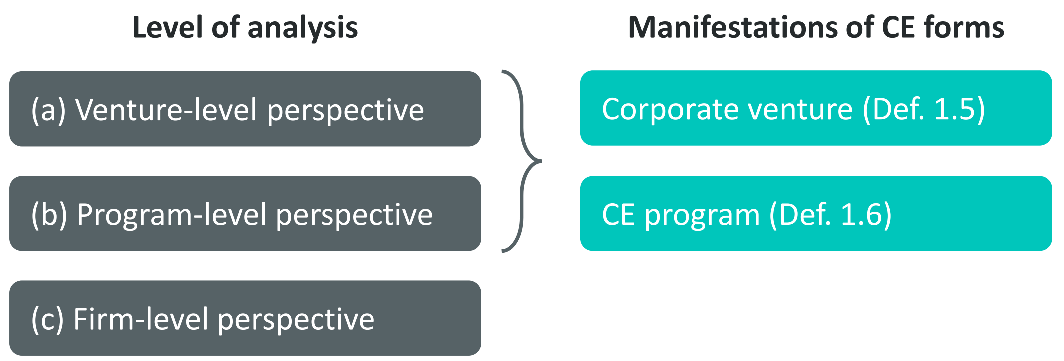

Figure 1.1: Different levels of research & manifestations of CE forms

CE forms can be observed on (a) the venture-level and (b) the program-level. On the venture level, they are defined as follows.

> **Definition 1.5** A *corporate venture* is defined as an organizational unit that an established company creates to pursue a specific innovation idea using entrepreneurial approaches.

Examples for CE forms on the venture-level are internal corporate ventures (see Makarevich, 2017), joint ventures (see Vantrappen & Deneffe, 2016), or spin-offs (see Parhankangas & Arenius, 2003). In contrast, the *organizational designs* that can be observed on a program-level do not focus on a specific innovation idea but follow rather broad objectives (Selig & Baltes, 2019). Therefore, the CE forms on the program-level, henceforth termed *CE programs,* are in the focus of this study and understood as follows.

Definition 1.6 A *CE program* is defined as an organizational unit initiated to either support corporate ventures or work with external startups to make use of (developing or integrating) discontinuous types of innovation.

CE programs show a high level of heterogeneity regarding their organizational designs and their value creation (see Section 4.1). Due to the emergence of novel CE program types, this heterogeneity is currently even increasing (see, e.g., Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019)

Prior studies in the field of CE have often focused either on (1) investigating CE and its value creation from a firm-level perspective (see, e.g., Kuratko et al., 2015; Narayanan et al., 2009) or on (2) investigating a single CE form, such as corporate venture capital (Maula, 2007) or internal corporate ventures (Keil et al., 2009). However, surprisingly few studies compare the different organizational designs of CE programs and their value creation.

A literature review on the evolution of research on internal corporate venturing has highlighted the importance of deepening the understanding of (a) how the different CE programs create value for the core organization and (b) how those CE programs differ from each other (Hill & Georgoulas, 2016). The lack of understanding leads to certain problems for practitioners and researchers that are described below.

From a *managerial* perspective, the difficulty in choosing a suited CE program to achieve the intended output(s) can lead to wrong management decisions, e.g., by selecting conflicting objectives that shall be pursuit by the CE program (Hill & Birkinshaw, 2008) or by granting the wrong level of autonomy (Gard et al., 2018; Thornhill & Amit, 2001). This is additionally reinforced by the fact that in many cases, the created outputs are either unintended by the corporate management (Keil et al., 2009).

From a *scientific* perspective, the lack of understanding leads to challenges in investigating CE forms on the program-level. Even though a full understanding is not yet achieved, the heterogeneity of the value creation of CE programs is widely accepted. However, at the same time, a major part of the studies in CE focuses on traditional performance measures that do not reflect the variety of possible outputs (see Bierwerth et al., 2015). This leads to the circumstance that differences in the value creation of CE programs are not understood well. In addition, the emergence of new CE program types leads to a certain level of uncertainty regarding the organizational design of CE forms on the program-level, since it is not clear if and how these novel CE programs are different from the well-known ones. Considering the high relevance of CE, on the one hand, and the high level of uncertainty in selecting CE programs, on the other hand, the following problem statement (PS) is formulated.

PS: How can established companies effectively use CE programs to support their organizational transformation?

To answer the PS, three research questions are defined that are described in Section 1.5.

1.5 Research questions

The first research question (RQ1) is addressing the high heterogeneity of CE programs regarding their organizational designs, which is currently even increasing since novel CE programs are emerging in practice (see, e.g., Kurpjuweit & Wagner, 2020; Peter, 2018).

RQ1: What are the different types of CE programs?

In order to answer this research question, the literature on CE and its three sub-categories (a) corporate venturing, (b) strategic entrepreneurship, and (c) corporate nurturing (see Shankar & Shepherd, 2019; Kuratko et al., 2015; Guth & Ginsberg, 1990) will be reviewed (see Section 2.1). In this section, we use forward references for proper insight and coherence. Prior studies will be analyzed regarding the different organizational designs of CE programs and design elements that are already being used in research (see Section 4.1). In addition to the design elements derived from literature, further ones will be identified by analyzing the data set (consisting of 54 cases, for more details, see Section 3.2) to uncover novel design elements and to develop an approach to define and distinguish CE programs. This approach will contribute to a better understanding of the organizational designs and their differences.

Next, the focus is set on the value creation and the respective outputs that are created by CE programs. While the different types of organizational designs of CE have been the subject of investigations for several decades (e.g., Gutmann, 2018; Burgelman, 1984), we observe that a variety of outputs and value creation have so far not experienced the same level of attention (see, e.g., Hill & Georgoulas, 2016; Bierwerth et al., 2015). However, in our opinion understanding the full range of outputs that can be created by CE programs is crucial for investigating their value creation. Hence, RQ2 of this study will address the variety of outputs that can be created by CE programs.

RQ2: What types of outputs are created by CE programs?

We will focus on analyzing the value creation of various CE programs for the respective core organization. Therefore, two types of distinctions are important. First, *the level of analysis*, which can either focus on firm-level, program-level, or venture-level (Narayanan et al., 2009) and hence provide different results. Second, the distinction between the *objectives* and the *outputs* of CE activities. While there is a broader base of empirical investigations that have focused on *why* the CE activity was initiated (objectives), there are only a few studies focusing on the concrete outputs that were achieved. In particular when it comes to CE programs.

Regarding the level of analysis, most studies that have investigated the impact of CE on the core organization are either from (1) a firm-level perspective or from the perspective of (2) a single CE form, which either is (2a) the program-level or (2b) the venture-level of CE. This results in studies that either use (a) a broad and often purely financial performance measurement, which does not reflect the heterogeneous nature of CE, or (b) the narrowly defined objectives (intended outputs), that are suited to investigate one CE form at a time, which are too specific for comparing outputs across the different organization designs (in our case CE programs).

In this study, we focus on the concrete types of outputs created by CE programs in order to deepen the understanding of their value creation. The data will be analyzed regarding (1) the spill-over effects, (2) the outputs, and (3) the changes that have been created by the various CE programs. As a result, a comprehensive list of CE outputs is composed. The outputs must fulfill the criteria of being applicable for different CE programs and identifiable in interviews.

The CE outputs from RQ2 and the CE programs from RQ1 build the basis for answering RQ3. Having understood the organizational designs and the outputs of CE programs separately, the RQ3 will focus on the relationships between them.

RQ3: Can causal relationships between CE programs and their outputs be identified?

In a later stage, we will address the relationships between the CE programs (from Chapter 5) and the harmonized set of outputs (from Chapter 6). In a first step, the CE outputs are examined with regard to their occurrences in the various CE programs when they identify which CE programs are better suited to achieve certain outputs. In a second step, we focus on understanding how certain structural or contextual elements may have an impact on the occurrence of the various outputs.

Figure 1.2 provides a graphical overview of how the RQs described in this section are related to each other.

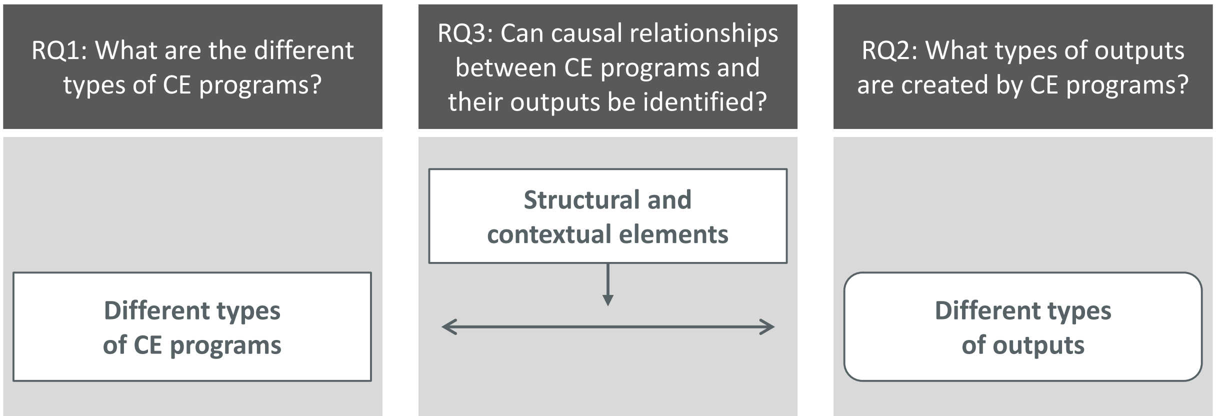

Figure 1.2: Graphical representation of research questions

RQ1 will focus on the various organizational designs that can be found in practice, which are used to foster entrepreneurial activities within established companies. Here, CE programs are covered, which are used to foster either (1) internal innovation ideas or (2) insource external innovation ideas from startups.

Due to the emergence of new CE programs and new fields of application, both are leading to increasing heterogeneity of value creation. Meanwhile, RQ2 is focusing on the different outputs created through CE programs. By providing a harmonized set of CE outputs from a program-level perspective, more comprehensive research on CE programs will be enabled.

Answering RQ3 is building on the results of the first two RQs. Here, relationships and patterns can be identified. They can ultimately serve as a basis for a more effective management of CE programs since the differences regarding their organizational designs, and their value creation will be better understood.

1.6 Research objectives

The RQs described in Section 1.5 form the basis for addressing the overall research objectives of this work. With this study, I aim to gain a deeper understanding of how to better manage CE activities by selecting the appropriate CE programs to achieve the intended outputs. With this understanding, CE programs can be used more effectively and better aligned with a company's overall strategy. To achieve this, the following three steps will be performed.

1) *Exploring differences* of various organizational designs and offering an updated list with all current types of CE programs.
2) *Investigating outputs* from a program-level perspective and offering a harmonized set of outputs that are created by CE programs.
3) *Exploring casual relationships* between CE programs and outputs and investigating the role (influence) of certain structural or contextual elements on their occurrence.

These three steps go in line with the RQs as mentioned in Section 1.3 and form the basis of our research. Table 1.1 provides an overview of the research steps and the research method.

Research steps		Chap.	Research method	PS	RQ1	RQ2	RQ3
Introduction		1	-	X	X	X	X
Theoretical embedding		2	Literature review on CE and related work	X	X	X	X
Research method		3	-				
Systematic analysis		4	Literature review and data coding to derive design elements CE programs		X		
Step 1	Defining and distinguishing CE program types	5	Coding and morphological analysis of 54 cases to derive CE program types		X		
Step 2	Describing and harmonizing outputs	6	Creating a harmonized set of output categories and outputs (inductive coding)	X		X	
Step 3	Identify relationships between outputs and CE programs	7	Mapping CE programs and outputs to understand relationships between them				
Discussion and conclusion		8	-	X	X	X	X

Table 1.1 Structure of the research

Our data set covers in total 67 semi-structured interviews, whereby eight out of them are follow-up interviews with the same person. The interviews represent 54 cases from 36 companies. For all three research steps, the same data set was used. A detailed overview of the data set is provided in Chapter 3.

1.7 Research methodology

For conducting this explorative study, a qualitative research design was chosen. It is based on a large data set with different CE programs from established companies. The companies are headquartered in Germany, Austria, and Switzerland to reduce cultural differences that may impact the findings. Some of the companies had subsidiaries in other countries.

Based on the following three reasons, I have chosen a purely qualitative research design (see later, Subsections 1.7.1, 1.7.2, and 1.7.3).

1) Novel CE programs are emerging in practice. For example, corporate company builders (Peter, 2018), internal corporate accelerators (Selig et al., 2018), and startup supplier programs (Kurpjuweit & Wagner, 2020). However, they lack a broader base of empirical investigations and thus are neither well described nor clearly distinguished from well-known CE programs. To investigate differences in the value creation of CE programs, we need a clear understanding of their different organizational designs (see Subsection 1.7.1).
2) Regarding CE outputs, there is a higher level of unclarity than it is the case for CE programs. One reason for this high unclarity can be found in the circumstance that most studies focusing on outputs of CE did analyze this from a firm-level or venture-level perspective. The program-level perspective, however, did experience less attention when it comes to research about CE outputs. Furthermore, outputs are mostly reduced to financial performance measurement (Bierwerth et al., 2015), ignoring the variety of outputs that can be created by CE (see Subsection 1.7.2).
3) To the best of my knowledge, there is no research that is focusing on outputs of CE by comparing them across the different internal and external CE programs. Consequently, it is unclear which outputs are created by CE programs and in particular, how the various CE program types are different in their value creation. Further explorative research is required to investigate the variety of outputs and to create a harmonized set of outputs that is valid across all CE program types. Due to this lack of empirical findings, a qualitative approach was chosen (see Subsection 1.7.3).

1.7.1 Identifying and describing CE programs

The first step of this thesis focused on deepening the understanding of the various designs of CE programs. Therefore, a systematic approach to analyze CE programs was developed. This is based on an abductive approach that combines organizational design elements from existing studies and newly identified ones that were unveiled in the coding process. The analysis followed grounded theory principles (Walker & Myrick, 2006; Strauss & Corbin, 1994) to uncover new insights regarding the organizational design of CE programs

After developing the systematic approach, all 54 cases (see Subsection 3.2.2) were described and distinguished. Thereby, rather novel CE programs that still lack a broader base of empirical investigations were identified and compared to well-known ones. RQ1 will be answered by systematically describing and distinguishing the CE programs using a set of organizational design elements.

1.7.2 Exploring CE outputs and proposing a harmonized set

Answering RQ2 will be achieved by identifying and harmonizing the different outputs that are created by CE programs. In contrast to the first RQ, a purely inductive approach was selected, since so far and to the best of my knowledge, the outputs of CE from a program-level perspective have not been in the focus of prior studies.

For analyzing the 54 cases, grounded theory principles were applied, which resulted in a total number of 27 distinct outputs (see Section 6.1). These 27 outputs can be grouped into seven overall categories that are describing the areas of value creation, which can be achieved through the different CE programs.

1.7.3 Mapping CE forms with CE outputs

The last part of the empirical analysis of this study aims at investigating relationships between CE programs and CE outputs. Therefore, the results from Chapter 5 (organizational designs of CE programs) and Chapter 6 (outputs of CE programs) are used as a basis to identify relationships and patterns between both dimensions. For the outcome, read later Section 7.2 – Section 7.4.

Furthermore, this study unveiled various contextual factors that seem to have an impact on the occurrence of certain outputs in relation to CE programs. The results of this study were analyzed from a configuration theory perspective (see Subsection 2.2.3), which provided a suitable framework to embed and understand the findings from the previous chapters.

Since this empirical study aimed at understanding the heterogeneity of CE programs, a relatively large data set was used to ensure that the full variety of organizational designs is covered. The in-depth interview, on the one hand, allows for understanding how the respective CE programs are designed, while on the other hand, due to the relatively large data set, a comparison across the different CE programs was possible.

1.8 Structure of the research

Below we provide a preview of the research performed.

Chapter 1 – Entrepreneurial activities in established companies: In the first chapter, the motivation for conducting this research is presented. Based on the motivation, I formulate the problem statement and three RQs. They are followed by the research objectives and research methodology. All four together (PS, RQ1, RQ2, and RQ3) clearly explain (1) why this specific research design was selected and (2) how this study can contribute to a deeper understanding of CE programs and their value creation including the scientific and managerial relevance.

Chapter 2 – Related work and theoretical embedding: In Chapter 2, the subject of CE will be described. Reviewing the literature about CE shows that even though the overall value of CE is widely acknowledged and understood, the concrete value creation (outputs), as well as the organizational implementation (CE programs), is not fully understood yet. Furthermore, Chapter 2 is elaborating a suited theoretical framework for conducting this research.

Chapter 3 – Describing the research method: In Chapter 3, the research method and the data set used in this study will be described. This explorative study follows a purely qualitative approach, which requires a clear and transparent description of the research process and the evaluated data in order to ensure the clarity and plausibility of the results.

Chapter 4 – Systematic approach to analyze CE programs: Chapter 4 is aiming to provide the basis for answering RQ1. Therefore, the existing literature on CE programs is reviewed (1) to describe well-known CE programs and (2) to identify design elements that are suited to describe and distinguish CE programs. The design elements derived from the literature are complemented by additional ones derived from coding our cases. Building on this set of design elements, a systematic approach was developed to analyze CE programs.

Chapter 5 – Exploring the different types of CE programs: Chapter 5 aims to answer the RQ1 by applying the systematic approach from the previous chapter to the 54 cases from our data set. In a first step, the focus is set on defining the different CE program types, followed by the investigation of differences that clearly distinguish them.

Chapter 6 – Exploring outputs of CE programs: Chapter 6 aims at answering RQ2 by investigating the outputs of the various CE programs. In order to evaluate and compare the value creation of CE, the respective CE outputs have been investigated from the program-level. Therefore, the 67 interviews have been analyzed using an inductive approach. They identify the variety of outputs. As a result, a harmonized set of CE outputs that is valid across the various CE programs is presented.

Chapter 7 – Mapping different CE programs and CE outputs: In Chapter 7, RQ3 is answered by mapping CE outputs from RQ2 with the CE programs described in RQ1. Furthermore, relationships and patterns of certain outputs and organizational design elements and/or contextual factors are investigated. Configuration theory perspective is used to embed the finding into a theoretical framework and to better describe the results.

Chapter 8 – Answering the problem statement and concluding on this research: Chapter 8 reflects on how the PS and RQs have been answered. Based on this reflection, the theoretical contributions are highlighted. Relevant insights into the value creation and management of CE on a program-level are provided by (1) understanding the relationships between CE programs and CE outputs as well as (2) the influence of certain contextual and organizational design elements. We conclude our study by a discussion on (a) future research ideas, (b) the limitations of this work, and (c) practical implications for the management of CE programs.

1.9 Scientific relevance

The scientific relevance of this study concerns two topics that so far have received little or no attention in CE research. They are (1) a holistic understanding of the heterogeneity of organizational designs on the program-level and (2) the different types of value creation of CE programs. Furthermore, this study sets the basis for applying a promising theoretical perspective, which so far has only been hardly used in the context of CE.

The first scientific contribution is an *improved understanding of the organizational designs of CE programs*. As described earlier in this chapter, it can be observed in practice that within the past years, new CE programs have emerged. This emergence has led to a certain degree of uncertainty about the various CE programs and their differences (Hill & Georgoulas, 2016). One example is the set of startup supplier programs, which are in some studies acting as a type of external corporate accelerators (Weiblen & Chesbrough, 2015), while other studies are distinguishing them as two different CE programs (Kurpjuweit & Wagner, 2020). This example symbolizes the uncertainty regarding the organizational designs of CE programs.

For conducting comprehensive research that is investigating the various CE programs and their differences, e.g., regarding their value creation or their effective management, it is crucial to deepen the understanding of differences in the organizational designs (Hill & Georgoulas, 2016). In our study, a set of design elements is presented that is suited to define and distinguish the different CE programs. This approach contributes to a more holistic and comprehensive understanding of CE on the program-level. In addition, the set of design elements can be used to describe new types of CE programs that may arise in the future.

The second scientific contribution is *the improved understanding of CE program's value creation and the respective outputs*. The value creation shows an even higher level of uncertainty than the organization designs of CE. Even though the heterogeneity of different types of value that can be created is widely accepted (see Narayanan et al., 2009), a major part of the studies that are investigating the performance of CE did focus mostly on financial objectives (Bierwerth et al., 2015). They do not reflect the various motives and the potential outputs of CE activities (see Bierwerth et al., 2015; Keil et al., 2009). Analyzing and harmonizing the different outputs of CE programs will set a basis for deepening the understanding of the value creation of CE. Building on the results for the value creation, future studies can focus on aligning the value creation with the objectives and the performance measurement of CE programs. In this way, the investigation of the outputs contributes to a better understanding of how the various CE programs differ regarding their value creation.

The third scientific contribution of this study is made *by providing the basis for applying a configuration theory approach in the context of CE programs*. Even though the configuration theory has been widely used in organizational design and management studies, there are only a few studies using this approach in CE (e.g., Kreiser et al., 2019; Hill & Birkinshaw, 2008).

These few studies have acknowledged configuration theory (see Subsection 2.2.3) as a promising perspective to enhance the current knowledge boundaries in research on CE (see Kreiser et al., 2019).

1.10 Managerial relevance

From a managerial perspective, this study has at least two contributions that are addressing current issues in the management of CE programs.

First, there is a *broad range of different CE programs* and even more organizational design options. With the emergence of novel CE programs, the heterogeneity of organizational designs is even more increasing. By providing clearly defined CE program types and a set of design elements that are suited to define and distinguish them, the clarity in selecting a CE program for corporate management is improved. In addition, the design elements provide guidance for what design options must be considered when implementing a CE program.

Second, even though the overall value of CE activities is widely accepted, it is yet not well understood what *type of value creation can be expected*. This can be seen, for example, in the circumstance that either (1) CE programs are initiated with different, sometimes conflicting objectives or even no objective at all, and (2) a part of the value creation is not intended or unrecognized. Hence, it regularly happens that expectations are not met, and CE programs are perceived as not being successful. In general, providing a set of outputs that is reflecting the variety of values created by CE programs will form a basis for understanding (1) which objectives can realistically be achieved and (2) what objectives should be pursued with other means than CE programs.

Third, by *linking the outputs with the CE program types,* the selection of appropriate CE programs to achieve a certain objective is supported. For the corporate management, it becomes clearer (a) what types of outputs (value creation) can be expected and (b) which CE program types are better suited to create certain outputs. In addition to that, a better understanding of the outputs can also lead to more effective management, as the *measurement of the performance* can be better *aligned to the value creation* of the respective CE program.

2 Related work & theoretical embedding

This chapter aims to deepen the understanding of CE. Moreover, it explains why the design and management of CE programs require further research. For this purpose, in Section 2.1, the different categories of CE will be described. This is followed by the theoretical embedding of our study in Section 2.2. In Section 2.3, the theoretical framework will be presented.

2.1 Understanding entrepreneurial activities in established companies

Section 2.1 starts with a short overview of how CE differs from related research areas. Subsequently, the three different sub-categories of CE (see Subsections 2.1.1 to 2.1.3) will be described to deepen the understanding of the heterogeneity of CE. In the last part of the section, the challenges of managing CE more effectively are described.

Adapting to changing market conditions is one of the key challenges of the 21st century. In that respect, entrepreneurial activities within established companies become increasingly important as a managerial way to support the organizational transformation (see Teece, 2016; Kuratko, 2009). From a scientific perspective, the activities can be subdivided into (a) *corporate entrepreneurship* and (b) *intrapreneurship* (see Schindehutte et al., 2019; Blanka, 2018). As previously described in Section 1.3, the concept of CE focuses on formalized entrepreneurial activities that are initiated top-down with the aim to support the creation of new businesses and the organizational transformation. In contrast, intrapreneurship[4] focuses on rather informal entrepreneurial activities that are driven by individuals without being mandated by the company (see Rigtering & Weitzel, 2013; Pinchot III, 1985). According to these two different streams of activities, the research conducted in this study belongs to the stream of CE studies, as it focuses on the design and strategic use of CE activities.

Over the past decades, there have been various studies defining what CE is and what it is not (cf. Schindehutte et al., 2019; Sharma & Chrisman, 2007; Zahra, 1993). This thesis follows Definition 1.3, which is reflecting that CE activities can be (a) formally set up and (b) designed and used for different objectives. For a better understanding, there are different sub-categories that describe the various phenomena covered by CE (cf. Kuratko & Audretsch,

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[4] Intrapreneurship is a combination of the two terms intra-organization and entrepreneurship. It focuses on the individual, entrepreneurial behavior of employees within an established company (see Blanka, 2018).

2009; Zahra & Covin, 1995; Guth & Ginsberg, 1990). Figure 2.1 illustrates the categorization applied. It consists of the three sub-categories (a) corporate venturing, (b) strategic entrepreneurship, and (c) corporate nurturing.

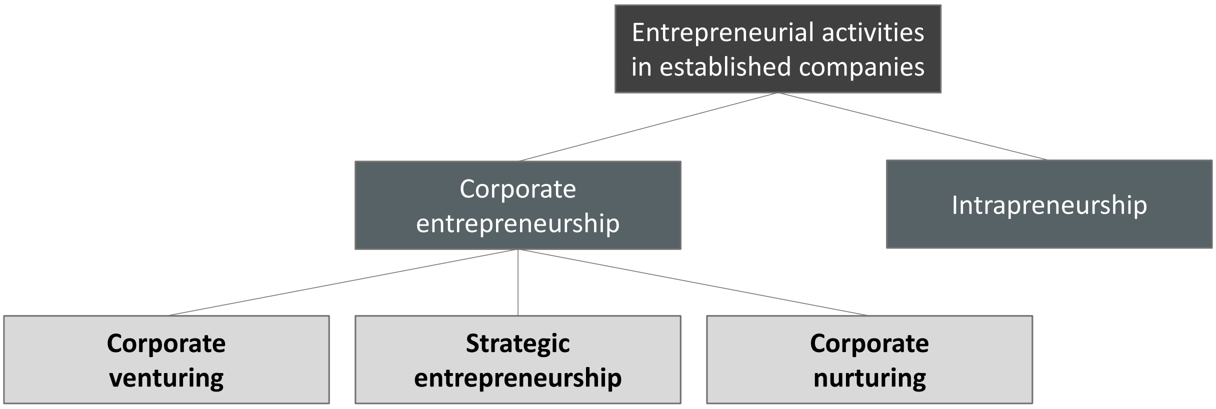

Figure 2.1: Research on entrepreneurial activities in established companies

In Subsections 2.1.1 – 2.1.3, the three sub-categories will be described, and a definition of each sub-category will be provided.

2.1.1 Corporate venturing

As one key element of the CE concept, corporate venturing focuses on the creation of new businesses within the context of an established company, which is defined as follows (see, e.g., Narayanan et al., 2009; Guth & Ginsberg, 1990).

> **Definition 2.1** *Corporate venturing* is defined as all structures and processes that are using (internal and external) entrepreneurial approaches to developing rather discontinuous innovations in the context of an established company.

The creation of new businesses can be subdivided into the following three approaches.

1) *Internal corporate venturing*: Using internal means by identifying and leveraging hidden innovation potential within the company, e.g., an internal corporate incubator that supports the employees in implementing their innovation ideas.
2) *External corporate venturing*: Using innovations from external sources, either through (a) collaborating with startups or (b) investing in startups, e.g., with a corporate venture capital unit that builds a portfolio of strategically relevant startup investments.

3) *Cooperative corporate venturing*: Applying a hybrid version of internal and external corporate venturing by combining internal and external means, e.g., through the creation of joint ventures.

These three different approaches to drive the creation of new businesses will serve as a basis for the classification of the organizational design of CE programs in Chapter 4.

2.1.2 Strategic entrepreneurship

Strategic entrepreneurship, formerly known as strategic renewal (see, e.g., Mazzei et al., 2017; Kuratko & Audretsch, 2009; Guth & Ginsberg, 1990), covers different types of innovation with the aim of achieving a competitive advantage (Mazzei, 2018). According to the understanding of strategic entrepreneurship, innovation is not limited to new products or new services but also takes place on the levels of corporate strategy, corporate organization, and business model, as well as on the market side (see Kuratko et al., 2015; Covin & Miles, 1999). Hence, corporate venturing differs from strategic entrepreneurship since creating a new business is not mandatory for this concept (Kuratko & Audretsch, 2009).

> **Definition 2.2** *Strategic entrepreneurship* is focusing on the transformational aspect of entrepreneurial activities within an established company.

In practice, strategic entrepreneurship has the following five different manifestations (see Kuratko & Audretsch, 2009). An example is given (in italics) at the end of each description.

1) *Business model reconstruction* describes the (re-) design of a company's core business model(s), aiming at differentiating the company from its competitors in a beneficial way. *Rolls-Royce shifted from selling aircraft turbines to offering them as a service – "power by the hour" – which is one example for reconstructing a business model.*
2) *Sustain regeneration* refers to the capability of companies to develop a continuous stream of new products and/or new services, which are introduced to the market. *Amazon continuously experiments with new products and services as one example of sustained regeneration.*
3) *Strategic renewal* relates to fundamental changes in a company's strategy to improve the positioning of a company in its competitive environment. *Microsoft's shift from pushing their operating system (Windows) towards providing their services to all users, independent from the used operating system.*

4) *Organizational rejuvenation* aims at innovations that primarily address the organization, e.g., by creating processes, capabilities, and structures that enable more entrepreneurial activities. *SAP has introduced design thinking throughout the whole company to become more customer-centric and more innovative.*
5) *Domain redefinition* focuses on the proactive creation of a completely new product-market arena that offers a basis for sustained competitive advantage. *The introduction of the iPad by Apple is one example of domain redefinition as it has created a totally new market in-between smartphones and laptops.*

The five manifestations illustrate the diversity of the CE concept and can serve as indicators for the possible areas of value creation discussed in Chapter 6.

2.1.3 Corporate nurturing

Corporate nurturing has recently evolved as the third sub-category of CE, complementing the ones described in 2.1.1 and 2.1.2 (Shankar & Shepherd, 2019). The need for an additional sub-category emerged out of the rather novel phenomena of different, formalized startup engagement programs, which do not fit into the scope of corporate venturing or strategic entrepreneurship. These startup engagement programs show different manifestations in practice, e.g., external corporate accelerators (Shankar & Shepherd, 2019) or startup sourcing programs (Kurpjuweit & Wagner, 2020). Corporate nurturing is focusing on these types of engagement with startups and is defined in the course of this work as follows.

> **Definition 2.3** *Corporate nurturing* is defined as all means to gain access to external innovations of new ventures, either by direct insourcing of innovations or indirectly by securing the option to access them.

Generally, there are two different paths for companies to pursue corporate nurturing. They are (a) nurture innovations and (b) nurture ecosystems. *Nurturing innovations* focus on scouting and insourcing innovations that have a rather near-term impact on the company's current core business, e.g., by running proof of concepts with startups to identify potential use cases of new technologies. *Nurturing ecosystems* is focusing on supporting startups (external ventures) with services and resources with the aim to create value in the long-term, e.g., by investing in startups to create a portfolio of potential customers and partners to expand the current market (Shankar & Shepherd, 2019). The main difference between the two paths is (a) the time horizon and (b) the directness of the value creation.

The phenomenon of corporate nurturing was already mentioned in early 2000 (Miles & Covin, 2002) but did afterward not experience much attention. This has recently changed due to the increasing efforts of CE programs that are focusing on engagement with external startups (e.g., Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019).

2.1.4 CE and challenges of an effective management

The three sub-categories described above reflect the heterogeneity of the CE concept, which ranges from insourcing external innovations (corporate nurturing), creating new businesses (corporate venturing) to the transformation of the company (strategic entrepreneurship). At the same time, the definitions show a certain overlap, e.g., corporate venturing and corporate nurturing, which both cover the collaboration with external startups. Even though we see an ongoing discussion regarding the sub-categories CE (cf. Schindehutte et al., 2019; Mokaya, 2012; Guth & Ginsberg, 1990) and no clearly defined boundaries between them, the sub-categories are useful for understanding the variety of CE in practice.

Although the overall value of CE is widely recognized (see Covin & Miles, 2007; Zahra & Covin, 1995), the effective management of CE activities on a more operational level seems to remain challenging (Hill & Georgoulas, 2016). This can be observed, for example, based on the phenomenon that many CE activities are terminated after a short period of time (see, e.g., Ma, 2020; Burgelman & Välikangas, 2005), often before they can develop their value, only to be restarted a few years later (Burgelman & Välikangas, 2005).

At least four reasons exist why both managing and operating CE programs are a challenge for established companies. We will describe the reasons below.

1) *Level of analysis*: On the firm-level, different types of value creation have been linked to CE, such as improved financial performance, increased innovativeness, higher profitability, or organizational learning (see, e.g., Kuratko & Hoskinson, 2019; Schindehutte et al., 2019; Narayanan et al., 2009; Zahra, 1995). However, when it comes to understanding the value creation of CE activities on the program-level, the concrete outputs are often unclear (Hill & Georgoulas, 2016).
2) *Subject of investigation:* At present, a high degree of dynamism is observed in practice with regard to the emergence of novel organizational designs at the program-level. As a result, there is increasing ambiguity since (a) in some cases, the same terms are used

to describe different organizational designs, or (b) the same organizational design is described with different terms (cf. Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019; Weiblen & Chesbrough, 2015).

3) *Lack of comparability:* Even though some studies investigate the objectives or outputs of CE programs, there is, to the best of my knowledge, a lack of studies that compare the CE program according to their value creation. This has been reported as one reason for the uncertainty the corporate management is facing when selecting the suitable CE program for achieving the desired goal (Hill & Georgoulas, 2016).
4) *Performance measurement:* Studies that are investigating the performance of CE, often focus on purely financial measurements only (Zahra & Hayton, 2008). However, such an exclusive focus on the financial value does not reflect the heterogeneity of the outputs that can be achieved by CE, which leads to uncertainty about the range of value creation of CE (Bierwerth et al., 2015).

It is therefore not surprising to observe that some CE programs are charged with different or even contradictory objectives (Hill & Birkinshaw, 2008) and that sometimes the results of CE activities are unintended or not even recognized by the management of the company (e.g., Hill & Georgoulas, 2016; Keil et al., 2009). In order to address this issue in the management of CE programs, our study focuses on understanding (a) the differences in the organizational designs and (b) the value creation of CE programs.

The next paragraphs will focus on describing *how* the RQs and the research design are addressing the four reasons for challenges in the management of CE programs. The research design itself is addressing the issue regarding *the level of analysis* by focusing on the organizational designs and value creation of CE programs, which will extend the current knowledge base about CE activities on the program-level.

- RQ1 (What are the different types of CE programs?) and the *subject of investigation*: Defining CE programs by identifying organizational design elements that are suited to systematically describe and distinguish the various CE programs, provides a clear understanding about the subject of investigation, independent from “names” or subjective interpretations of the interviewees. This will help to understand the heterogeneity of organizational designs of CE programs and deliver practitioners an overview of elements for designing and implementing a CE program.

- RQ2 (What types of outputs are created by CE programs?) and the *performance measurement:* Developing a harmonized set of outputs that is valid across the different CE programs sets a basis for future research that may aim at understanding what type of performance measurement is required to address the heterogeneity of CE outputs.
- RQ3 (Can causal relationships between CE programs and their outputs be identified?) and the *lack of comparabilit*y: By identifying relationships between the CE programs and the various CE outputs did improve knowledge about the differences in the value creation of CE programs. This will help practitioners in selecting appropriate CE programs for achieving a desired objective and will set a basis for future studies about the value creation of CE on a program-level.

To conclude, answering the three RQs improves the understanding of the heterogeneity of CE programs and is in line with Hill and Georgoulas (2016), who state: "*Beginning with the heterogeneity of forms of ICV* [internal corporate venturing]*, and of venturing more broadly, we believe that considerable scope exists for comparisons of the practices, challenges encountered, and outcomes associated with (a) dispersed versus focused modes of ICV, (b) different types of ICV units, and (c) alternative forms of CV* [corporate venturing] *(such as ICV, CVC, joint ventures and acquisitions). At present, little is known regarding whether and how the value created by these various forms varies systematically, creating considerable uncertainty in their selection by managers" (Hill & Georgoulas, 2016, p.36).*

In contrast to their conclusion, in our study, we will focus on CE programs only. However, the need for a more comparative understanding with a focus on the value creation and organizational designs is even increasing, as in practice, novel CE programs are emerging.

2.2 Theoretical embedding – understanding CE programs and their differences

Section 2.2 will focus on the theoretical embedding of our study. In this course, the three perspectives of (a) the *dynamic capabilities-based view*, (b) the contingency theory, and (c) the configuration theory are evaluated in Subsections 2.2.1 - 2.2.3. We remark that both, the contingency theory and the configuration theory, belong to the *organization design-based view*. Section 2.3 will present the most suited theoretical perspective, which will be linked with the three RQs to define the theoretical framework of our study.

As shown in Figure 2.2, our study covers three topics (linked to the three RQs) that play a role in choosing the appropriate theoretical perspective. First, the organizational design of CE programs. Second, the value creation of CE programs. And third, the relationship between organizational design and value creation and the potential impact of certain structural or contextual elements on these relationships. The appropriate theoretical perspective should, in the best case, be suitable for examining all three topics.

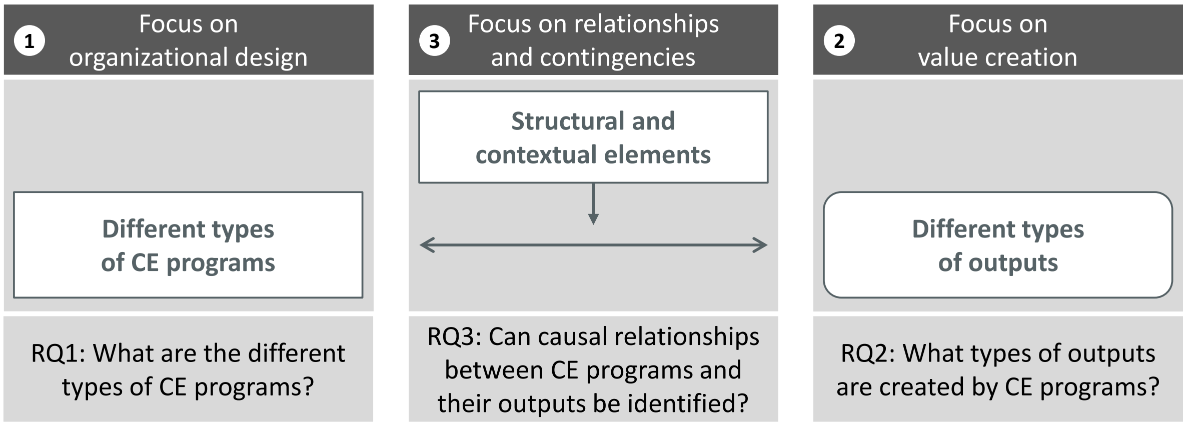

Figure 2.2: Different foci to understand the designs and value creation of CE programs

2.2.1 Dynamic capabilities-based view

The dynamic capabilities-based view focuses on the organizational abilities to adapt towards changing market conditions (see Wilden et al., 2013; Teece et al., 1997) and is meanwhile well acknowledged in strategic management and organizational design research (see, e.g., Bogers et al., 2019; Barreto, 2010). In order to adapt to changing market conditions, the companies must be capable of reconfiguring their available resource base (Barreto, 2010). This can be achieved through dynamic capabilities (Eisenhardt & Martin, 2000). In that sense, dynamic capabilities are defined as follows.

> **Definition 2.4** *Dynamic capabilities* are the processes of an organization that are used to adjust its resource base by reconfiguring, integrating, creating, or releasing resources in order to create a better fit with the market environment.

Companies that are capable of implementing effective routines of resource reconfiguration are more likely to sustain success, as the risk of organizational inertia and path dependencies is reduced (see O'Reilly & Tushman, 2008). The dynamic capabilities can be sub-divided according to the respective activities into the three types of (a) *sensing*, (b) *seizing,* and (c) *reconfiguring* (see Wilden et al., 2013; Teece, 2007).

- *Sensing* describes the capability to explore new business opportunities based on the assessment of technological or societal trends, which forms the basis for identifying relevant changes and emerging opportunities at an early stage.
- *Seizing* describes the capability to create a new product or service (based on identified opportunities), which requires, for example, testing business models, allocating resources, and capturing value.
- *Reconfiguring* describes the capability of an organization to adjust or reshape its resource base, such as assets, structure, ecosystem, and strategy, to ensure that they are aligned with changing market parameters.

Following the understanding described above, CE programs can be seen as processes that are implemented to execute the three types of activities (see Bogers et al., 2019; Teece, 2016; Yiu & Lau, 2008). In a recent study, different external CE programs were investigated according to their potential to strengthen the sensing, seizing, and reconfiguring activities of a company (Enkel & Sagmeister, 2020). That study has shown that CE programs differ by their value creation. Moreover, multiple CE programs can be used in a complementary manner, resulting in a strengthening of the dynamic capabilities of an organization.

Even though *value creation* is an important topic for research on dynamic capabilities, the precise understanding of value creation differs considerably. The dynamic capabilities-based view focuses on routines that lead to changes in a company's resource base. The focus on how (e.g., the routines) and their impact (e.g., reconfiguration, integration, creation, or releasing – see Def. 2.4) differs per RQ in our study for at least two reasons. First, RQ1 addresses differences in organizational designs of CE programs. It focuses on the structural characteristics of CE programs rather than on the process perspective that the dynamic capabilities-based view applies. Second, RQ2 addresses the different ways by which the CE programs create value. The emphasis is on the specific outputs created by CE programs, such as new products or new technological know-how. This type of value creation differs from the broader perspective of the dynamic capability-based view, which focuses on the impact of the four capabilities of reconfiguring, integrating, creating, or releasing the company's resources. Since (a) these two RQs form the basis for answering the third RQ and (b) the dynamic capability-based view does not seem to be suitable for answering them, the latter is discarded as a theoretical perspective for our study.

Besides the dynamic capabilities based-view, there are additional ones that follow a similar focus, e.g., the organizational learning or the competence based-view (Mintzberg et al., 2009). Based on the same line of reasoning described above, they were also discarded as a theoretical perspective for our study. In our search for an appropriate theoretical perspective, we will discuss the contingency theory (2.2.2) and the configuration theory (2.2.3). Both belong to the organizational design-based view as potential perspectives.

2.2.2 Contingency theory

Researching organizational designs has a long history in organizational science and strategic management studies. Over the last decades, different perspectives have emerged to improve the investigations of organizations and organizational units.

One of the most influential frameworks is the *contingency theory* which has been frequently applied in research (van de Ven et al., 2013), as well as in practice, e.g., McKinsey's 7-S framework (Pascale & Athos, 1981). The rise of contingency theory has contributed to (a) a better understanding of different types of organizations and (b) why some of them perform better than others. In the course of this work, contingency theory is defined as follows.

> **Definition 2.5** *Contingency theory* is defined as the understanding that the performance of an organization or organizational unit depends on the fit between certain design parameters and the external environment.

This definition reflects the key elements of the contingency theory, which are (a) the optimal organizational structure is determined by external contingencies and (b) internally consistent organizational structures that have a fit with the external contingency, show a better performance in achieving desired outputs (see van de Ven et al., 2013; Donaldson, 2002).

Studies that are using contingency theory aim at explaining how differences in the organizational structure are influencing the performance in relation to a certain contingency, such as technology or environment (Donaldson, 2002). Moreover, rather simplistic methods are applied that use only one element at a time to explain differences in performance (van de Ven et al., 2013). The relationship between the respective contingency and the structural element is assumed to be unidirectional and linear (Meyer et al., 1993) or in some cases curvilinear (Donaldson, 2002).

Table 2.1 presents five key assumptions based on a publication by Meyer et al. (1993) that is characteristic of the contingency theory approach.

Key assumptions of research	Manifestation in contingency theory
Dominant mode of inquiry	*Reductionistic analysis* – focuses on understanding the different parts of an organization separately. Assumes that aggregating the knowledge of each of them will result in a holistic understanding.
Social system cohesion & constraint	*Aggregates of weakly constrained components* – assumes that the respective organizational components are loosely connected subsystems, whereby each of them can be adjusted individually.
Relationship (impact) among attributes	*Unidirectional and linear* – the relationships between the few elements that are analyzed are assumed to be simple causal relationships that show a unidirectional and linear behavior.
Equilibrium assumption & mode of change	*Quasi stationary equilibrium* – following a static view that operationalizes the concept of fit as static equilibrium. In this view, changes are assumed to occur incrementally and continuously.
Effectiveness assumption	*Determined by situational context* – following the understanding that an effective (successful) organizational structure is mainly influenced by the situational context of the company.

Table 2.1: Elements of contingency theory research (Meyer et al., 1993)

Over the past decades, criticism regarding the contingency theory has evolved. The first criticism is the *suitability for different types of environments*. Whereas the contingency theory has provided relevant insights for organizations into relatively stable and simple environments, the theory seems fallible (and therefore not suited) for rather complex and dynamic environments (van de Ven et al., 2013). The second criticism is the *reductionistic approach* which implies that it is possible to understand an entire organization by investigating certain parts of it separately (van de Ven et al., 2013). This may happen in cases but not in general. The third criticism regards the *unidirectional and linear relationships* that are assumed. The unidirectional relationship ignores the mutual influences the multiple elements of an organization can have on each other (Meyer et al., 1993).

Reflecting on the five manifestations of the key assumptions of contingency theory on the three RQs leads to the following conclusion. The general understanding that certain structural or contextual elements influence the performance in achieving certain objectives might be true. The conclusion contributes to the focus of our study. However, the three well-defined criticisms are also relevant to answer our RQ. Below we reconsider the power of the arguments that reside in the manifestations, and then we investigate the three points of criticism mentioned above to a larger extent.

First, the lack of *suitability in complex and dynamic environments*. The environment of CE programs can be understood as dynamic due to at least these three circumstances.

1) Novel organizational forms of CE programs are currently emerging in practice, which makes the subject of investigation itself dynamic.
2) CE programs are used to support organizational change, which then leads to changes that alter the core organization as the direct environment of the CE program.
3) CE programs are often used to address challenges of changing market parameters, which means that the environment is dynamic as well.

Next to the dynamic elements, it holds that to study CE programs, multiple environments must be considered, such as the intra-organizational context as well as the external context, which makes the analysis complex.

Second, the *reductionistic approach* (analyzing one element at a time) does not seem to be well suited to define and distinguish the different organizational designs. This is due to the fact that CE programs are multidimensional organizational units that exhibit a high degree of heterogeneity (see Gutmann, 2018; Hill & Georgoulas, 2016). Examining the various CE programs by looking at only one design element at a time does neither reflect the heterogeneity of CE programs nor the small differences between rather similar designs.

Third, the assumption of *unidirectional and linear relationships* does not mirror the complex organizational context in which CE programs are embedded. For instance, let us assume that CE program activities and outcomes have an impact on the core business. Based on this assumption, we provide two occurrences that may happen: (1) a new product is developed that partially cannibalizes the sales of an existing product, and (2) a digital sales channel is developed that complements existing sales activities. We believe that as a result, the following would happen: (a) changes in the core organization may, in turn, impact expectations for CE programs and (b) lead to changes in their objectives or orientation. These reciprocal relationships contradict the contingency theory.

To conclude, an approach that follows contingency theory is not appropriate as a theoretical framework for our study. Focusing on only one variable seems too simplistic to examine and distinguish the rather complex organizational designs of CE programs. However, building on the basic ideas of contingency theory seems to be a promising avenue that can be followed to understand organizational designs.

2.2.3 Configuration theory

This subsection will focus on the configuration theory, which is also known as the multi-contingency theory (Snow et al., 2006). It has emerged out of the rich theoretical foundation of the contingency theory (see van de Ven et al., 2013). In general, the configuration theory differs in at least five aspects from the contingency theory (summarized in Table 2.2). Similar to contingency theory, the internal and the external fit are at the core of the investigations.

To understand the internal fit, research focuses on identifying organizational configurations, which are multidimensional combinations of organizational design elements that commonly occur together (see van de Ven et al., 2013; Meyer et al., 1993). The focus on (a) multiple structural elements, (b) contingencies, and (c) performance outputs is characteristic of the configuration theory and fully different from the way contingency theory deals with these three elements. It is expected that focusing on multiple elements will lead to a more holistic understanding of the organization (Snow et al., 2006).

In the course of this work, the configuration theory is defined as follows.

> **Definition 2.6** *Configuration theory* is defined as a theory providing a holistic understanding about organizations by (a) investigating configurations, consisting out of multiple organizational design and performance elements that commonly occur together, and (b) their fit with different external contingencies.

Table 2.2 presents five key assumptions based on Meyer et al. (1993) that characterize research using configuration theory.

Key assumptions of research	Manifestation in contingency theory
Dominant mode of inquiry	*Holistic synthesis* – focusing on a holistic understanding with the basic assumption that the parts of an organization derive their meaning from the whole and cannot be understood separately.
Social system cohesion & constraint	*Configuration of strongly constrained components* – Organizations are understood as tightly coupled connections of the different parts of a company with more or less strong relationships between them.
Relationship (impact) among attributes	*Reciprocal and nonlinear* – the relationships between the different elements of an organization are assumed to be reciprocal and effects show a nonlinear behavior.
Equilibrium assumption & mode of change	*Punctured equilibrium* – organizations alternate between different states. Change tends to be episodic and discontinuous, as configurations are rather stable up to a certain pressure to change.
Effectiveness assumption	*Equifinality concept* – acknowledges that different organizational designs exist which are suited equally well to achieve a certain objective within the same context.

Table 2.2: Elements of configuration theory research (Meyer et al., 1993)

Two well-known examples for configurations are (a) simple structure, machine bureaucracy, professional bureaucracy, divisionalized form, and adhocracy (Mintzberg, 1981) and (b) defender, prospector, analyzer, and reacator (Miles et al., 1978). Both examples focus on the firm-level. However, configuration theory has also been applied on other levels of analysis, such as the unit-level like a department or program within a larger organization (see Biniari et al., 2015; Hill & Birkinshaw, 2008) or on the individual-level (Meyer et al., 1993). Depending on the level of analysis, the elements to describe the configuration are different (Dess et al., 1993). For example, describing configurations on the firm-level uses design elements such as the level of centralization, while on the individual-level, elements such as personality traits are used. In general, the configuration theory follows the equifinality concept (see Table 2.2), which assumes that there are several ways (configurations) that are suited equally well to achieve a certain objective (see, e.g., van de Ven et al., 2013; Doty et al., 1993).

Studies that are applying a configuration theory focus in their analysis at least on the three dimensions, viz. (a) the strategy, (b) the structure, and (c) the context (see van de Ven et al., 2013; Short et al., 2008). Figure 2.3 shows these dimensions and their relationships. Here, the strategy and structure dimensions (under left) are used to examine the internal CE program fit of a configuration (under right), while the organizational context (up in the middle) is used to examine the external CE program fit.

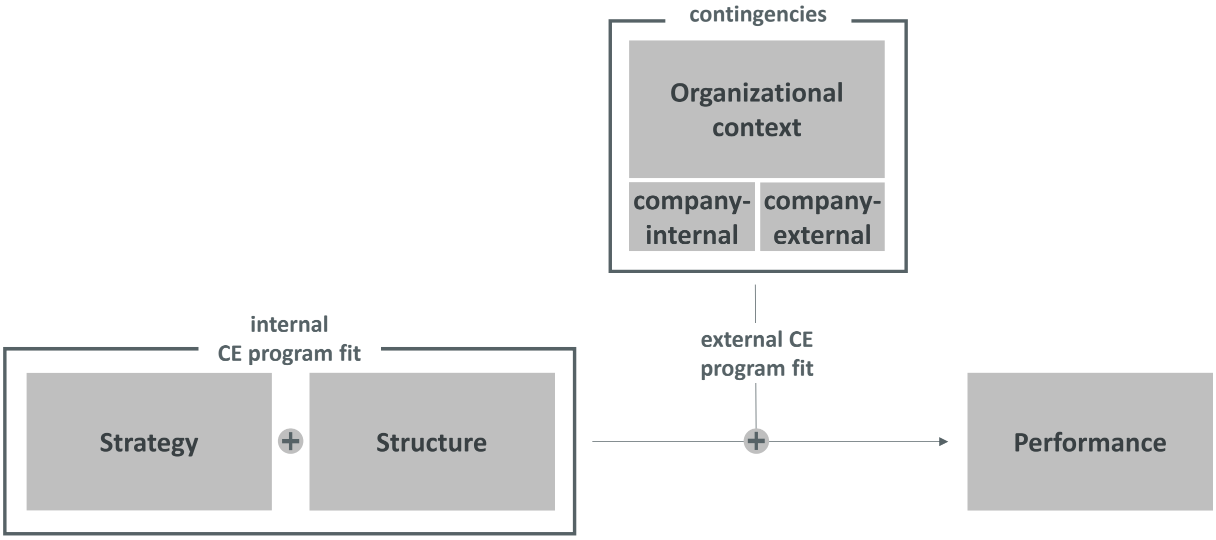

Figure 2.3: Visualization of the dimension in configuration theory

In the context of configuration theory, strategy focuses on either (a) the process of how a strategy can be developed or on (b) the content of a strategy, meaning the positioning or the objectives that should be pursued. The organizational structure focuses on design elements of an organizational unit such as the level of differentiation, formalization, or centralization (Dess et al., 1993). The context can be subdivided into (a) the *company-external context*, which describes the organizational environment using elements such as the level of uncertainty or the complexity, and into (b) the *company-internal context* that focuses on the organization itself using elements such as size, age or technology (see van de Ven et al., 2013; Mintzberg, 1981). As stated above, depending on the level of analysis, the manifestation of these elements is varying. Generally, the configuration theory, with its focus on multiple strategic, structural, and contextual elements, seems to fit well to study (a) the heterogeneity of CE programs and their different organizational designs (structure) and (b) their link to the value creation (strategy and performance).

2.3 Linking configuration theory and corporate entrepreneurship

Configuration theory has been used in a variety of fields such as strategic management and entrepreneurship (see, e.g., Harms et al., 2009; Mintzberg et al., 2001; Miles et al., 1978). For CE, the configuration theory has experienced a relatively late adoption with the publication of Hill and Birkinshaw (2008), who state as being the first one using configuration theory in the field of CE. Since then, many studies did apply a configuration approach (see, e.g., Kreiser et al., 2019; Biniari et al., 2015; Kraus et al., 2011). Recent studies recommend using configuration theory to extend current knowledge in CE (see Kreiser et al., 2019; Hill & Georgoulas, 2016).

In Subsection 2.3.1, the fit between the configuration theory and the research questions will be discussed. Subsection 2.3.2 will then present the theoretical framework of our study.

2.3.1 The relation between our problem statement and the research questions

As described in Subsection 2.2.3, one characteristic of the configuration theory (in contrast to the contingency theory) is the simultaneous focus on (1) multiple structural elements, (2) multiple contextual elements, and (3) performance outputs. Furthermore, the configuration theory acknowledges that multiple organizational configurations (distinct set of structural elements) can be suited equally well to achieve a certain objective. In this subsection, we will discuss how well the configuration theory fits to answer the problem statement and research questions (RQs) of this study.

We start with RQ1, which focuses on defining and distinguishing the different organizational designs of CE programs. We note that CE programs exhibit a wide range of different organizational designs. Many novel programs have emerged in practice in recent years. On the one hand, some of them show clear differences, e.g., corporate venture capital units investing in startups vs. corporate incubators supporting intrapreneurial employees. On the other hand, it can be observed that others are rather similar, e.g., external corporate incubators and external corporate accelerators (see, e.g., Selig et al., 2018; Pauwels et al., 2016). This leads to the need for multiple structural elements to be defined and distinguished for at least the following two reasons. First, defining rather similar CE programs with many common structural elements will require the precise definition of multiple elements, ensuring that they are clearly defined and yet distinguishable from each other. Second, rather different CE programs also appear to require very different structural elements to define them and thereby to cover the wide range of organizational designs (e.g., investing in external startups vs. supporting internal employees). These two reasons indicate that multiple structural elements need to be seriously considered when examining the organizational designs of CE programs. This is consistent with configuration theory.

Next, RQ2 is discussed. This research question focuses on the different types of outputs that can be created by CE programs. As shown in Section 2.1, CE has been associated with different types of value creation, such as (1) the creation of new businesses or (2) the transformation of the organization itself. Depending on the desired objective, companies need to select a CE program that is suitable to work with. This split matches with the configuration theory, which recognizes that performance in achieving a particular objective is influenced by the fit between the multiple structural elements, (the context) and the various performance outputs (see van de Ven et al., 2013). By providing an overview of the different types of outputs created by CE programs, RQ2 builds the basis for (1) a better understanding of the various objectives that can be pursued (intended outputs) as well as for (2) a more nuanced performance measurement of CE programs.

Here we arrive at RQ3. This research question focuses on understanding the relationships between (a) the different CE program types and (b) the outputs that can be generated by them. The analysis of these relationships matches with the perspective of an internal fit applied in the configuration theory. Moreover, the internal fit focuses on how consistent an organization's structure is with its strategy (objectives). On top of that, the internal fit assumes that the higher the internal consistency, the better the performance in achieving the intended outputs.

As described above, the configuration theory matches the three RQs of our study. Hence, the configuration theory, with its general focus on understanding different organizational designs and their suitability to achieve a certain objective, shows that this theoretical perspective also provides a clear fit to the problem statement of this thesis, which we repeat here: “How can established companies effectively use CE programs to support their organizational transformation?”

2.3.2 Theoretical framework

In this section, we will focus on the theoretical framework that is applied in our study. It is illustrated in Figure 2.4 below. In the figure, we have combined the dimensions from configuration theory (based on Figure 2.3) with the specific dimensions for CE programs that are relevant for answering the RQs. This illustrates the relationship between the configuration theory (terms in brackets) and our subject of investigation (terms above brackets).

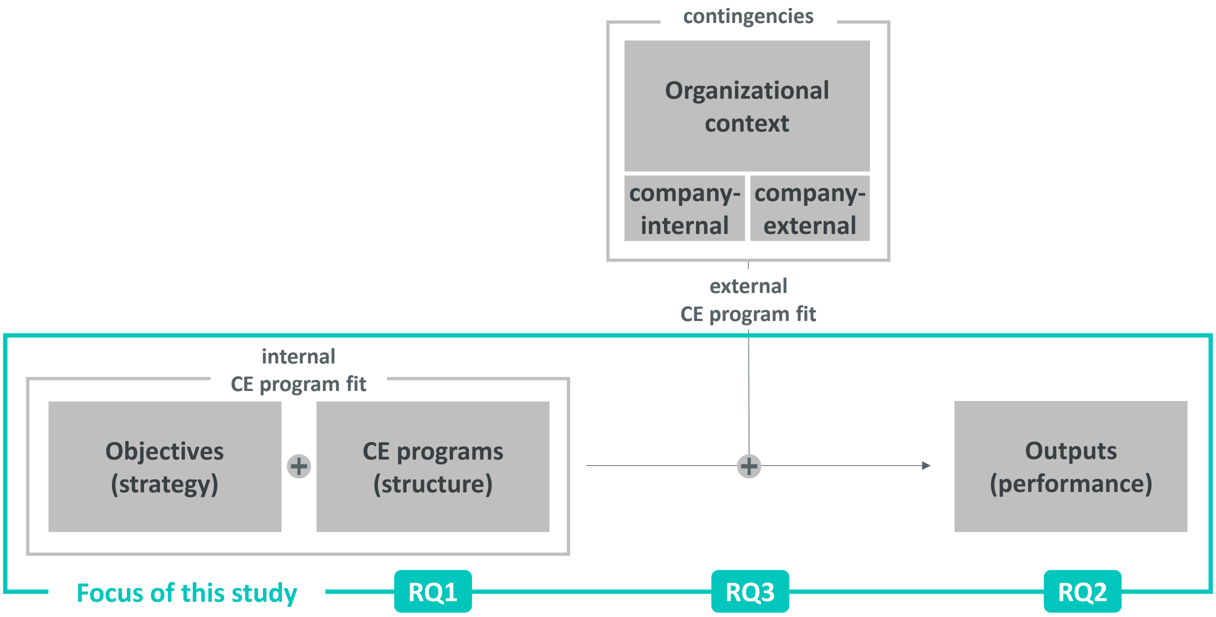

Figure 2.4: Framework of the study

Figure 2.4 includes the four dimensions of configuration theory, namely (a) the strategy, (b) the structure, (c) the performance, and (d) the organizational context. The focus of our study is set on the three dimensions (a to c). They are required to understand the internal fit of CE programs (represented by the mint-colored frame). These three dimensions and their interpretation in the context of CE are briefly described below.

a) *Strategy dimension*: For the effective use of CE programs, it is important to be clear about the specific objectives being pursued. Understanding the different outputs will form the basis for knowing the different objectives that can be achieved.
b) *Structure dimension*: The structure of CE programs is the focus of RQ1. It is described by design elements covering different aspects. For each CE program, a subset of design elements and their different manifestations is used to define them and also distinguish them clearly.

c) *Performance dimension*: The performance, or in our case the value creation of CE programs, is addressed by RQ2. The aim is to develop a harmonized set of outputs that can be created by CE programs. The output will result from the activities of the different CE programs and will serve as a basis for analyzing the performance.

Understanding the **internal fit of CE programs** is improved by identifying the different types of relationships between the CE programs (structure) and their outputs (performance), which is the focus of RQ3. Once it is known what type of outputs can be created by what type of CE program, it is possible to compare how well the CE program matches the objective (the internal CE program fit). For example, if the CE program leads primarily to the creation of new technologies but is intended to support cultural change, the fit between the objectives and the outputs tends to be poor.

To conclude, the configuration theory serves as an appropriate theoretical framework that fits well with the focus of our study. In the next chapter, the research method will be described.

3 Research method

The aim of this study is to deepen the understanding of (a) the organizational design of CE programs and (b) the value creation of CE programs. For both, there is a high degree of uncertainty, which can be mostly traced back to the emergence of new organizational designs and new fields of application whereas both still lack empirical investigations (see, e.g., Kurpjuweit & Wagner, 2020; Selig et al., 2018; Hill & Georgoulas, 2016). To understand the full heterogeneity of CE programs, a comparatively large dataset consisting of 67 semi-structured interviews representing 54 cases was created.

Qualitative research, by its nature, focuses on improving the understanding of a practical phenomenon and is well established in the fields of strategic management and CE (see, e.g., Shankar & Shepherd, 2019; Weiblen & Chesbrough, 2015; Nag & Gioia, 2012; Davis & Eisenhardt, 2011; Kuratko et al., 2001). A qualitative research approach seems well suited for studying the heterogeneity of CE programs for at least two reasons. First, new organizational designs are currently emerging in practice that has not yet been studied. Defining and distinguishing them from existing ones may require different and perhaps previously unknown (or unused) design elements. Second, it is unclear what types of outputs can be created by CE programs, as no harmonized set of outputs exists to date. Consequently, there are no previous studies that focus on comparing outputs across CE programs.

This chapter describes the research method and data to illustrate the empirical basis of our study. Section 3.1 will focus on the data collection. In Section 3.2, a description of the data set is given. Finally, in Section 3.3, our data analysis will be presented.

3.1 Data collection

For data collection, we will deal with the following topics. (A) semi-structured interviews, (B) the content of the interviews, (C) the composition of the data set, (D) description of the roles of the interviewees, and (E) sampling strategy.

A: Semi-structured interviews

We collected semi-structured interviews over a period of five years, starting in June 2015 and ending in July 2020. Most of the interviews were combined with an on-site visit of the respective CE program, while mainly in the last months of the data collection, the interviews were conducted via telephone or video conferencing tools (due to the corona crisis). The use of semi-structured interviews with mostly open-ended questions made it possible to uncover and follow up on new topics that emerged during the interviews and to adapt to the specific characteristics of the respective CE program.

B: Content of the interviews – Interview guideline

The conducted interviews focus on five key themes described in Table 3.1. The interview guideline with all questions can be found in Appendix 1.

Key themes	Focus of investigation	Sample questions
(1) Personal background	Personal information	- What is your name/age? - Educational background?
	Professional career	- How did your professional career develop until today?
	Current job position	- Can you describe your current role within the CE program?
(2) CE program background	Reason for initiation	- What was the company's motivation for starting the CE program?
	Mission and objectives	- What are your objectives? - How are they measured?
	Development over time	- Did you have major adjustments in structure and/or strategy?
(3) Organization of CE program	Structural embedding	- Where are you located in the companies' organigram?
	Program structure	- Are you organized as an own legal entity?
	Level of autonomy	- Which processes/rules are different from core organization?
	Steering of CE program	- How are you controlled/steered by the management?
(4) Mode of operation	Scope of activities	- What are the tasks/activities to run the CE program?
	Program workflow	- Can you explain the process of the program and the stages?
	Type of support	- What do you offer to support the innovation projects?
(5) Value creation and impact	Project results	- How many new businesses or products did you develop?
	Spill-over effects	- What processes, etc. did change in the core organization?
	Success and impact	- What is a successful project in your understanding?
	Enabler/disabler	- What factors were critical for being successful?

Table 3.1: Structure and content of the interviews

C: Composition of the data set

For the data collection, 59 different persons were interviewed. In order to collect missing information, eight follow-up interviews with the same person were conducted, leading to a total number of 67 semi-structured interviews (according to the counting of our data set). These interviews refer to 54 cases belonging to 36 different companies (see Figure 3.1).

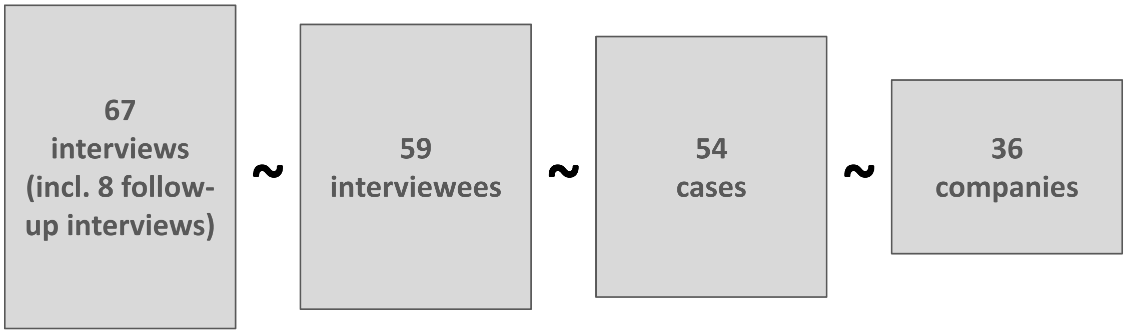

Figure 3.1: Composition of the data set

The discrepancy between the 59 different interviewees and the 54 cases can be explained by the circumstance that five people were interviewed about CE programs that were already included in our dataset. This was done to obtain additional information that could not be provided by the first interviewee. The reasons for this were either that (a) the interviewee entered the CE program at a later stage and did not know about certain facts or (b) the interviewee did not have access to the information due to his or her job position.

The distribution of these 54 cases among the 36 companies is as follows.

- 24 companies with one CE program = 24 cases
- 9 companies with two CE programs = 18 cases
- 1 company with three CE programs = 3 cases
- 1 company with four CE programs = 4 cases
- 1 company with five CE programs = 5 cases

The numbers listed above represent the interviews conducted during our research. This does not reflect the actual number of CE programs operated by the company. For example, in the case of the company where we interviewed five CE programs, there are two others that could not be interviewed due to limited access or changes in the CE programs' leadership team.

D: Description of the roles of the interviewees

The following step is the description of the four different job roles of the 59 interviewees. The number of interviewees per role is indicated in parentheses (# interviewees + # follow-up interviews) after the role name.

1) *Program lead* (40 + 4): The program lead is the person who is responsible for managing the CE program. It typically includes the design and implementation of the program as well as the management of the stakeholders from the core organization.
2) *Managing director* (4 + 1): The managing director is leading a program that is investing in startups. Due to the investments, these programs are quite capital intensive and have different structures, so they can act similarly to professional investors.
3) *Program specialist* (12 + 2): The program specialist can play different roles in the field of business development, viz. marketing or method expert. The program specialist is responsible for the support of the innovation ideas within the program.
4) *Investment manager* (3 + 1): The investment manager is supporting the investment process in startups by scouting and evaluating startups. The investment manager acts as the point of contact for the portfolio companies.

In addition to the semi-structured interviews, further data was collected (see Appendix 2) to ensure triangulation of the information (Yin, 2013). The additional data consists mainly of field notes, social media activities, scientific and practical publications, presentations, press releases, and the website of the respective CE program and the core organization.

E: Sampling strategies

For the data collection, we applied two different sampling strategies, namely *snowball sampling* and *purposive sampling*. They were needed to address the respective situation adequately. Based on two sampling strategies, we can split our data collection into two phases, which will be described below.

Phase 1 (2015 – 2017): In the first phase, we applied a *snowball sampling strategy* for our data collection. This sampling strategy is based on recommendations from one interviewee to another, which allows identifying study participants who are rather difficult to identify. When we started to conduct our semi-structured interviews in June 2015, CE was still a novel topic, and the community in the DACH[5] region was still quite young as not many companies were operating CE programs (only eleven out of 54 cases from our data set did exist before 2015). So, we decided to focus on building a network by using peer-to-peer recommendations from one interviewee to another, which resulted in a total number of twelve interviews (from twelve different cases) that were conducted in phase 1. Based on these twelve cases, the scope of our study became clearer. In addition, CE programs were experiencing high popularity at that time, which can be seen from the fact that 43% of the cases in our data set were launched in the years 2015 and 2016. Due to this changing situation and the better visibility of potential interviewees, we changed the sampling strategy around the end of 2017.

Phase 2 (2018 – 2020): In the second phase, we switched to a *purposive sampling strategy*. This means that we from then purposively selected our interview partners according to the following two aims. First, we wished to collect interviews with all different types of CE programs that were known at the time. Second, we wanted to have multiple cases for each type covered in our data set. During phase 2, a major part of the largest companies in the DACH region were operating CE programs as an element of their innovation and digitalization strategy (Lehnen et al., 2020). This high popularity and visibility allowed us to conduct an additional 55 interviews until July 2020 (end of phase 2). At the end of our data collection, we had created a data set consisting of 67 semi-structured interviews that were representing 54 cases.

To reach theoretical saturation, 15 - 30 interviews are usually recommended (see Mason, 2010). In our case, we exceed this number by a factor of two. This was done on purpose to ensure that the variety of CE programs is fully covered and at least three cases per CE program type were included in our data set.

In Subsection 3.2, background information about the data set will be provided, followed by a general description of the data analysis in Subsection 3.3.

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[5] The DACH region comprises the three countries Germany (D - Germany), Austria (A) and Switzerland (CH - Confoederatio Helvetica). In these countries the German language is largely spoken as a native language. Due to geographical proximity and similarities in their national culture, only companies based in Germany, Austria and Switzerland were covered in this study to reduce the impact of cultural differences.

3.2 Data set

This section will focus on describing the data set of our study. As shown in Figure 3.1, our data set consists of 36 different companies that are representing a total number of 54 cases. We will start this section with three information items having a general background.

1) All interviews were recorded and transcribed for analysis. This resulted in 4,533 minutes of recorded material with a total of 2,257 pages. On average, an interview lasted 68 minutes, with the shortest interview lasting 32 minutes (excluding follow-up interviews) and the longest 117 minutes.
2) Except for one company, all others have their headquarters in Germany, Austria, or Switzerland, which is known as the DACH region. The one exception is a German subsidiary of a large Spanish multinational company. The subsidiary was originally a German-based company that was acquired. It is therefore expected that the subsidiary is culturally similar to the rest of the data set.
3) Eleven of the 54 cases are CE programs located in Silicon Valley. These so-called innovation outposts (Di Fiore, 2017) are initiated to identify and understand trends early on. Since Silicon Valley is recognized as one of the world's leading innovation clusters, many companies from DACH region have launched innovation outposts there.

The next subsections will describe the data set from two different perspectives, namely the company perspective (Subsection 3.2.1) and the CE program perspective (Subsection 3.2.2).

3.2.1 Data set from a company-perspective

The companies in the data set reflect the various facets and characteristics of the DACH-industrial landscape, e.g., the high number of hidden champions, the German Mittelstand[6], and world-leading multinationals. According to configuration theory, the context of an organization has an influence on its structure and performance (see Subsection 2.2.3). Consequently, our data set should not only cover a high level of heterogeneity regarding the different organizational designs of CE programs but also take into account the companies that

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[6] The Mittelstand describes the small and medium-sized companies that can be considered the backbone of the German industry. In addition to size, also the ownership structure (family-owned or family-controlled), the management style (patriarchal culture, flat hierarchy & high degree of informality) and the way of thinking (longevity & value orientation) characterize the Mittelstand (see, Pahnke and Welter (2019); Schmitt et al. (2018)).

are operating them. It is expected that a heterogeneous data set provides results that are more stable, independent from the context the CE program is operating in.

Subsequently, the data set will be described by (A) the industry classes, (B) ownership structure, and (C) company size. This illustrates the level of heterogeneity of the companies covered in our data set.

A: Industry classes

We start our description with the different industry classes to which the companies from our data set belong. For assigning a company to an industry, the NAICS (North American Industry Classification System) was used. NAICS is a common standard to classify industries, e.g., used by the federal statistic agency of the United States of America (see Pierce & Schott, 2012). The codes used in NAICS show different resolution levels, starting with two-digit numbers (11-92) that are representing broad industry titles. For example, NAICS code 11 stands for "Agriculture, Forestry, Fishing and Hunting". Below this number, a more detailed classification can be found, e.g., 11 1211 for "potato farming".

A database (EBSCO host[7]) was used to identify the NAICS code for the companies. Small companies are sometimes not found using the database. Thus, it required a second manual step to assign all companies with NAICS codes. When a company is operating in multiple industries, each NAICS code was counted to show the full range of industries. As a result, more NAICS codes than companies are used to describe the data set in terms of industry classes.

Table 3.2 illustrates the distribution of industry classes in our data set. The table shows eleven different industry classes. It is ordered by percentage, starting with the industry class that shows the highest number in our data set. The largest proportion of companies (40%) is assigned to the manufacturing industry, followed by finance and insurance with 17%. The chemical and pharmaceutical manufacturing, as well as the information class, follow with 11%. Thus, our data set covers a broad spectrum of different industries.

[7] EBSCO host – is service to access various full text database of scientific publications, which is offered by the company EBSCO Information Services.

Industry class	NAICS code	% in our data set
Manufacturing	33	40%
Finance and Insurance	52	17%
Manufacturing (chemical and pharmaceutical)	32	11%
Information	51	11%
Transportation and warehousing	48+49	5%
Utilities	22	3%
Retail trade	44	3%
Professional, scientific, and technical services	54	3%
Other services (except public administration)	81	3%
Construction	23	2%
Administrative, support, waste management, & remediation services	56	2%

Table 3.2: Overall industry classes (NAICS codes)

B: Ownership structure

In our data set, the ownership structure plays an important role. For the companies in our data set the following six types of ownership were identified.

1) *Listed public company:* A company that is listed on the stock exchange and is not majority-owned by one or more families. In most cases, these companies operate as Societas Europaea (SE), which is in the DACH region defined as Aktiengesellschaft (AG).
2) *Family ownership:* A company that is substantially controlled by a family (or a limited number of owners with family ties) and is not listed on the stock exchange.
3) *Hybrid ownership:* A company listed on the stock exchange but is usually still controlled by one or more families.
4) *State-owned:* A company that is entirely or partially owned by the state. That is either Germany or Switzerland in the case of our data set.
5) *Miscellaneous:* Different legal forms of companies that are considered to be rather rare. For example, foundation companies, cooperatives, or research companies.
6) *Subsidiaries:* A special group within our data set are subsidiaries of larger companies. All cases that belong to this category are companies that appear on the market as their own brand but belong to a larger corporation or holding structure.

The subsidiaries in our data set show different types of ownership (family ownership, hybrid ownership, listed corporations, and foundation companies). Since some of them are significantly smaller than the other companies with the same ownership structure, they are highlighted separately in Table 3.3 and Table 3.4.

Within our dataset, companies are distributed in terms of ownership structure as follows.

Ownership (# of companies)	Distribution in %
1. Listed public company (7)	19.44 %
2. Family ownership (8)	22.22 %
3. Hybrid ownership (6)	16.67 %
4. State-owned (5)	13.89 %
5. Miscellaneous (5)	13.89 %
6. Subsidiaries (5)	13.89 %

Table 3.3: Division of the companies according to the type of ownership

C: Company size

For a better understanding of the companies in our data set, they are differentiated according to their size (number of employees) in Table 3.4. We use the following three different types of values to provide a good overview: (1) $E_{MIN,}$ which describes the minimum number of employees, (2) $E_{MAX,}$ which describes the maximum number of employees, and (3) $E_{AVG,}$ which describes the average number of employees.

Ownership	E_{MIN}	E_{MAX}	E_{AVG}
1. Listed public company	34,523	385,000	173,210
2. Family ownership	1,097	64,585	33.179
3. Hybrid ownership	39,000	240,000	113,517
4. State-owned	10,000	546,924	222,249
5. Miscellaneous	2,288	147,797	53,940
6. Subsidiaries	665	58,000	13,028
Total	665	546,924	104,752

Table 3.4: Division of number of employees according to the ownership structure

Following the classification of company sizes according to the common definition used in the European Union (European Commission, 2003), all companies in our data set are defined as large companies. However, as the company sizes range from 665 employees (subsidiary) for the smallest company to more than 540,000 employees for the largest company, a further subdivision by the number of employees is made to give a more accurate picture of the data set (see Table 3.5).

Range of company size	Distribution in %	Avg. # of CE programs
1) Companies with >500 and <1,000 employees	6%	1
2) Companies with >1,000 and <5,000 employees	11%	1
3) Companies with >5,000 and <10,000 employees	8%	1
4) Companies with >10,000 and <20,000 employees	19%	1.29
5) Companies with >20,000 and <50,000 employees	14%	1.20
6) Companies with >50,000 and <100,000 employees	17%	1.33
7) Companies with >100,000 employees	25%	2.33

Table 3.5: Distribution of company sizes in our data set

The data set shows a rather balanced distribution regarding the different company sizes, covering small, medium, and large companies. For the smaller companies up to 10,000 employees (1 – 3 in Table 3.5), we see that they operate only one CE program at a time. The companies larger than 10,000 employees (4 – 7 in Table 3.5) are operating on average 1.49 CE programs in our data set.

It must be stated that these numbers are based only on the cases we collected in our study. While for the smaller companies, it was possible to understand whether all CE programs were investigated, for the larger companies, the total number of CE programs operated by each company cannot be derived from the data. However, cross-checking with a recent consultant study (Lehnen et al., 2020) suggests that the number of CE programs operated by large companies is higher than the 1.49 from our data set.

D: Understanding the heterogeneity

In summary, this subsection has shown that the dataset exhibits high heterogeneity in terms of (A) industry classes, (B) ownership structure, and (C) company size. From a company perspective, the data set represents a cross-section of the industry landscape in the DACH region. This is important because there may be differences in the organizational design of CE programs depending on contextual factors such as industry class, ownership structure, or company size. Covering different manifestations of these factors increases the chance to better understand the heterogeneity of CE programs. Furthermore, it is expected that when the same configuration of CE programs can be found in a different organizational context, the validity of the identified CE program type is even stronger.

3.2.2 Data set from a program-perspective

In this subsection, background information on the CE programs themselves are provided. In the beginning, three superordinate CE program categories are introduced. These are used to present the information in a more detailed manner. The introduction of these categories is necessary for the following two reasons. First, there is nowadays a certain degree of uncertainty about the currently known CE programs (see Section 1.4 or Subsection 2.1.4). Second, the updated list of CE program types that will be developed to answer the first RQ will be presented in Chapter 5. Hence, to present the background information clearly, the three CE program categories appear to be the best way to do it. They are defined as follows.

1) *Internal CE programs*: fostering internal innovation initiatives by supporting intrapreneurial employees or by building new internal capabilities.
2) *External CE programs:* fostering innovation using different types of external means such as the collaboration with or investments in startups.
3) *Radical innovation units*: A collective term for organizational units that are combining multiple innovation activities or formats[8].

The dataset represents a cross-section of different CE programs that, to the best of my knowledge, reflects the full heterogeneity of organizational forms in CE. The 54 cases from our dataset fall into the three categories as follows.

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[8] Examples for names used in practice are innovation lab, digital lab, digital factory, or innovation hub.

1) 23 cases are internal CE programs (from 21 different companies)
2) 20 cases are external CE programs (from 18 different companies)
3) 11 cases are radical innovation units (from 10 different companies)

Having presented the three CE program categories, next the background information will be provided. They will be distinguished by (A) the age, (B) the location, and (C) the size.

A: Age of the CE programs

For calculating the age of the CE programs, the end of October 2020 was chosen as the cut-off date. At that time, the youngest CE program that is still operating has an age of 1.83 years, whereas the oldest, still operating has an age of 24.75 years. The average age across the CE programs is 5.97 years (excluding the ones that were terminated).

Table 3.6 illustrates the age of the CE programs (in years) and compares two groups of (a) only CE programs that are still alive and (b) all CE programs, including the terminated ones.

CE program category	CE programs (still alive)			All CE programs		
	Age $_{MIN}$	Age $_{MAX}$	Age $_{AVG}$	Age $_{MIN}$	Age $_{MAX}$	Age $_{AVG}$
1) Internal CE programs	2.33	9.25	4.44	2.00	9.25	4.18
2) External CE programs	1.83	9.25	4.63	1.83	17.67	5.28
3) Radical innovation units	2.08	24.75	11.82	1.50	24.75	9.47
All CE programs	1.83	24.75	5.97	1.50	24.75	5.76

Table 3.6: Age distribution across the CE program categories

Age comparison of three classes

Below we compare the values of the three CE program categories from the "still alive" group. It can be observed that the internal and external CE programs have similar values for the minimum age, maximum age, and average age. In contrast, the values for the radical innovation units are more than twice as high, at 24.75 for the maximum age and 11.82 for the average age. A possible explanation for this is given on p.69.

For the group of "All CE programs", which also includes those that have been terminated, the general observation can be made that the overall age of CE programs is slightly decreasing. However, looking at each CE program category individually, it can be seen that the maximum age and average age of the external CE program category is increasing. In contrast, for the internal CE programs and the radical innovation units, the average ages are decreasing. To better understand these different developments, the next step is to analyze the terminated CE programs in more detail.

In total, 8 out of 54 CE programs were terminated (or paused), which reflects 14.8% of all cases[9]. Four of them are internal CE programs, three are radical innovation units, and one is an external CE program. Comparing these numbers with the total cases of each CE program category shows the following rates of termination – 27.3% for radical innovation units, 17.4% for internal CE programs, and 5% for external CE programs. This circumstance will be discussed in more detail in Chapter 5 after the introduction of the different types of organizational designs to provide a more nuanced understanding regarding their differences.

In Table 3.7, the CE programs that have been terminated are compared with those that are still alive. The table shows that the overall average age of the group (a) [terminated CE programs] is lower than the ones of the group (b) [CE programs that are still alive]. However, there is one exception, namely the external CE programs in the group (a) which covers only one case with a comparably high age of 17.67 years. This exception also explains the observation from Table 3.6 that the age of internal CE programs and radical innovation units decreases when terminated cases are included, while the age of external CE programs increases.

CE program category	**(a) CE programs (terminated)**			**(b) CE programs (still alive)**		
	Age $_{MIN}$	**Age $_{MAX}$**	**Age $_{AVG}$**	**Age $_{MIN}$**	**Age $_{MAX}$**	**Age $_{AVG}$**
1) Internal CE programs	2.00	3.83	2.98	2.33	9.25	4.44
2) External CE programs	17.67	17.67	17.67	1.83	9.25	4.63
3) Radical innovation units	1.50	3.00	2.42	2.08	24.75	11.82
All CE programs	1.50	17.67	4.60	1.83	24.75	5.97

Table 3.7: Comparing age of CE programs that are terminated vs. still alive

[9] The number of terminated CE programs in our study does not reflect a general termination rate for CE programs. Due to our study design, we only interviewed CE programs that were operating. Of the 54 cases, eight were terminated by the end of October 2020. Examining the overall termination rate would require a different study design that captures both (a) CE programs that are still operating and (b) CE programs that have already terminated over a period of time.

Reasons for termination

Generally, the termination of a CE program is a strong indicator of the fact that it was not successful (see Burgelman & Välikangas, 2005). In order to better understand the differences in the age of the CE programs, a deeper look at the reasons for the termination of the eight cases has been made. For that investigation, we collected follow-up data (through desk research or follow-up messages with our interviewees).

This process revealed that five of the eight CE programs were terminated because they either (a) did not meet the expectations of the core organization or (b) the economic situation in the core business became worse. For the remaining three cases, the interviewees stated that the CE program was replaced by a larger one that was initiated due to the previous positive experiences. In this case, the activities of a CE program can be seen as rather successful since the company has understood its value.

Two reasons are more closely investigated and lead to a further distinction into the following two groups: (a) the ones that were terminated and perceived as being *unsuccessful* and (b) the ones that were terminated but replaced by a successor CE program, which was seen as *rather successful*. Moreover, the external CE program (age of 17.67 years) belongs to group b as it has been replaced by an even larger, company-wide program to intensify the collaboration with startups.

Figure 3.2 is showing these two groups and the respective average ages of the CE programs.

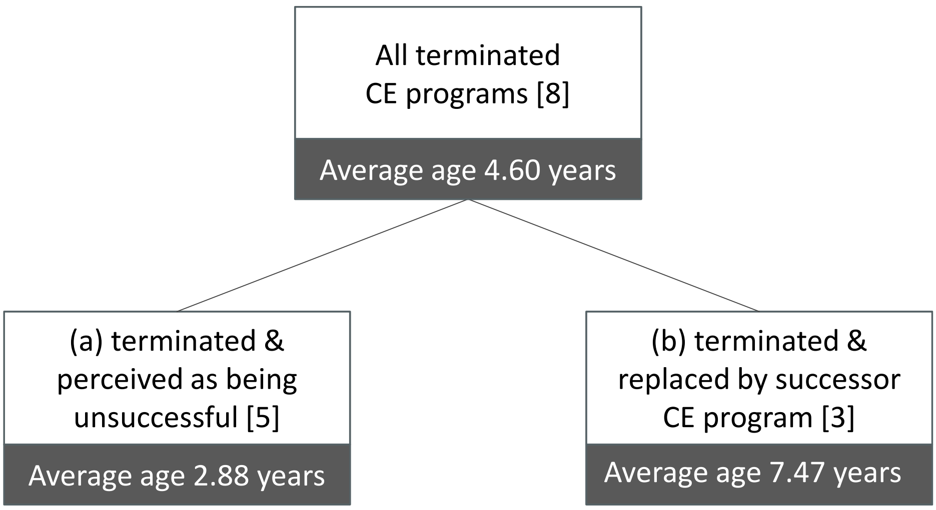

Figure 3.2: Different groups of terminated CE programs

Distinguishing the terminated CE programs into two groups shows that the ones that are terminated and perceived as being unsuccessful have an average age of only 2.88 years. This is significantly lower than the average age across all CE programs in our data set (5.76 years, see Table 3.6). The fact that terminated CE programs, which are perceived to be unsuccessful, have an average age of only 2.88 years supports the assumption that unsuccessful CE programs are terminated relatively soon after their initiation (Ma, 2020; Burgelman & Välikangas, 2005). Furthermore, it must be noted that not all CE programs that are closed are perceived as being unsuccessful, especially not when they are replaced by a successor CE program (see (b), with an average age of 7.47 years).

Subsection conclusion

This subsection has shown that the age of the CE programs shows a broad range from 1.83 for the youngest one and 24.75 years for the oldest still operating one (see Table 3.6). Furthermore, the data shows that between the ones that are terminated and the ones that are still operating, a strong difference in their age can be observed. In that respect, it is important to consider the reason for the termination of the CE program, as the cases in our data set indicate that not every CE program that is terminated is unsuccessful. However, for the ones that are being perceived as rather unsuccessful, the average age is much lower.

B: Location of the CE programs

Our study includes CE programs from companies headquartered in the DACH region and one from a German subsidiary of a large multinational corporation from Spain. A large proportion of the CE programs is located in Germany (39 cases); of them, one case belongs to a Swiss company. Only two cases are located in Switzerland and one in Austria. In addition, twelve cases are so-called innovation outposts located in Silicon Valley (USA), of which eleven are German companies, and the remaining one is Swiss.

In most cases, the CE programs were located close to the main office[10] of the respective company. The locations for the three CE program categories are as follows.

- *Internal CE programs*: 19 of the 23 internal CE programs were located near the main office. In the other four cases, the CE programs were located in innovation hotspots

[10] Some companies did have multiple main offices, e.g., when having several large business units, but only one headquarter. The term main office is used as a CE program is not necessarily located nearby the headquarter.

(two in Silicon Valley, two in Germany). In two cases, the internal CE program was located in multiple locations, including close to the main office.

- *External CE programs*: Twelve out of the 20 external CE programs were located near a main office in the DACH region. The remaining 8 CE programs did have their location in innovation hotspots (seven in Silicon Valley, one in Berlin), whereof four of them did operate multiple locations worldwide.
- *Radical innovation units*: Eight out of the eleven radical innovation units were located close to the main office. The three remaining ones were located in Silicon Valley.

Distinguishing the CE programs according to their location shows that there is a difference in age between the CE programs located in (a) the DACH region vs. the ones located in (b) the Silicon Valley. Table 3.8 illustrates the difference in age between the two geographical groups.

CE program category	(a) CE programs (DACH region)			(b) CE programs (Silicon Valley)		
	Age $_{MIN}$	Age $_{MAX}$	Age $_{AVG}$	Age $_{MIN}$	Age $_{MAX}$	Age $_{AVG}$
1) Internal CE programs	2.00	9.25	4.25	2.75	2.75	2.75
2) External CE programs	1.83	8.42	4.44	2.25	17.67	6.87
3) Radical innovation units	1.50	18.83	5.25	20.33	24.75	22.14
All CE programs	1.50	18.83	4.47	2.25	24.75	10.66

Table 3.8: Age distribution of CE Programs without innovation outposts

Subsection conclusion

The comparison of the two geographical groups (DACH region vs. Silicon Valley) shows that the CE programs located in Silicon Valley have a significantly higher age than those in the DACH region. The average age for all CE program categories is 10.66 years for those in Silicon Valley, more than double the age of those in the DACH region at 4.47 years. In addition, the following things can be stated about the two geographical groups.

1) The category of internal CE programs includes only one case located in Silicon Valley. This case is among those that were paused during the Corona crisis, which may explain why the average age of the CE program category is lower than those in DACH region.
2) Radical innovation units located in Silicon Valley show the highest values for minimum, maximum, and average age among all cases. With an average age of more than four

times that of the radical innovation units in the DACH region, they appear to be a major driver of the difference in average age between the two geographical groups.

C: Size of the CE programs

The third type of background information is the size of the CE programs. In general, it can be observed that the size of the CE programs shows a wide range, with the smallest program employing only one person, in contrast to the largest with 300 employees. The average size according to the three CE program categories is as follows.

- Internal CE programs = 10.93 employees on average
- External CE programs = 9.45 employees on average
- Radical innovation units = 75.82 employees on average

For explaining the differences between the average size of internal and external CE programs on the one hand and the radical innovation units on the other, a better understanding of the different organizational designs seems to be required. This understanding will be provided in Chapter 5 by introducing an updated list of the different types of organizational designs that have been identified in our study. Having defined these types, the size and the other background information will be described and discussed in a more detailed way.

Subsection conclusion

To conclude on the data set, the cases covered by the data set show a high degree of heterogeneity regarding the three types of background information (A) age, (B) location, and (C) size. This is supportive for understanding the heterogeneity of (1) the organizational designs and (2) the value creation of CE programs for the following two reasons.

Organizational design: A larger number of cases located in different geographic regions (DACH region and Silicon Valley) is helpful to understand the full range of different organizational designs, as they may be influenced by external contextual factors. In addition, looking at CE programs with different levels of maturity provides an opportunity to examine whether and how organizational designs change over time or if they are similar regardless of their age.

Value creation: With an average age of 5.97 years, the CE programs in our data set appear to be well suited for examining the value creation of CE programs, as it is expected that some outputs will require a longer time frame to become observable. Furthermore, the different locations of CE programs may be appropriate for revealing certain types of outputs that are different or unique to the area in which they are located. For understanding value creation, the size of the CE program also seems to be an interesting element, as more available resources (i.e., number of employees) may influence the variety or intensity of outputs.

To conclude on Section 3.2, the data set seems well suited to answer the RQs of our study.

3.3 Data analysis

This section will focus on the data analysis of our study. A purely qualitative research method will be used to answer the RQs. Our data analysis will follow grounded theory principles, which is one of the most established and widely used approaches (see Bell et al., 2019). The grounded theory goes back to Glaser and Strauss and their work from 1967.

In Subsection 3.3.1, the three-step coding process will be described. Subsection 3.3.2 focuses on answering the RQ1 to RQ3. Subsection 3.3.3 is describing the actions that were undertaken to ensure the quality of our research.

3.3.1 Coding process following grounded theory principles

The grounded theory coding process follows a three-step process that is divided into (A) *open coding, (B) axial coding,* and *(C) selective coding*. Throughout the entire coding process, continuous comparison and theoretical embedding are important tools to improve the quality of the results. The three coding steps will focus on the aspects described below (see Bell et al., 2019; Walker & Myrick, 2006; Strauss & Corbin, 1994). After that, we describe the *application* of the three coding steps.

A: Open coding in theory

In the open coding step, the data (consisting of interview transcripts, field notes, and other secondary sources) will be analyzed line by line. The aim is to identify and conceptualize different concepts and phenomena that occur in the data. The result of this coding step will be a large number of codes that are into broader categories (higher-order concepts).

B: Axial coding in theory

The axial coding step focuses on identifying relationships and patterns between the codes and categories described in the open coding. Therefore, the codes are examined for causal conditions, context variables, interaction patterns, or consequences of actions or interactions.

C: Selective coding in theory

The selective coding step focuses on the core category, also called the core variable, which is the central topic of the research. The aim is to systematically link additional categories to the core and to identify and validate relationships between the categories. The result is a holistic understanding of the core variable. For this purpose, the data set is continuously expanded (theoretical sampling) until saturation is reached.

Having described the three general steps of the grounded theory, their *application* in the course of our study will be discussed below.

A: Applied open coding

The aim of the open coding step is to identify the different relevant themes for answering our RQs. This step resulted in the three themes of (a) organizational designs and design elements to describe CE programs, (b) value creation and outputs created by CE programs, and (c) contextual factors that seem to influence the work of CE programs. For the coding of the interviews and the additional data, we used the content analysis program NVIVO 10. The open coding resulted in 184 concepts (codes) that were identified, as counted by the author.

B: Applied axial coding

The aim of the axial coding step is to align and harmonize the codes that resulted from the open coding. The focus was set on the two themes of (a) organizational design elements and (b) the outputs of CE programs since they build the basis for answering RQ1 and RQ2. Due to the different starting points in terms of existing knowledge on the two themes, two different approaches were chosen in order to harmonize them.

- For the organizational designs of CE programs, several studies exist (see, e.g., Gutmann, 2018; Weiblen & Chesbrough, 2015). To ensure a good theoretical embedding, it is relevant to consider these existing results (Gioia et al., 2013). The concepts from open coding were aligned with design elements derived from literature, resulting in a set of 26 design elements.
- In contrast to the organizational design, for the value creation of CE programs, there are no previous studies that are comparing different types of value creation of CE programs. The concepts identified in the open coding step were aligned to create a set of outputs that are applicable across the different CE programs.

C: Applied selective coding

The aim of the selective coding is (a) coding all cases and (b) making a targeted enlargement of the data set. The coding coincides with the continuous comparison of the codes and the data. During the process, the codebooks for the organizational design elements and the outputs were continuously adjusted, which resulted in 26 codes for the design elements and 27 codes for the outputs of CE programs.

3.3.2 Answering the research questions

The coding process described above built the basis for answering the RQs of our study. The next paragraphs will describe how codes that were derived from the coding process are used to answer the RQs.

RQ1: What are the different types of CE programs?

The first RQ focuses on defining and distinguishing the different types of CE programs. The following steps were undertaken. First, the 26 codes (derived from the data and literature) were used to create a morphological box[11]. The box consists of (a) the design elements and (b) the element characteristics. For example, (ad a) innovation type is considered a design element, and (ad b) process innovation or product innovation are considered as two potential characteristics. For each of the 54 cases, such a morphological box was created. It serves to represent the specific organizational design of the case. Second, the cases were compared with each other. This resulted in the identification of cases that share a high degree of similar design elements, which represent one CE program type. Third, based on these cases and the design elements, for each CE program type, the following holds: (1) a definition was provided, and (2) design elements were highlighted that are suited to distinguish one type from another.

RQ2: What types of outputs are created by CE programs?

In contrast to the organizational designs, the codes for the value creation of CE programs do already represent the answer for the second RQ. The harmonized set of 27 outputs (codes) created through the coding of the interviews represents the different types of value creation through CE programs. To provide a clear answer for RQ2, the outputs were clustered into

[11] In general, morphological analysis is a structured approach for investigating a variety of possible solutions, which is suited for multidimensional, complex problems that are non-quantifiable Ritchey (2011b).

seven categories and described clearly. For further empirical embedding, they were complemented with quotes from the data.

RQ3: Can causal relationships between CE programs and their outputs be identified?
Having understood the different types of CE programs and outputs, they are now investigated for relationships between them. For the investigation of the relationships, different types of analysis, e.g., box analysis, coding comparison, and crosstables, were executed. The content management program NVIVO 10 was used to run different analyses automatically, allowing an easy comparison of different variables, which is helpful for identifying patterns and differences. This step resulted in the identification of different types of relationships between the CE program types and the outputs, which answers RQ3 by showing how they are related.

3.3.3 Ensuring the quality by five criteria

Ensuring the quality of research is a highly relevant topic. Meanwhile, it is acknowledged that the quality criteria for quantitative and qualitative studies are different (see, e.g., Bell et al., 2019; Frambach et al., 2013). In quantitative research, the focus is set on the criteria of *validity* and *reliability* (see Bryman et al., 2008), which, however, do not apply to qualitative studies (see Korstjens & Moser, 2018).

In general, quality criteria for qualitative research are frequently and controversially discussed (cf. Bell et al., 2019; Korstjens & Moser, 2018; Tracy, 2010; Bryman et al., 2008). In the course of this work, we follow the five quality criteria described below that are proposed by various authors (see Stenfors et al., 2020; Korstjens & Moser, 2018).

(A) *Credibility*: how trustable and believable are the findings to others?
(B) *Transferability*: is there a potential application of the findings in another field?
(C) *Dependability*: how consistent are the findings in relation to the context of the data?
(D) *Confirmability*: how clear are the findings embedded and derived from the data?
(E) *Reflexivity*: is the researcher aware of their impact on the research process?

For the five quality criteria, we did apply in a total of 18 actions which will be described subsequently. The respective actions are guided by recommendations from the literature on how to ensure quality in qualitative studies (see Stenfors et al., 2020; Korstjens & Moser, 2018; Treharne & Riggs, 2015; Frambach et al., 2013). A list of definitions for the eight terms highlighted in italics in this subsection will be provided in Appendix 3.

A: Ensuring credibility

For ensuring credibility, which focuses on the extent to which others can trust the results, the following six actions have been undertaken.

- Using multiple data sources, such as interviews, internal documents, company presentations, or press releases to achieve triangulation of data.
- Collecting follow-up data, either through interviews or messages, to resolve ambiguities and to collecting missing information in order to ensure a holistic and comprehensive understanding of each case.
- Discussing the findings with some of the interviewees to verify/falsify conclusions drawn from the interviews.
- Presenting the findings at practitioners' conferences to receive additional feedback and to strengthen the credibility among the practitioners to build more trustworthy relationships with the interviewees.
- Using recommendations from interviewees or academic colleagues to establish a good level of trustworthiness when conducting new interviews.
- Using quotations to underline findings and make them easier for the reader to understand.

B: Ensuring transferability

For ensuring transferability, which focuses on the degree to which the results can be transferred to other fields of application, the following three actions were undertaken.

- Documenting the research process and providing detailed descriptions of the data set, including various background information on the companies and the CE programs.
- Conducting a data set that is comparably large with 54 cases that are covering the full heterogeneity of CE programs.
- Having covered cases from the three countries of the DACH region and so-called innovation outposts located in the Silicon Valley. Different cultural and economic contexts of the cases strengthen the transferability to other countries that share similar characteristics.

C: Ensuring dependability

To ensure dependability, which focuses on the extent to which the results are consistent given the context in which they were generated, the following three actions were performed.

- Striving for theoretical saturation in two ways. First, by having covered all the different organizational designs that were known at that time (covering full heterogeneity). Second, by having collected multiple cases for each CE program type to better understand their differences and similarities.
- Iterating multiple times through the data and applying different perspectives when analyzing them. By frequent publications (at least one publication per year) the findings were additionally reviewed by other academics.
- Using semi-structured interviews with open-ended questions to ensure that a holistic understanding of the phenomenon was created. Preliminary interviewing training exercises and debriefing of interviews to ensure good quality interviews.

D: Ensuring confirmability

For ensuring confirmability, which focuses on how well the findings are embedded into the data (reducing the researchers' bias), the following four actions were undertaken.

- Using accurate transcriptions of the semi-structured interviews to capture nuances and slight differences in the various concepts. Furthermore, the use of a software tool for coding and analyzing the data.
- Discussing the results, new ideas, as well as any ambiguities in the data with colleagues from the research institute to ensure a more objective interpretation.
- Discussing results with a fellow researcher who has extensive experience in the field of corporate entrepreneurship to reduce own biases in data analysis and to strengthen the trustworthiness of the results.
- Conducting the first 15 interviews jointly with colleagues from the research institute to (a) increase the quality of the interviews through a post-interview feedback session and (b) reduce ambiguities in initial interpretations and the formation of first ideas.

E: Ensuring reflexivity

For ensuring reflexivity, which focuses on how aware researchers are regarding their own role within the study, the following two actions were undertaken.

- Visiting an annual, European-wide graduate school, to receive feedback from other Ph.D. students and experienced scientists and to reflect on my research activities.
- Collecting ideas, future research avenues, good practices, or open questions in a notebook that was used throughout the research process.

Subsection conclusion

The 18 actions described above were performed throughout the research process. The aim of them is to strengthen each of the five quality criteria (A to E) in order to ensure a high quality of the results of our study. Each of the five criteria is expected to contribute to a higher quality of the research (see, e.g., Stenfors et al., 2020).

However, there is no weighting for the five criteria, and consequently, it is rather difficult to evaluate the relative and exact contribution of each of the 18 actions that were undertaken. Nevertheless, the actual undertaking of these actions is recommended by previous studies (Korstjens & Moser, 2018), which will, in our opinion, contribute to a higher quality level and the *trustworthiness* of our results.

4 A systematic approach to analyze CE programs

The aim of this chapter is (1) to derive *design elements* that are suited to define and distinguish CE programs and (2) to develop a *systematic approach* for analysis of our data set. This aim forms the basis for answering RQ1 - *What are the different types of CE programs?* The investigation of organizational designs has been a topic of interest since the early days of CE research and is still a relevant topic today (e.g., Gutmann, 2018; Burgelman, 1984).

In Section 4.1, the CE programs discussed in the literature will be re-arranged in an overview of the current knowledge. Section 4.2 will focus on deriving design elements from (a) the existing literature and (b) our data set. These two sets of design elements will be harmonized in Section 4.3. In Section 4.4, the systematic approach that was developed to analyze CE programs will be presented.

4.1 CE programs and unclarities regarding their definitions

One aim of our research is to understand the heterogeneity of the organizational designs of CE programs. It can be observed that in the past years, the heterogeneity of organizational designs is increasing due to the emergence of novel types of CE programs (see, e.g., Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019; Peter, 2018; Selig et al., 2018). To ensure a good theoretical embedding of our results and to build on the existing knowledge about the various CE programs, this section will provide a brief overview of the previous research conducted on CE programs.

In Subsection 4.1.1, we will describe the CE program types that have already experienced a larger number of empirical studies. In Subsection 4.1.2, the more novel CE program types and the accompanying ambiguities will be discussed. Subsection 4.1.3 will briefly summarize the different CE program types.

4.1.1 Established types of CE programs

Below, we briefly describe the four CE program types that have received considerable attention in previous studies and are thus considered well-established organizational designs in research. Since only well-established CE programs are described, this list does not aim for any completeness. The four CE program types are (1) internal corporate incubator, (2) external corporate incubator, (3) external corporate accelerator, and (4) corporate venture capital.

(1) *Internal corporate incubators*, sometimes also termed intrapreneurship programs (see Chettipally, 2020; Rule & Irwin, 1988), are focusing on the support of innovation ideas from intrapreneurial employees (Becker & Gassmann, 2006a). An internal corporate incubator is structured as an organizational entity that provides an environment that is supportive for the creation of rather discontinuous innovation or non-core business innovation (see Weiblen & Chesbrough, 2015; Ford et al., 2010). The programs mostly support cohorts of intrapreneurial teams by providing them access to resources and support services for a limited period of time. The start and end points are often clearly defined according to a batch logic. At the end of each batch, a jury (often made up of senior management representatives) evaluates the ideas and decides whether the project is to be terminated or continued. In case of continuation, the ideas are either (a) re-integrated into the core organization, e.g., by creating a new department, or (b) by being spun-off into a new organization (Ford et al., 2010).

(2) *External corporate incubators* are programs similar to their internal counterparts, but with a major difference, viz. that the focus is set on working with external startups instead of intrapreneurial teams (see Eckblad & Golovko, 2016; Becker & Gassmann, 2006b). External corporate incubators support their startups with different resources and services, ranging from office spaces, mentoring & coaching, and access to a corporates' resources like expertise, know-how, and network (Becker & Gassmann, 2006b). In addition to that, they mostly act as a seed investor (investing startups with an early stage) and thereby provide funding for the program participants (Kupp et al., 2017)[12]. The focus on rather early-stage startups comes in hand with a comparably long program duration of typically more than one year to support the startups until market readiness (Cohen, 2013). Companies run external corporate incubators for several reasons, such as (a) insights into trends and new technologies, (b) accessing innovative solutions from startups, and (c) leveraging existing technologies into a new field of application through the participating startups (Eckblad & Golovko, 2016).

(3) *External corporate accelerators* are focusing on collaboration with external startups. Similar to external corporate incubators, they do also support startups with resources and services such as the companies' expertise, network access, office spaces, coaching, and

[12] In this publication Deutsche Telekoms Corporate incubator hub:raum is described as an accelerator. However, according to the understanding about CE programs in this work and the self-conception of hub:raum's website, it is more likely an external corporate incubator than an external corporate accelerator.

mentoring (Kohler, 2016). Hence, it is not surprising that they are sometimes described as a new generation of corporate incubators (Pauwels et al., 2016). However, there are four key distinctions compared to external corporate incubators. *First*, the shorter duration of the accelerator program, which typically ranges from three to a maximum of six months (Moschner et al., 2019). *Second*, the program organization typically follows a batch logic, meaning the program phase has fixed starting and ending dates and is run multiple times per year (see Kohler, 2016; Weiblen & Chesbrough, 2015). *Third*, the maturity of participating startups, which are more mature as the aim is to accelerate their growth of already existing products (Selig et al., 2018). *Fourth*, the funding that is provided by external corporate accelerators does not necessarily cover an equity investment into the startups. Studies have identified different modes of external corporate accelerators and different types of value creation, e.g., testing innovative solutions (Kohler, 2016), positive impact on the brand (Moschner et al., 2019), or talent acquisition (Kanbach & Stubner, 2016).

(4) *Corporate venture capital* units are initiated to invest a minority stake in promising startups to create strategic or financial value for the core organization. Corporate venture capital is one of the most renowned CE programs and has been the subject of investigations for several decades (see, e.g., Dushnitsky & Lenox, 2006; Sykes, 1990; Winters & Murfin, 1988). Besides the difference in their focus (strategic vs. financial), corporate venture capital units can also vary regarding their organization and structure. While some companies invest directly into startups, others may pursue indirect investment through an external venture capital fund (see Maula, 2007; Miles & Covin, 2002). Furthermore, the objectives of why companies pursue corporate venture capital activities show a broad variety. The objectives can range from gaining access to new technologies (see Benson & Ziedonis, 2009; Markham et al., 2005), via learning about trends and developments (Markham et al., 2005), and exploring options to enter new markets (Chesbrough, 2000) towards changing the company’s culture (Sykes, 1990).

Established types of CE programs and their successors

The four CE programs described above have experienced a broad base of empirical investigations over the past five years. It is important to have a clear understanding of them since (a) they are the most commonly used concepts in research on CE and (b) many novel types of CE programs show a relationship to these four CE program types (see Shankar & Shepherd, 2019; Pauwels et al., 2016). The novel types of CE programs will be discussed in the next subsection.

4.1.2 Novel types of CE programs

With the increasing interest in CE, it can be observed that novel CE programs are emerging in practice. Four examples are (a) startups supplier programs (Peter et al., 2018), (b) corporate company builders, (c) internal corporate accelerators, and (d) venture client models (see, e.g., Kurpjuweit & Wagner, 2020; Peter, 2018; Selig et al., 2018; Gimmy et al., 2017).

Still, these rather novel CE program types either (a) lack a broader base of empirical research or (b) do not yet have a clear definition because the same CE program type is discussed under different names, or the same name is used to describe different CE program types. Due to these two reasons, ambiguity regarding the organizational designs of CE programs exist.

Discussion and ambiguity

For CE programs that are focusing on engagement with startups, this ambiguity can be observed. Here we note that at least three *different* names are currently used to describe the same organizational design. The two terms, *startup supplier program* and *venture client*, are both used for describing a CE program that focuses on scouting innovative startup solutions that can solve current business problems (see Kurpjuweit & Wagner, 2020; Gimmy et al., 2017). Aside from using different terms for the same organizational design, the researchers seem to agree that this is a novel type of CE program that is distinct from existing ones. Other scholars, however, follow the understanding that this is a manifestation of the external corporate accelerator, but not a novel CE program type (see Shankar & Shepherd, 2019). This example on startup engagement highlights the *ambiguities* that currently exist regarding the organizational design of CE programs and underlines the *need for a systematic approach* to analyze and compare CE program types. We will present such an approach in Section 4.4.

4.1.3 Structure and overview

Figure 4.1 covers the four CE program types from Subsection 4.1.1 (numbered 1 - 4) and three examples for novel CE programs (dotted lines) that were discussed in Subsection 4.1.2. In the figure, the CE programs are subdivided according to their locus of opportunity (internal vs. external), which describes to what extent they are either focusing on (a) supporting internal innovation ideas[13] of their employees or (b) sourcing external innovation ideas from startups.

The fact that a broader base of empirical research does not yet exist for nearly half of the CE programs (included in the figure) highlights the need for more research on the organizational designs of CE programs. In addition, many of the well-established CE programs and their understanding have grown historically, and in some cases, are already outdated (see Pauwels et al., 2016; Becker & Gassmann, 2006b).

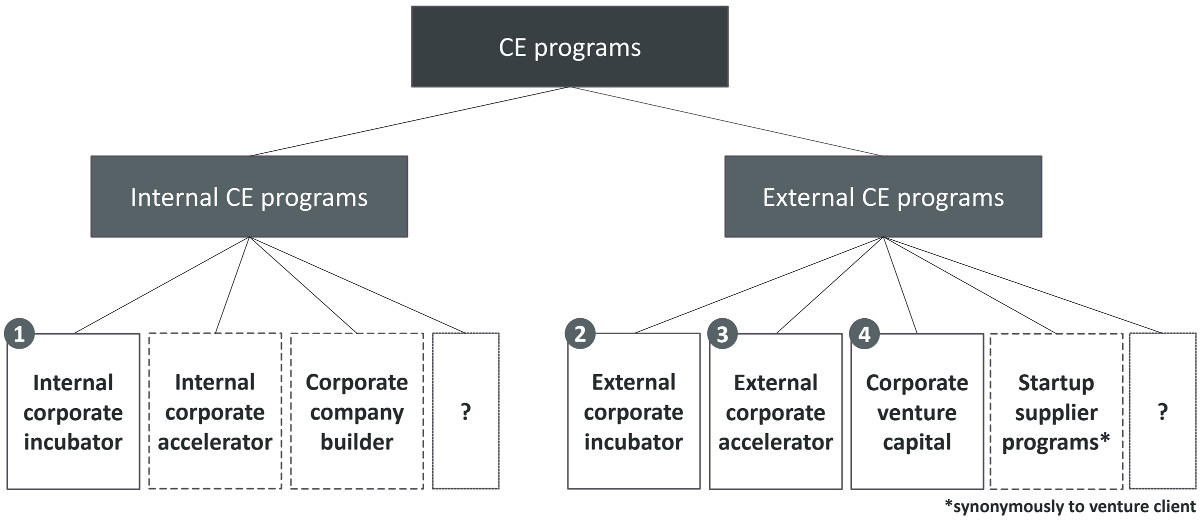

Figure 4.1: Different types of CE programs described in the literature

Understanding the variety of CE program types that are currently discussed in the literature is also important for deriving the design elements that are suited to define and distinguish the different types of CE programs. All CE program types from Figure 4.1 will be considered when reviewing the literature for design elements, which will be done in Section 4.2.

[13] Innovation idea is used as an umbrella term for ideas, concept as well as corporate ventures and independent ventures, which are involved in the work of the CE program.

4.2 Design elements of CE programs

In this section, the focus is set on deriving the design elements that are suited to define and distinguish the different types of CE programs. In the course of this work, a design element is understood as follows.

> **Definition 4.1** *Design elements* are defined as the various elements that are describing the strategy and the structure of an organization that are suitable for characterizing its organizational design.

As outlined in Section 4.1, regarding the investigation of organizational designs of CE programs we can see on the one hand a broad base of empirical investigations for some well-established CE program types and, on the other hand, a lack of investigations and ambiguities for rather novel types of CE programs. Based on this classification, we have decided to apply a hybrid approach to derive the design elements from (a) the existing literature on CE programs (13 studies – see Appendix 4) and from (b) the cases covered in our data set (54 cases – see Subsection 3.2.2) that includes both established and novel CE program types.

Figure 4.2 below illustrates our methodology to identify design elements, in which we combine design elements from (A) the literature and (B) our data to derive the ones that answer RQ1. Subsection 4.2.1 describes Steps 1 & 2, which focus on deriving the design elements from literature, based on 13 studies. Next, subsection 4.2.2 describes Step 3, which focuses on deriving the design elements based on our data (54 cases). Although the steps are described sequentially, it is important to note that an iterative approach was used to derive the design elements in Step 2 and Step 3, as this is crucial for aligning them. In Section 4.3, Step 4 will be described, which focuses on combining them to create the final set of design elements that are suited to define and distinguish CE programs. After the harmonization of the design elements, we will present an approach to systematically analyze the organizational designs of CE programs in Section 4.5.

Each of the four steps that are described in Figure 4.2 results in a set of design elements (see Set I to Set IV in Figure 4.2). For a detailed description of the sets, a separate Table is provided that describes the respective design elements within the set (see Table 4.1 to Table 4.4).

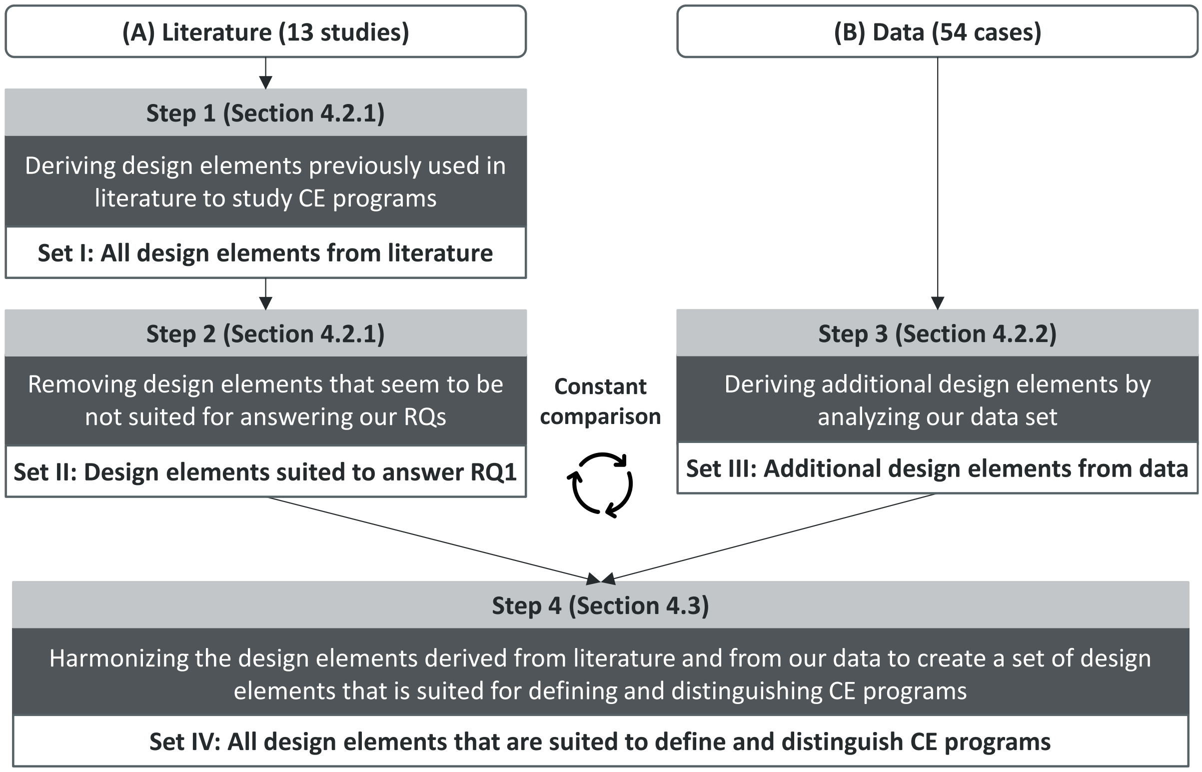

Figure 4.2: Four steps for deriving design elements as a basis to answer RQ1

4.2.1 Design elements derived from literature

For analyzing the literature on the organizational design of CE programs, we did focus on all studies that investigated the CE programs by using design elements. Generally, two types of studies can be identified: (a) studies that are using typically two design elements to create a rather broad categorization of organizational designs of CE (Hill & Birkinshaw, 2008) and (b) studies that are using multiple design elements (more than two) to provide a more detailed description or comparison of them (Weiblen & Chesbrough, 2015). Since RQ1 focuses on defining and distinguishing the different CE program types, we excluded studies that have a scope on broad categorizations of CE programs as it can be expected that the design elements used are not suited for defining the different CE program types.

Reviewing the literature led to 13 studies that did use multiple design elements in their investigation of CE programs. An overview of these 13 studies is provided in Appendix 4, which presents (a) the focus of the study, (b) the design elements that were applied, and (c) the respective reference. In total, these studies cover 103 design elements that were used. Analyzing the 13 studies shows that they can be grouped into four different types of studies according to their focus of analysis.

1) **Single CE program studies:** Studies that focus on a single CE program in their study and use organizational design elements to define it. With six out of 13 studies, they reflect the majority of the studies. Mainly the two CE program types of the external corporate accelerators and corporate venture capital are subject of investigation.
2) **Comparing similar CE programs:** Studies that are comparing rather similar CE programs, such as external corporate accelerators vs. startup supplier programs (Kurpjuweit & Wagner, 2020). In total, three out of 13 studies show this focus. They are using design elements to highlight differences between the CE programs.
3) **Comparing internal and external CE programs:** Studies that compare multiple internal and external CE programs. Studies that focus on the comparison of heterogeneous CE program types are most similar to our study and have been examined two out of 13 times in the reviewed studies (e.g., Gutmann, 2018; Weiblen & Chesbrough, 2015).
4) **Theoretical typologies:** Studies that are using design elements to theoretically distinguishing CE activities into different typologies. Three out of 13 studies show this scope, which is more high level than the ones focusing on specific CE programs.

For selecting design elements that are suited to answer the first RQ of our study, we focus on the studies that are comparing different CE programs. Hence, the ones that investigate only one CE program type at a time (type 1) and the studies that focus on a rather broad range of CE activities (type 4) are excluded. This is done since studies that focus on one CE program use design elements that are too narrow and specific for the scope of our research. In contrast, the studies that focus on typologies for many CE activities use design elements that are expected to be too broad for distinguishing the various CE programs. Removing these studies leads to four studies that are remaining with 42 design elements (Set I) as a result of Step 1.

An overview of all design elements that are derived from literature is provided in Table 4.1. They are grouped into two dimensions, viz. *strategy* and *structure.* The grouping is according to the configuration theory that is applied as a theoretical perspective (see Section 2.3). The strategy dimension focuses on all design elements that are describing the scope and orientation, whereas the structure dimension is focusing on design elements that are describing the governance, processes, and embedding of the CE programs.

In addition to the grouping according to strategy and structure, the design elements in Table 4.1 are also grouped regarding their *content*. Design elements that describe the same content are listed in the same row within the table. For example, (4) *main goals* and (5) *program objective,* (6) *initial purpose*, and (7) *prioritization of objectives,* which are all focusing on the objective of a CE program, are listed in the third row of Table 4.1.

Dimension	Design elements (Set I)
Strategy elements (11)	(1) Locus of opportunity, (2) focus of activities
	(3) Innovation flow
	(4) Main goals, (5) program objective, (6) initial purpose, (7) prioritization of objectives
	(8) Strategic logic, (9) ambidexterity strategy
	(10) Project focus (result)
	(11) Innovation focus (types of innovations)
Structure elements (31)	(12) Operational relatedness, (13) strategic relatedness, (14) structural relatedness
	(15) Closeness to core business, (16) link to the corporate firm
	(17) Integration with core business, (18) integration of business units
	(19) Organizational setup
	(20) Main contact, (21) organizational anchoring
	(22) Top management involvement
	(23) Time horizon of involvement, (24) duration
	(25) Level of investment intermediation
	(26) Probe-and-learn process
	(27) Co-creation, (28) implementation strategy
	(29) Completeness of startup support, (30) value proposition to startup
	(31) Provided resources (financial, educational, networking, product-related)
	(32) equity involvement
	(33) Scale (# of startups), (34) number of startups
	(35) Startup type, (36) startup maturity
	(37) Value capturing, (38) exclusivity (access to innovation)
	(39) Application procedure, (40) evaluation process, (41) use of standardized approaches
	(42) End of program

Table 4.1: Design elements used in prior studies to compare different CE program types (Kurpjuweit & Wagner, 2020; Gutmann, 2018; Alänge & Steiber, 2018; Weiblen & Chesbrough, 2015)

Due to the circumstance that the studies differ in their subject of investigation, the level of detail of the design elements covered in the table can vary. For example, studies analyzing rather similar CE programs, such as external corporate accelerators vs. startup supplier programs (Kurpjuweit & Wagner, 2020) use more detailed elements than studies that compare CE program types with a higher degree of heterogeneity in their organizational designs (Weiblen & Chesbrough, 2015).

In Step 2, the 42 design elements (Set I) will be further aligned to be able to answer RQ1, which aims at defining and distinguishing CE programs. For this purpose, similar design elements (shown in the same row in Table 4.1) were aggregated and adjusted to describe the organizational design of a CE program. This was done to ensure that all design elements derived from the literature have the same level of analysis. Furthermore, design elements were removed if they were unsuited to answer RQ1, which is the case if they meet at least one of the three criteria below. We call them *removal* criteria.

1) **Redundancy:** The content of the design element is already covered in another one. For example, (1) *locus of opportunity* describes the origin (internal vs. external) of the ideas targeted by a CE program. However, this information is also covered in (3) *innovation flow*. This design element describes the origin and the remaining of the idea. Hence, the locus of opportunity design element can be removed due to redundancy.
2) **Simple count:** A design element does not have the intention to define and distinguish the different CE program types. For example, (33) *number of startups* supported by the CE program. These design elements may be suited to describe a concrete case. However, it does not show the structural difference between CE program types.
3) **Scope:** A design element is either too general or too narrow to define and distinguish across the different organizational designs. For example, (26) *probe-and-learn process*, which is describing how learning is achieved in the respective CE program.

Applying the three *removal* criteria resulted in 15 design elements (Set II) that are remaining. Set II consists of the design elements derived from the literature that are suited to define and distinguish CE programs. In Table 4.2, the 15 design elements will be briefly described. It is important to note that their harmonization was done in iteration with the derivation of design elements from the data to ensure that they were well aligned (see Figure 4.2).

Design element (Set II)	Description
1. Orientation	The main orientation of the activities which follow either a strategic or a financial objective
2. Strategic logic	The underlying learning mode behind the activities either focuses on exploring new knowledge or exploiting existing one
3. Innovation type	The type of innovation that is pursued by the innovation ideas that are participating in the CE program
4. Innovation flow	The direction of the innovation flow, describing the place where the idea originated and the embedding after the program
5. Application process	The procedure how innovation ideas are being selected to participate in the CE program
6. Starting point	The organization of the starting point for the program, which either is on a rolling basis or at specific times
7. Duration	The way in which the duration of the program is determined, based either on a specific time or on the progress of the content
8. Program end (content)	The stage of the innovation idea that should be achieved at the end of the CE program
9. Governance mode	The structural design and the organizational embedding of the CE program
10. Power promoter	The responsible role under which the program is organizationally integrated
11. Key points of contact	The main points of contact for the program within the core organization
12. Type of funding	The type of funding provided for the innovation ideas in the program
13. Key value proposition	The main added values that the program offers as a support to the innovation ideas
14. Program participants	The type of participants of the program who work on the innovation ideas
15. Idea maturity	The typical maturity of innovation ideas at the start of the program

Table 4.2: Overview of the design elements derived from the literature (Set II)

The 15 design elements (Set II) from Table 4.2 represent the ones derived from literature to define and distinguish CE programs. It is important to note that they are not a full list of all design elements that are generally conceivable to describe the organizational design of CE programs. Instead, the design elements (Set II) cover only the ones that are suited for comparative analysis across the different organizational designs. In the next subsection, we show the result of the process of deriving the design elements from the cases in our data.

4.2.2 Design elements derived from data

In this subsection, we will focus on the design elements that were derived empirically (see Step 3 in Figure 4.2). In general, the investigation of organizational designs can be distinguished into typologies and taxonomies. They differ in that a typology is based on theoretically derived elements while a taxonomy is based on elements that have been empirically derived (Dess et al., 1993). It means that the dimensions used to create typologies are based primarily on theoretical concepts rather than empirical design elements. In contrast, taxonomies use empirically-based elements that are *observable* and *measurable* within data (Smith, 2002). Using a taxonomic approach is recommended for research that focuses on discovering novel organizational designs, while typologies are useful for testing theoretical configurations (see van de Ven et al., 2013).

Mirroring the taxonomic approach to the context of CE programs, we then see that the focus of our research underlines the need for using (a) both designs elements that are derived from literature and (b) from our data. On the one hand, there are various prior studies that have investigated the organizational designs of CE programs which provides a rich basis we can build on. On the other hand, the emergence of novel organizational designs that are not well investigated (see Subsection 4.1.2) demands a taxonomic approach to discover and define novel CE program types. In particular, we see that some of the novel CE program types show clear differences to the well-known ones, e.g., a corporate company builder (see, e.g., Peter, 2018; Rathgeber et al., 2017).

For these novel CE program types, it can be expected that they require additional design elements for defining and distinguishing their organizational designs. Furthermore, only three out of the 13 studies from Subsection 4.2.1 focus on the simultaneous investigation of internal and external CE programs. Consequently, the design elements (Set II) derived from literature are not intended to be used in the investigation of the full heterogeneity of CE programs. Such an investigation demands a hybrid approach that combines design elements from previous studies with novel design elements that are derived empirically.

For deriving the design elements based on our 54 cases, we applied a grounded theory approach in order to investigate new concepts of the organizational design of CE programs. The open coding phase explored all concepts belonging to the organizational designs, the strategy, and the potential relationships between them. The open coding resulted in a total number of 89 concepts identified as potentially relevant for understanding the organizational design of CE programs.

In the axial coding, the concepts were compared with those derived from the literature (design elements Set I and Set II) to ensure a good theoretical embedding of the results (see Gioia et al., 2013). The iterative comparison and alignment of the design elements from literature and data did finally result in the identification of eleven additional design elements (Set III) that were empirically derived (Step 3 from Figure 4.2).

Each of the eleven design elements (Set III) consists of multiple *element characteristics* reflecting the various practical manifestations. We will use two element characteristics that belong to the design element *business relatedness* (describing the scope of the innovation ideas targeted by the CE program) to illustrate the different practical manifestations of it.

The two element characteristics in our example are (a) *improve core business* and (b) *adjacent to core business*. The element characteristic *improve core business* is describing that the scope of the CE program is set on the optimization and improvement of the existing business, e.g., by automating processes in the production. The element characteristic *adjacent to core business* is describing a different scope of the CE program, which aims at developing new businesses that extend the core organization into new fields, e.g., by leveraging an existing technology into a new field of application.

The eleven design elements (Set III) are briefly described in Table 4.3.

Design element (Set III)	Description
1. Business relatedness	What is the scope of the innovation ideas of the CE program? Are they aimed, e.g., to improve or complement the core business?
2. Innovation demand	Who is the driver of the innovation demand, is, e.g., is it pushed by the CE program itself or by the core organization?
3. Number of phases	In what type of phases is the CE program structured and what is their focus regarding business development?
4. Preferred exit path	What is the preferred exit path of the innovation idea after the program's end? (e.g., transfer to a department in the core organization or creating a spin-off)
5. Location	Where is the CE program geographically located in relation to the core organization?
6. Funding source (during program)	Who (which organizational entity) is funding the innovation ideas during the CE programs phases?
7. Funding source (post-program)	Who is providing the funding after the innovation ideas have left the CE program?
8. Key activities	What are the main activities that are pursued to operate the CE program?
9. Different innovation formats	What types of different innovation formats are run by the program? (e.g., acceleration, hackathon, or ideation)
10. Platform openness	By whom is the CE program operated? Is it an exclusive program or are multiple players involved?
11. Key functions	What different roles are employed in the CE program itself? (e.g., Does it have its own technical specialists or innovation scouts?)

Table 4.3: Overview of the empirically derived design elements (Set III)

The empirically derived design elements (Set III) are complementing the ones derived from the literature (Set II).

4.3 Harmonizing the design elements

In this section, we will focus on harmonizing the design element. Starting with the process of harmonizing the 15 design elements (Set II) that are derived from literature with the eleven design elements (Set III) that were derived empirically (Step 4 from Figure 4.2). After a more detailed explanation of this process, we will present the harmonized set of design elements.

It is important to note that for reasons of comprehensibility, the derivation of the design elements was presented separately (see Subsection 4.2.1 and 4.2.2). However, the practical realization was an iterative process in which the results from the literature and the data were consistently compared and aligned. For selecting the design elements that are suited to answer RQ1, we applied the following two criteria.

1) The design elements must be applicable across the different types of CE programs.
2) The design elements must be suited to differentiate rather similar CE program types.

Furthermore, to create a harmonized set of design elements that are suited to answer RQ1, we had to align the design elements regarding (a) their *content* and (b) their *level of analysis*. For aligning the content, the design elements with a similar focus (see Table 4.1, the design elements summarized in the same row) were either merged into one design element or are split into multiple design elements that have a clear distinction from each other. For aligning the level of analysis, the design elements were re-formulated in their focus to be applicable across the different CE program types. This was necessary since the studies building the basis for deriving the design elements from literature did have a different subject of investigation. For example, studies comparing rather similar CE program types use narrower defined design elements (Kurpjuweit & Wagner, 2020) than the ones that cover more heterogeneous CE program types (Gutmann, 2018; Weiblen & Chesbrough, 2015).

Applying the different aspects led to the list of design elements that were already presented in Subsection 4.2.1 (design elements Set II) and Subsection 4.2.2 (design elements Set III). Combining the design element from Set II (15 design elements) and Set III (eleven design elements) leads to the final set of design elements that consist of 26 different design elements (see Table 4.4). The 26 design elements were grouped into eight design categories based on thematic similarities to improve the clarity further. Table 4.4 provides an overview of the design elements, the design categories to which they belong, and their link to the dimensions of strategy and structure.

Dimension	Design category	Design elements (Set IV = Set II + Set III)
Strategy	*Purpose*: Strategic direction of the program	- Orientation - Strategic logic
	Scope: Type of ideas that are in the focus of the program	- Innovation type - Business relatedness - Innovation flow - Innovation demand
Structure	*Process*: The course and key aspects of the program	- Application process - Starting point - Duration - Number of phases - Program end - Preferred exit path
	Governance: Embedding of the CE program into the core organization	- Governance mode - Location - Platform openness - Project funding (during program) - Project funding (post-program) - Power promoter
	Operations: Activities that are performed to run the program	- Key activities - Different innovation formats
	Support type: Type of support for the innovation ideas by the CE program	- Key contacts - Type of funding - Key value proposition
	People: Program employees and the participants for the ideas	- Program participants - Key functions - Idea maturity

Table 4.4: Overview of organizational design elements to define CE programs

The 26 design elements (Set IV) presented in Table 4.4 form the basis for developing an approach that allows a systematic analysis of the organizational designs of CE programs.

4.4 General morphological method for CE programs

In this section, we will focus on the approach to allow a systematic analysis of the 54 cases from our data set. In this regard, the *general morphological method* will be described as a potential approach for a systematic analysis of the organizational design of CE programs.

The general morphological method is a problem-solving and creativity technique that was developed by Fritz Zwicky (see Ritchey, 2011a; Zwicky, 1967). It has been applied in various fields such as organizational development, technical design, or innovation management (see, e.g., Duczynski, 2017; Álvarez & Ritchey, 2015). Using morphological analysis is recommended when the subject of investigation is characterized as (a) complex, (b) multi-dimensional, and (c) non-quantifiable (Ritchey, 2006).

Mirroring the characteristics of CE programs and their organizational design with the three aspects described above shows the following.

a) The design elements of a CE program are interrelated, which makes them a rather complex subject of investigation, as changes in one design element may affect several other design elements.
b) CE programs are multidimensional organizational units that encompass a wide range of different design elements (see Section 4.2).
c) It is unclear which design elements are best suited to define and distinguish the different types of CE programs. This lack of understanding requires further qualitative efforts to develop a deeper understanding of the subject of investigation.

These three aspects overlap with the recommendations of when to use a morphological analysis (Ritchey, 2006), which makes it an appropriate approach to systematically analyze the organizational design of CE programs.

The basic principle of the morphological analysis is illustrated in Figure 4.3. It is used to identify element characteristics that show a high frequency of occurrence (marked in darker colors) and that are commonly occurring together. By identifying these element characteristics, we can derive potential solutions for a problem, which reflect in research on organizational designs the different configurations that are possible.

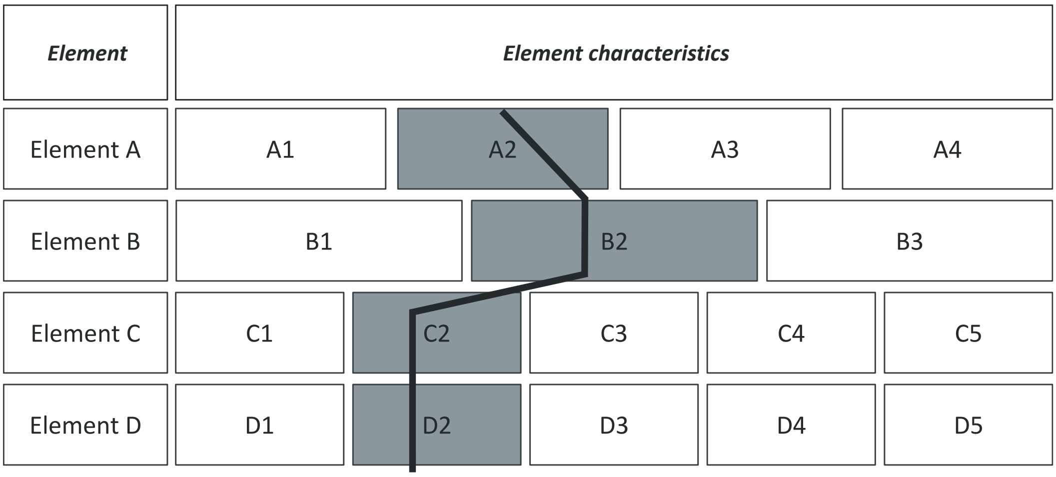

Figure 4.3: Using a morphological box to derive a configuration or solution

In general, for applying a morphological analysis, the following four steps must be performed.

1) Identification and definition of all elements (A-D in Figure 4.3) that are describing the problem or the subject of investigation.
2) Identification of the different characteristics (A_n, B_n, etc.) that the respective elements can exhibit in practice to understand the heterogeneity of each element. As shown in Figure 4.3, the number of element characteristics can vary per element.
3) Create a matrix based on the elements (first column) and the characteristics behind each element (in the same row), as shown in Figure 4.3. Depending on the characteristics of an element, the number of columns can vary.
4) Connecting the element characteristics across all rows to identify the possible solutions (illustrated in Figure 4.3 with the line connecting the element characteristics that are highlighted in a darker color).

Applying this approach to the cases on the data set leads to the identification of the solutions that are generally possible. In addition, the approach can be used to reveal relationships between the elements that contribute to a better understanding of the subject of investigation. An example is provided with Figure 4.4 on the next page.

Creating a morphological box for CE programs

For creating a morphological box that can be used to analyze the organizational designs of CE programs, two things are required, namely the design elements and the element characteristics. The 26 design elements that were presented in Section 4.3 (see Table 4.4) form the basis for creating the first row of our morphological box. In addition to them, the respective element characteristics are required for each design element, which reflects the practical manifestation the design element can have. An example for such an element characteristic was provided in Subsection 4.2.2 with the design element *business relatedness* and its element characteristics like *improve core business* or *adjacent to core business*. The element characteristics are used on an operational level to define and distinguish the different CE program types.

Deriving the element characteristics did follow an iterative process. The 54 cases were analyzed regarding the 26 design elements and the respective element characteristics the design element did show in each case. With each additional case, either (a) already known element characteristics were found or (b) novel element characteristics were identified. Based on the identification of the elemental characteristics, the morphological box was continuously adjusted with new elemental characteristics simultaneously with the analysis of the cases. At the end of the analysis, a total number of 138 element characteristics were identified, which also reflect the entirety of the element characteristics of the final morphological box. Due to the large number of design elements and element characteristics, the full morphological box must be split into two pages. The 138 elements with a brief description can be found in Appendix 5. Figure 4.4 serves as an illustration of how the morphological box is generally structured.

Design dimension	***Design category***	***Design element***	***Element characteristics***				
Strategy	**Scope**	**Innovation type**	**Process**	**Service**	**Product**	**Business model**	
		Innovation flow	**Inside-in**	**Inside-out**	**Outside-in**		
		Innovation demand	**Push by intrapreneur**	**Pull by core organization**	**Moderated pull**	**Push by top management**	**Push by CE program**
		Business relatedness	**Improve core business**	**Complement core business**	**Adjacent to core business**	**Cannibalize core business**	**Independent new business**
…	**…**	**…**	**…**	**…**	**…**	**…**	**…**

Figure 4.4: Extract of morphological box used for the systematic analysis

For each of the 54 cases, a morphological box was created that is reflecting the configuration of the organizational design. These boxes are used to investigate the organizational design of the 54 cases in order to answer RQ1. The identification of distinct CE program types did follow five steps which are summarized below.

1) The cases were grouped according to the rather general CE program categories, which are internal CE programs, external CE programs, and radical innovation units.
2) Within the three categories, cases were first grouped according to their self-conception, which followed mainly the CE program types presented in Section 4.1. This results in several subgroups within each CE program category.
3) The cases within the subgroups were investigated regarding the similarities of their organization design which was done by comparing the morphological boxes of each case. This comparison led to the identification of a certain set of design elements that were characteristic for the respective group.
4) If a case did not fit this set of design elements, it was excluded from this subgroup and compared with the other subgroups. This either resulted in (a) the assignment of the case to another subgroup or (b) the creation of a new subgroup if the case did not fit any of the existing ones.
5) The comparison of the morphological boxes was repeated until all cases were assigned to a group, and the respective group did have a certain set of design elements that shared the same characteristics.

Applying these five steps to our 54 cases resulted in different subgroups that are characteristic of a certain type of organizational design. An example using the same morphological box as in Figure 4.4 is provided with the description of our first CE program type in Chapter 5 (see Figure 5.1). It is important to note that each of the types can have a different set of design elements and that only a subset of the 26 design elements is being used. This subset of design elements and the respective element characteristics allowed a clear and systematically derived definition of the CE program types. The next chapter will present the results from the systematic analysis of the organizational design and provide an answer to RQ1.

5 Identifying and defining CE programs

This chapter aims at providing an answer to RQ1, which reads as follows: *What are the different types of CE programs?* In order to answer RQ1, it will be divided into the following two sub-questions.

- RQ1a: *What types of CE programs can be defined?*
- RQ1b: *Which design elements are suited for distinguishing these CE programs?*

Parts of the results in Chapter 5 are based on the following two publications:

- C. J. Selig, T. Gasser and G. H. Baltes, "**How Corporate Accelerators Foster Organizational Transformation: An Internal Perspective**," 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Stuttgart, 2018, pp. 1-9, doi.

- C. J. Selig and G. H. Baltes, "**Towards an effective management of corporate entrepreneurship activities**," 2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Valbonne Sophia-Antipolis, France, 2019, pp. 1-9.

To answer RQ1, we will present a taxonomy of CE program types that is based on the design elements presented in Chapter 4 (that are suited to define and distinguish different types of CE programs). In total, twelve types of organizational designs will be defined, which belong to the three CE program categories (see Subsection 3.2.2). Each identified CE program type will be presented in a separate subsection.

There are four internal CE program types presented in Section 5.1. They are followed by five external CE program types (Section 5.2) and three types of the radical innovation unit category (Section 5.3). In Section 5.4, we will compare the different organizational designs of the CE program types and provide an overview of their differences (using the design elements from Chapter 4). Section 5.5 will present the background information in relation to the twelve CE program types. In Section 5.6, the results will be discussed and embedded into the existing literature. Section 5.7 will conclude on the CE program types and how the results answer RQ1.

5.1 Defining internal CE program types

In Section 5.1, we will present the four internal CE program types that were identified in our study. The first CE program type is the *venture builder*. It will serve as an example of how the systematic approach was applied to identify the CE program types and how the definition was derived using the design elements and design categories.

The definitions presented in Section 5.1 – 5.3 will provide an answer to RQ1a - *What types of CE programs can be defined*?

5.1.1 Venture builder

The *venture builder* is the first CE program type of the internal CE program category. The definition of the venture builder is based on three cases (n=3). This is the smallest number of cases per CE program type in our study. The rather small number of cases has two causes. First, the venture builder is one of the most novel types (average age of 3.3 years in our data set) and still shows comparatively low adoption in practice (compared to other CE program types). Second, three cases declared themselves as venture builders but were originally assigned to another CE program type, according to our analysis.

In order to derive a definition of the venture builder, the three cases were coded using the morphological box, which provides an understanding of the design elements and element characteristics of a venture builder.

In general, the morphological box consists of four columns, which are (1) design dimension, (2) design category, (3) design element, and (4) element characteristics.

1) The first column *design dimension* consists of *strategy* and *structure*, which reflect the general assignment according to configuration theory (see Subsection 2.2.3).
2) The second column *design category* serves as a thematic bundle for the identified design elements and is used to increase the clarity of the morphological box. A total of seven design categories were identified (see Section 4.3).
3) The third column *design element* consists of the 26 design elements that were derived in Chapter 4. They are identified as the ones that can be used to define and distinguish between the CE program types (see Section 4.2).
4) The fourth column *element characteristics* differs from the others in that it consists of several sub-columns. Depending on the design element, the columns vary in number.

In total, 138 element characteristics were identified, representing the manifestations of all design elements, which reflects the heterogeneity of organizational designs.

The overall morphological box for each CE program type is created as follows. For each case of the venture builder, a separate morphological box is created that represents its specific configuration. These specific morphological boxes per case are then merged into one overall morphological box for the venture builder (illustrated by Figure 5.1). Summing up the morphological boxes (and setting them into relation with the total amount of cases) leads to a certain percentage per element characteristic, which describes how often the element characteristic has been observed for the CE program type. The ones with a high percentage can be understood as being typical for the respective organizational design.

The organizational design of the venture builder

In Figure 5.1, we have highlighted the results for the venture builder with color-coding. The darker an element characteristic is visualized, the higher the percentage for the particular design element to which it belongs (see description after Figure 5.1). In the case of the venture builder, it means that for the design element *innovation type*, the element characteristic *business model* is the most significant one (100% of the cases), followed by the element characteristic of *service* (67% of the cases). Consequently, they are two element characteristics of the design element innovation types that are typical for the venture builder.

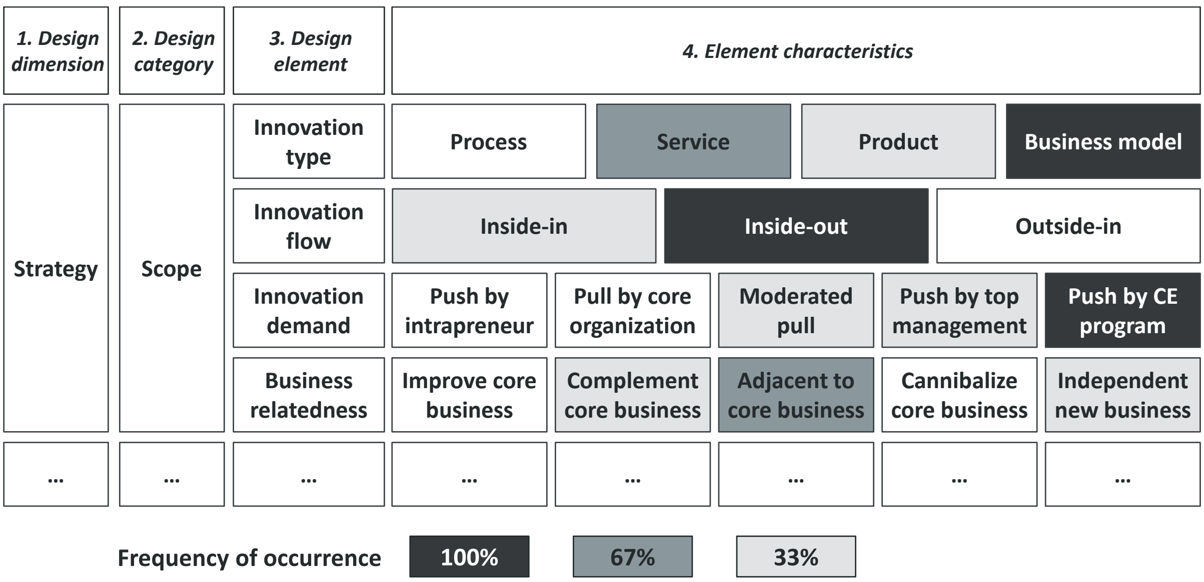

Figure 5.1: Extract of morphological box for the venture builder

The process described above is illustrated in Figure 5.1 and has been executed for the 26 design elements from Table 4.4. It forms the basis for deriving a precise definition for a venture builder. Building on the full morphological box for the venture builder (see Appendix 6), the organizational design of this CE program type can now be described systematically.

Figure 5.1 shows that multiple element characteristics (column 4) can be assigned to a design element (column 3). However, there is usually one dominant characteristic (defined by the frequency of occurrence higher than 80%). The dominant element characteristics are the focus of our investigation since they can be understood as those that are typical for the respective CE program type. Regarding the percentages for the element characteristics of a design element, it must be noted that they can result in a number larger than 100%. This can be explained by the fact that multiple element characteristics can occur for a design element, which results in a total of more than 100% occurrence when summing them up.

The design elements

Subsequently, the design elements from Figure 5.1 (3rd column) will be described based on the element characteristics that were identified for them.

- *Innovation type:* The venture builder shows a strong focus on business model innovation and service innovation. The focus on product innovation is rather unclear, whereas it can be stated that process innovation is not pursued by venture builders.
- *Innovation flow:* The main innovation flow is inside-out, which means that innovation ideas are (1) spun-off into their own legal entity or (2) become a business unit that is separated from the core organization. In some cases, the expertise of venture builders is used as a service by the core business, an inside-in innovation flow can be observed.
- *Innovation demand:* The main driver of the innovation ideas is the venture builder itself, which may be explained by the fact that the aim is to develop businesses that are mainly spun-off and consequently require less cooperation with the core business. Again, for cases where the venture builder is used as a service provider, the demand can be triggered by or in cooperation with internal departments.
- *Business relatedness:* The innovation ideas that are being developed by a venture builder show a strong focus on businesses that are adjacent to the current core business. This goes in line with the inside-out innovation flow and the fact that the innovation idea is driven by the venture builder itself.

By summarizing the element characteristics for each design element as described above, we build the basis for a definition that is empirically derived. However, it is important to acknowledge that, in general, not every single design element has to be considered for the final definition due to the following two reasons.

1) The design elements do not have a clear pattern, e.g., when the element characteristics occur equally distributed and show no dominant characteristic.
2) The design elements are not suited to distinguish the CE programs one from the other, e.g., when all have the same element characteristic.

By removing the “unsuited” design elements, the content becomes more clear and typical for the respective CE program type. The remaining design elements will then be aggregated one more time to the level of the design category. The goal of aggregating the design elements into the respective design category is to achieve more clarity since precisely these design elements are used for the respective CE program type. Table 5.1 on the next page shows the seven design categories (from Section 4.3) and their manifestation for the venture builder, which provide a clear description.

The derivation process described in this subsection is exemplary for the twelve CE program types identified in our study. For the eleven remaining types, we will use a summarized presentation based on the three types of information (a) the general information about the cases, (b) the table describing the seven design categories, and (c) the definition of the respective CE program types, which is contributing to answering RQ1a.

The descriptions of the seven design categories (see below) and Definition 5.1 are based on three cases of the venture builder that are covered in our data set.

Design category	**Description**
Purpose	*Venture builders* place a strong emphasis on creating strategic value, which in some cases may be accompanied by the aim of increasing the financial value of their own portfolio companies created by their activities.
Scope	Innovation ideas within a venture builder are mainly focused on business model innovations and service innovations that are adjacent to the core business.
Process	The innovation ideas are developed in and by the venture builder itself. Support from the program lasts until the ideas have reached the maturity of an independently operating company.
Governance	Due to the rather independent character of a venture builder, they are often organized as a separate legal entity, equipped with the resources to develop new businesses.
Operations	Activities focus mainly on idea generation and new business development, which are spun off into stand-alone units. This capability is also partially requested by the core organization as a service to solve internal innovation challenges.
Support type	The financing of the innovation idea and the resulting initial funding of the corporate venture is driven by the program itself, either by having its own fund or formalized processes to make the investment decision.
People	Venture builders mainly work on innovation ideas with their own employees and hence, typically have technical and business capabilities to create and operate new businesses themselves.

Table 5.1: Description of the venture builder and its design categories

Based on the description of the seven design categories for the *venture builder* in Table 5.1, Definition 5.1 is formulated for the venture builder.

> **Definition 5.1** *Venture builders* are defined as units that are equipped with the capabilities and resources to develop new businesses that are adjacent to the core business themselves.

5.1.2 Idea validator

The *idea validator* is the second internal CE program type that has been identified. In our data set, we cover four cases (n=4) belonging to this type. Table 5.2 describes the seven design categories that form the basis for the definition.

Design category	Description
Purpose	*Idea validators* mainly aim at the exploration of innovation ideas that seem to have strategic relevance for the core organization.
Scope	The innovation ideas focus on improving and complementing the core business. This typically is done with service, process, and product innovations that are driven either by individuals or departments of the core organization.
Process	The program is usually organized in batches with fixed starting and ending points. It focuses on validating the problem-solution fit before the ideas are transferred back to the core organization.
Governance	Idea validators are organized as programs within the hierarchy of the core organization and are usually located on company premises.
Operations	The main activity is to *incubate* the innovation ideas during their validation. This is done by creating a supportive environment (freedom, resources, and training) until innovation ideas are validated and transferred back to the core organization.
Support type	The support within the program focuses mainly on providing the teams some dedicated time to work on the idea. In addition, the teams can access relevant expertise (innovation methods) and have a small budget for validating the ideas.
People	The teams consist of employees from the core organization. They are supported by coaches who are either employed by the CE program or mandated by it.

Table 5.2: Description of the idea validator and its design categories

Based on the descriptions for the seven design categories, Definition 5.2 is formulated for the idea validator.

> **Definition 5.2** *Idea validators* are focusing on the early phase of the innovation process by offering a supportive environment, services, and resources that allow a fast validation of innovations with an unclear fit to the core organization.

5.1.3 Intrapreneurial excubator

The *intrapreneurial excubator* is the third internal CE program type that was identified in our study. We have covered nine cases (n=9) of this CE program type. Table 5.3 presents the seven design categories of intrapreneurial excubators and forms the basis for its definition.

Design category	Description
Purpose	*Intrapreneurial excubators* focus on exploring and leveraging internal innovation potentials. They support employees in developing rather discontinuous innovations that seem to have strategic relevance for the company.
Scope	They focus on product and business model innovation. Since the ideas are driven bottom-up by intrapreneurs, they vary in terms of their relatedness to the core business. The innovation flow is inside-in and inside-out to a similar extent.
Process	The program is usually open to all employees and has a fixed duration of several months, with support until the idea reaches a product-market fit. They often have multiple phases with different thematic focuses. At the program's end, the main exit paths are (a) becoming a separate business unit or (b) becoming a spin-off.
Governance	Most often, they are organized as a central office, which serves the purpose that the program is open to all employees and their ideas.
Operations	Two key activities are (1) *incubating* the ideas by creating an environment (resources, capacity, process, etc.) that is supportive and (2) *educating* the individuals by teaching methods/skills that are helpful for creating innovations.
Support type	Program support is mainly focused on providing an initial budget for the innovation idea, educational resources, and the capacity (time) to work on the idea, often for 100% of their time once they have reached a certain maturity.
People	The program participants are mainly employees of the core organization, sometimes supported by external experts. The program itself typically employs innovation coaches and persons to facilitate the innovation process.

Table 5.3: Description of the intrapreneurial excubator and its design categories

Based on the seven design categories and their descriptions the definition 5.3 is formulated for the intrapreneurial excubator.

> **Definition 5.3** *Intrapreneurial excubators* support employees in developing rather discontinuous innovation ideas by providing them access to resources, entrepreneurial training, and autonomy from daily business.

5.1.4 Assisted incubator

The *assisted incubator* is the fourth of the internal CE program category that was identified. In our study, seven cases (n=7) can be counted as this CE program type. Table 5.4 summarizes the design categories of the assisted incubator and forms the basis for defining it.

Design category	Description
Purpose	*Assisted incubators* support the core organization in developing innovations with strategic relevance to the core business that requires a high level of exploration.
Scope	They have a clear scope on market-oriented innovation, distributed in a balanced way between product, service, and business model innovation that complement the core business with an inside-in innovation flow.
Process	The program start is rolling and can have different starting points, which keeps the hurdles low and thus helps to embed it into the core organization. Usually, the process consists of multiple phases and supports the innovation idea up to a minimum viable product before they are transferred back to the core business.
Governance	Assisted incubators are usually located close to the core organization and are mainly structured as a central office.
Operations	The main activity besides (a) *incubation* (supportive environment and resource access) and (b) *education* of methods is (c) the *assistance* in the implementation of the innovation ideas. Experts from the assisted incubator join and assist the teams (adding required capabilities for the innovation development) during the program phases until the innovations are transferred back to the core business.
Support type	The support includes initial funding, the capacity to work on the innovation idea (released from the daily business), and the support and expertise of the CE program's employees who are working temporarily within the innovation teams.
People	Participating teams are a mix of employees from the core business and employees from the CE program. The assisted incubators employ specialists in business development, user experience, and digital technologies.

Table 5.4: Description of the assisted incubator and its design categories

Based on the design categories described in Table 5.4, Definition 5.4 is formulated for the assisted incubator.

> **Definition 5.4** *Assisted incubators* are specialized units that support the core business in the cooperative development of strategically relevant innovations that require a high degree of exploration and capabilities that are new to the core organization.

5.1.5 Conclusion on internal CE programs

In Section 5.1, we have presented four internal CE program types that were identified in our study. They are enhancing the current literature on CE programs, which focuses mainly on internal corporate incubators (see Section 4.1), by providing a more nuanced understanding of the internal organizational designs of CE programs.

The focus of support

Based on the descriptions and definitions of the four different internal CE program types, we derived an additional design element, namely the *focus of support*. The focus of support is understood as a continuum describing the CE program's activities that range from *enabling innovation ideas* at one end to *executing innovation ideas* themselves at the other end. Typically, the closer the continuum is to the execution end, the higher the degree of ownership that the particular CE program has for the innovation ideas in the program.

Using the *focus of support* design element shows that the four internal CE program types can be distinguished according to their intensity of support (illustrated in Figure 5.2). This further underlines that the four internal CE program types are distinct in their organizational design and their mission for what they are used by established companies.

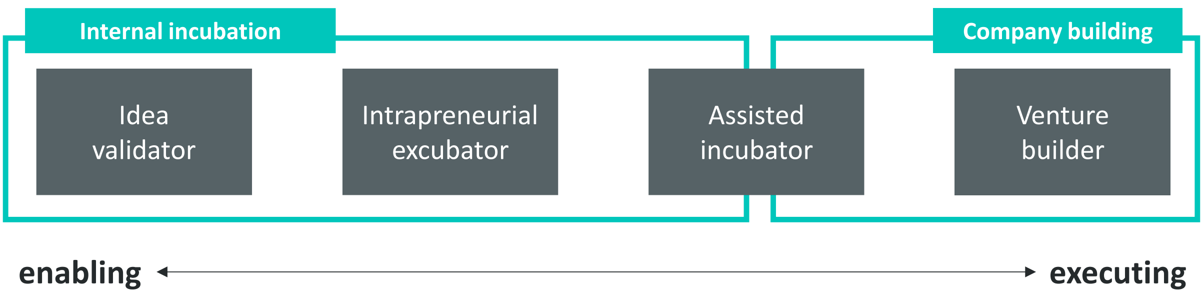

Figure 5.2: Overview of different types of internal CE programs

Internal incubation and company building

In addition to the *focus of support*, Figure 5.2 contains another layer of information. The mint-colored frames are used to group the CE program types by the *type of activity* the respective CE programs are mainly pursuing. The type of activity is focusing rather on the work of the CE program from a content perspective and can be distinguished into the following two groups for the internal CE program types.

1) *Internal incubation:* The CE programs in the group of internal incubation focus on leveraging internal innovation potentials by supporting intrapreneurial employees in implementing their innovation ideas. For this purpose, they provide access to resources and grant a certain degree of freedom from the daily business, which is referred to as incubation.
2) *Company building:* The CE programs in the group of company building are designed to create new businesses and thus contribute to diversification. As such, they have the required resources, capabilities, and structures to develop innovations themselves.

As shown in Figure 5.2, there is also a hybrid type that is combining elements from both groups. The assisted incubator aims to support employees from the core business in the development of innovation ideas (*internal incubation*). For this purpose, the assisted incubator does not only provide the required resources and the appropriate environment but also assists in the actual development through the competencies and capacities of the employees of the CE program, who temporarily join the innovation team (*company building*).

To conclude, the four internal CE program types and the two groups (internal incubation and company building) are enhancing our understanding of the organizational designs of internal CE activities.

5.2 Defining external CE program types

Below we will continue with the *external CE program types*. In our study, we have identified five distinct types that will be presented in the following Subsection 5.2.1 – 5.2.5, focusing on the general information of the cases, the seven design categories, and the definition for the respective external CE program type.

In Subsection 5.2.6, the five *external* CE program types will be briefly discussed and aligned with the results of the *internal* CE program types to gain a better understanding of their differences.

5.2.1 Startup facilitator

The *startup facilitator* is the first out of five external CE program types. It is a rather novel type that experiences much attention in practice and is with six cases (n=6) the most common external type in our data set. Table 5.5 illustrates the design categories of startup facilitator.

Design category	Description
Purpose	*Startup facilitators* focus on solving problems of the core business by connecting them with startups. This can have an explorative or exploitative orientation, depending on the type of problem that has to be handled (and solved).
Scope	They mainly focus on improving the core business. The startup solutions that are scouted must show a fit to the current business problems. The innovation demand is jointly elaborated with the core organization and mostly results in process innovations.
Process	The program start follows either a batch-logic or a rolling format. Startups are selected based on scouting or a call for application. The program focuses on developing a proof of concept to validate whether the startup solves the problem.
Governance	Startup facilitators are mostly organized as central offices as they aim to address all departments of the core business with their service.
Operations	The key activities focus on scouting, which covers (a) internal business problems and (b) startups for assisting in handling the respective problems. In addition, they facilitate the proof-of-concept process with the core business.
Support type	The participating startups mainly benefit from access to the company and the direct connection to the various departments of the core business.
People	The CE program's employees are responsible for the scouting activities and for facilitating the proof-of-concept projects. The startups occur mostly in a later stage; they can be qualified as a supplier.

Table 5.5: Description of the startup supplier and its design categories

Based on the design categories described in Table 5.5, Definition 5.5 is formulated for startup facilitators.

> **Definition 5.5** *Startup facilitators* aim at insourcing innovative solutions to solve business problems. By facilitating proof of concept projects to validate the problem-solution-fit and the interaction between the startup and the core organization, they provide access to solutions that would not fit into the company's purchasing process.

5.2.2 Collective matchmaker

The *collective matchmaker* is the second external CE program type. The descriptions of the design categories are given in Table 5.6, and the definition is based on three cases (n=3). In contrast to the other CE program types, this one is run by multiple established companies. The three cases were collected with the companies that were initiating the CE program.

Design category	Description
Purpose	*Collective matchmakers* aim at both exploratory and exploitative activities by building an open platform to attract startups that are strategically relevant.
Scope	The scope is rather broad and includes product, service, and process innovation, which is reflected in the intention to complement, enhance, or expand the core business by opening up the innovation process to external startups.
Process	The program phases have fixed start and end dates (batches with thematic focus) that are carried out several times a year. During the program phase proof-of-concept, projects are used to validate the identified innovation ideas.
Governance	Collective matchmakers are organized as central offices with multiple locations in different countries. A key difference from all other CE program types is that multiple corporate partners are involved in the program.
Operations	The main activities are scouting (a) startups with relevant innovation and (b) problem owners in the core organization. In addition, they support proof-of-concept projects during the program phase. A second activity is the management of the platform and its partners by the founding companies.
Support type	The most important support for ideas is the network of the platform itself, which provides both the startups with access to potential customers and the partner companies with access to a wide range of startups.
People	They typically employ innovation scouts, project facilitators, business developers, and community managers. The participating startups have a higher level of maturity, which is crucial for cooperation after a successful proof of concept.

Table 5.6: Description of the collective matchmaker and its design categories

Building on the seven design categories, Definition 5.6 is formulated.

> **Definition 5.6** *Collective matchmakers* are jointly organized innovation platforms that are connecting promising startups with multiple established companies with the aim to make the innovation of the startups accessible for the corporate partners.

5.2.3 Cooperative explorer

The *cooperative explorer* is the third external CE program type. The descriptions of the design categories and the definition are based on three cases (n=3). Table 5.7 is presenting the seven design categories that are characterizing the cooperative explorer.

Design category	Description
Purpose	*Cooperative explorers* aim at exploring strategically relevant technologies with the potential to enhance or extend the current product portfolio of the company.
Scope	The focus is mainly set on product and service innovations that are adjacent or complementary to the core business. The innovation demand is triggered either by (a) the CE program itself or (b) through a joint process with the core business.
Process	They are mainly organized in a rolling format, which fits with continuous scouting activities. Innovation ideas within the program are supported until the product-market fit and are transferred to the core organization after the programs end.
Governance	Cooperative explorers are structured as own legal entities or central offices. This is supportive for their exploration activities. They have a budget to drive proof of concepts and to develop prototypes to experiment with new technologies.
Operations	The main activities of the program focus on scouting and evaluating promising startups and the initial support of the collaboration projects, which mainly cover business development and education to bridge cultural differences.
Support type	Innovation ideas focus on R&D, which is the main point of contact for the startups participating in the program. The cooperative explorer provides financial resources to fund the development of prototypes, in some cases via investment.
People	Cooperative explorers mainly employ innovation scouts, project facilitators, and business developers. The participating startups tend to be rather mature startups. The innovation idea projects are usually staffed with people from the core business, the startups, and the CE program.

Table 5.7: Description of the cooperative explorer and its design categories

Building on the seven design categories described above, Definition 5.7 is formulated for the cooperative explorer.

> **Definition 5.7** *Cooperative explorers* focus on identifying and implementing innovation opportunities, whereby the company partners with startups to jointly develop new products in order to improve or expand the core business.

5.2.4 Investing co-creator

The *investing co-creator* is the fourth type of external CE programs. The descriptions and definition are based on five cases (n=5) of this CE program type. The descriptions of the seven design categories are summarized in Table 5.8.

Design category	Description
Purpose	*Investing co-creators* aim at developing strategically relevant partnerships with startups that either can have an explorative and exploitative nature.
Scope	The scope mainly focuses on product innovations that aim at complementing or at extending the core business. The demand for the innovation is initiated by the CE program itself and rather pushed into the core organization.
Process	The process builds on ongoing screening activities to identify startups for collaboration with the core organization. Since they focus on collaboration and/or investing in startups, there is no “standard” process of the program. After the startups are connected to the core business, the program's support decreases.
Governance	They are mostly organized as their own legal entities and are located either close to the headquarters of the core organization or in an innovation hotspot.
Operations	In addition to scouting and investment activities, they focus on initiating collaborations with startups, which also entails business development activities.
Support type	They are designed to invest in startups. However, an investment is not mandatory since collaboration has a higher priority. Providing funding to the startups is mainly done to strengthen a strategic partnership.
People	Investing co-creators employ innovation scouts, investment managers, and business developers supporting the initial phase of the startup collaboration. Typically, the startups have launched their first products on the market or are in the growth phase of their business.

Table 5.8: Description of the investing co-creator and its design categories

Based on the descriptions presented in Table 5.8, Definition 5.8 is formulated for the investing co-creator.

> **Definition 5.8** *Investing co-creators* focus on building partnerships with startups that show a rather immediate strategic value for the core organization, either by partnering with or investing in them.

5.2.5 Strategic investor

Strategic investor is the fifth external CE program type that was identified. This CE program type is rather popular and has already experienced much attention in research (Gutmann, 2018; Weber & Weber, 2005; Chesbrough, 2002). The descriptions of the design categories in Table 5.9 and the definition are based on three cases (n=3).

Design category	Description
Purpose	They have a balanced orientation, meaning investments must show a strategic link to the core organization while at the same time being financially promising.
Scope	The investment scope is broad and not focused on one specific type of innovation. A tendency for new businesses apart from the core business can be observed. The innovation demand is driven rather autonomously by the strategic investor itself.
Process	The starting point for investment comes from a continuous screening of startups and trends. Unlike the other CE programs, there is no formalized "program-like" process. The preferred exit path is either an IPO or an exit to another investor.
Governance	The strategic investors were structured as separate legal entities located in an innovation hotspot. They were directly subordinate to the C-level management of the company and had their own investment fund.
Operations	The two main activities are identifying of and investing in promising startups. As a by-product of their scouting activities, they connect startups with the core organization to increase the strategic value they are providing.
Support type	With their investment, they provide equity funding for the startup as well as access to the company’s network and relevant domain expertise (which is one main difference to independent venture capitalists).
People	They mainly employ innovation scouts and investment managers. In some cases, they had business developers to leverage the value of their investments. The focus is set mostly on later-stage startups that secured multiple financing rounds.

Table 5.9: Description of the strategic investor and its design categories

Building on descriptions of the seven design categories in the table above, definition 5.9 is proposed for the strategic investor.

> **Definition 5.9** *Strategic investors* are semi-autonomous investment vehicles that aim at building a portfolio of promising startup investments that deliver strategic benefits for the core organization and simultaneously creating financial value.

5.2.6 Concluding external CE programs

In Section 5.2, we have presented five external CE program types identified in our study.

The focus of support

To provide an overview of the different types of external CE programs, we will order them according to their *focus of support*, which is illustrated in Figure 5.3.

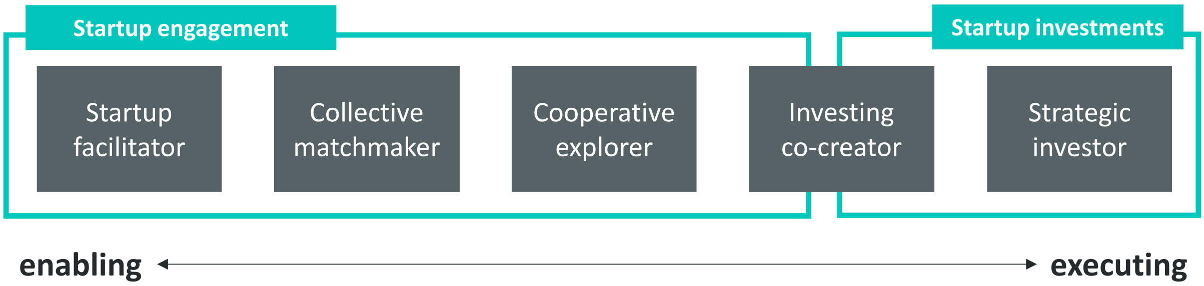

Figure 5.3: Overview of different types of external CE programs

For external CE program types, execution is closely linked to the ownership of the innovation ideas in the program. Ownership is mainly reflected in whether the CE program takes shares (investing) or cooperates with the startup in a particular project (enabling).

Startup engagement and startup investments

Likewise, for the internal CE program types, we have grouped the external CE program types according to the *type of activity* they are mainly pursuing (highlighted with the mint-colored frame in Figure 5.3). This leads to the following two groups.

1) *Startup engagement:* The CE programs in the group of startup engagement focus on the collaboration between startups and the core organization with the aim to insource external innovation. The main activity of these CE program types is to identify startups and to match them with internal needs as a starting point for cooperation.
2) *Startup investing:* The CE programs in the group of startup investment are designed to invest in startups as strategic options or to strengthen strategic partnerships. The investment itself provides financial value which is supplemented by strategic values that occur through the work between the startup and the core business.

Combining focus of support and locus of opportunity

Having shown that external CE programs are distinct regarding their activities, we will add another dimension to the overview. The *locus of opportunity* design element has been used in several studies to cluster CE activities (Gutmann, 2018). It is a binary design element that describes where the innovation ideas originate (internal or external). By combining the *locus of opportunity* and the *focus of support*, the following overview on both internal and external CE program types is created (see Figure 5.4). The nine CE program types and their definitions presented in Section 5.1 & 5.2 provide the answer to RQ1a.

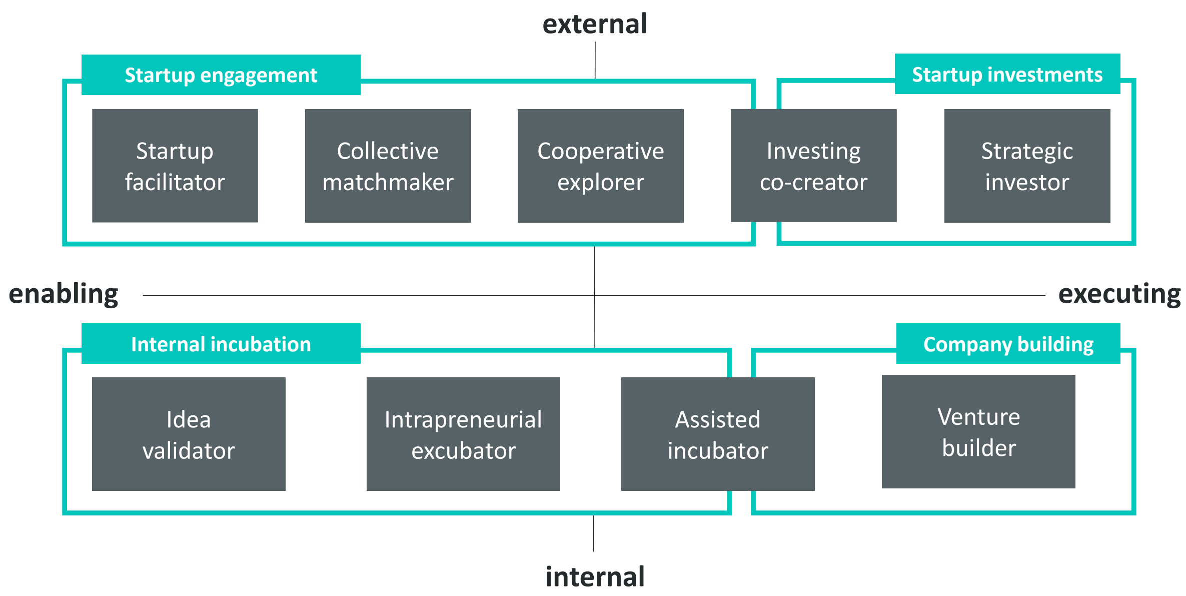

Figure 5.4: Overview of all internal and external CE programs

Generally, the following two aspects are in common for all nine CE program types. First, the focus on entrepreneurial activities, which is performed either by supporting intrapreneurial employees or by working with external startups. This *entrepreneurial focus* is a crucial element of the CE concept and is reflected in the CE program's activities. Second, CE programs are characterized by the fact that *multiple innovation ideas* are supported and that the support has a defined start and end point. This is typical for a program in general, whereas the type of support, as well as the start and end point, differ for the respective CE program types.

5.3 Defining types of radical innovation units

In addition to the nine CE program types presented in Sections 5.1 and 5.2, we have identified three types of organizational designs that are assigned to the category of radical innovation units. Even though they are not answering RQ1 per se, for completeness's sake, we will describe and define them in the same ways as the CE program types in Section 5.3. After their presentation, we will discuss why these radical innovation units are not counted as a CE program in Subsection 5.3.4.

5.3.1 Digital factory

The *digital factory* is the first out of three organizational designs that belong to the category radical innovation units. Table 5.10 and the definition for the digital factory type are based on four cases (n=4).

Design category	Description
Purpose	*Digital factories* have a balanced strategic logic, meaning they focus on exploring new capabilities and on operating the digital solutions being developed by them.
Scope	Digital factories focus on service and product innovations with the aim to improve and complement the core business (inside-in). Demand is driven by the digital factory, as it has responsibility for a specific task area related to digitalization.
Process	The innovation ideas developed by digital factories usually remain in this unit. It distinguishes them from a classic CE program, which aims to transfer the innovation idea. Thus, there is no start and end point, as digital factories are also responsible for operating the digital solutions they are developing.
Governance	Digital factories are usually organized as separate legal entities. They offer more flexible structures and serve the purpose of recruiting digital talent for the company, which is a core task of them.
Operations	The main activities include the development and operation of digital solutions for the core organization. In addition, they focus on developing new capabilities and recruiting digital talents.
Support type	The digital solutions created in digital factories have a strong focus on sales and marketing activities. The units provide an environment and infrastructure that supports the development of digital solutions within an established company.
People	The employees within a digital factory can be grouped into technical experts, user experience experts, project managers, and business developers. They cover all competencies to develop and operate digital solutions.

Table 5.10: Description of the digital factory and its design categories

Based on the design categories described in Table 5.10 above, for the digital factory, Definition 5.10 is formulated.

> **Definition 5.10** *Digital factories* are specialized digital units that are initiated to build new capabilities in a specific area and use them to develop and operate digital solutions that extend and transform the core business with digital components.

5.3.2 Tech labs

The *tech lab* is the second type of radical innovation unit category. This type is well known and used by companies for several decades (Heracleous et al., 2017; Pake, 1985). The definition of a tech lab and the descriptions in Table 5.11 are based on only two cases (n=2).

Design category	Description
Purpose	*Tech labs* exhibit a strong focus on exploring new technologies and understanding technology-related trends that appear relevant to the core organization.
Scope	They have a clear focus on technologies and related product innovations that complement or are adjacent to the core business. Their exploratory orientation leads to innovation being pushed by the tech lab itself.
Process	Tech labs do not follow a program-like process, but they rather explore and experiment with emerging technologies either driven by them or on behalf of the core organization. The aim is to build technological prototypes to understand the potential value for the company.
Governance	Tech labs are characterized by their location in an innovation hotspot, which is expected to support the early identification of emerging, relevant technologies.
Operations	They focus on understanding new technologies, which is done by scouting trends and experimentation and prototyping with new technologies.
Support type	The main contact of tech labs in the core organization is the R&D department which acts as their internal customer. Tech labs have the resources for initial funding and the time to experiment with new technologies.
People	Tech labs mainly employ technology specialists who assess technological trends. Due to the partly external focus, some of them act as innovation scouts. The maturity of the innovation ideas is mostly in the exploration and ideation stage.

Table 5.11: Description of the tech lab and its design categories

Based on the description of the seven design categories in Table 5.11, Definition 5.11 is formulated for tech labs.

> **Definition 5.11** *Tech labs* are specialized units that aim to explore new technologies and to develop relevant know-how about current technological trends. Their results are made accessible to the core organization by proof of concept and prototype projects.

5.3.3 Innovation labs

Innovation labs are the third type that belongs to the radical innovation unit category. This type is currently experiencing a high level of interest in practice and covers a rather broad organizational phenomenon. In contrast to the other types of organizational designs, the innovation lab has a less clear configuration which is rooted in the circumstance that it typically combines different CE and innovation-related activities in one organization unit. The definition of an innovation lab and the description in Table 5.12 are based on five cases (n=5).

Design category	Description
Purpose	*Innovation labs* are units with a strong explorative focus on new topics and digital technologies that are potentially relevant for the core organization.
Scope	The innovation scope is rather broad, including all four innovation types with a focus on product and service innovation. Innovation can have either an inside-in or an outside-in focus. Both are driven by the innovation lab. The relatedness of the innovation ideas to the core business does not follow a clear focus, rather they are a pool for topics that do not fit into the core business.
Process	The process for innovation development is diverse, which is due to the fact that several different activities are often bundled in the labs. The duration of support can range from validation to operation of the innovations. In some cases, the labs were a rather temporary unit initiated to work on different innovation ideas, but not as a formalized program for the continuous development of innovation ideas.
Governance	Due to the broad spectrum of activities and types of innovation, the structure of the labs shows a high degree of heterogeneity, with the most common type of embedding being a central unit.
Operations	A large proportion of the innovation labs combined several activities in parallel, including HR-related activities, an extended workbench for technology or digitization topics, or running multiple CE programs simultaneously.
Support type	The range of support is rather broad and depends on the concrete activities that are bundled in the innovation lab. Mostly, innovation labs have a budget to support the initial funding of innovation ideas that aim at their validation.
People	Innovation labs employ various roles, such as innovation coaches, business developers, tech experts, and innovation scouts. Depending on the nature of the activities, innovation ideas are developed by the lab staff themselves or together with startups and/or colleagues from the core organization.

Table 5.12: Description of the innovation lab and its design categories

Based on the characteristics described in Table 5.12 above, for innovation labs, Definition 5.12 is formulated.

> **Definition 5.12** *Innovation labs* are partly separated exploration units that serve as a pool for innovation ideas that do not fit into the scope of the core business but show a strategic relevance for the company.

The descriptions in the table and the definition show that innovation lab is more a generic term than a clearly describable organizational design. The reason for this seems to lie in the fact that companies are currently confronted with a variety of topics that are new to them, which require different capabilities. It can be observed that partially separate units are created in which these "new topics" are brought together – the innovation lab. This bundling of activities does lead to a wide variety of activities that are potentially carried out by innovation labs. In many cases, they run different innovation, digitalization, or HR-related activities, sometimes combined with CE activities. However, due to the variety of different activities, innovation labs are less structured and standardized, making it difficult to give a clear definition of what an innovation lab is.

5.3.4 Concluding on radical innovation units

As mentioned in Subsection 5.2.6, the three types that belong to the radical innovation unit category are not counted as a CE program as they show clear differences to the nine CE program types. In this subsection, the respective differences will be described to illustrate why they are not considered to be a CE program.

Starting with the *digital factory*, we remark that it differs at least regarding the following three aspects from a CE program. First, the innovation ideas or projects that are developed by digital factories often remain within them and are not transferred, which is different from all CE programs. Second, digital factories are not only developing innovation ideas but also focus on optimizing and operating digital solutions. Third, even though digital factories are organized as partly separated units, their activities are understood as a part of the core organization, which is reflected in the circumstance that they have clear functional responsibilities for their projects and innovation ideas. In the cases of our data set, these responsibilities are mostly in the areas of digital marketing, digital sales, and other customer-oriented functions.

The *tech lab*, as the second type of radical innovation unit, differs from CE programs as follows. Unlike CE programs that focus on entrepreneurship (either intrapreneurship or with external startups), tech labs are primarily focused on understanding new technologies and building know-how that is useful to the core organization. They are not designed to develop a product innovation but only to *identify* and *understand* relevant technologies. This approach differs fundamentally from CE programs that do not focus on technology only but on innovation as new products or new businesses that can be created from them. Therefore, tech labs can be seen more as a type of research and development activity. However, in our study, all tech labs were located in Silicon Valley and had the mission to understand trends and developments early on in order to not miss out on the latest technologies. This aspect is rather related to scouting activities of CE programs, which makes tech labs more than “just” a research facility.

The *innovation lab* as the third type of the radical innovation unit category is different from CE programs due to the following reason. In contrast to all other organizational designs that were investigated in this study, innovation labs are characterized by combining different activities that relate to CE, innovation, and digitalization in one organizational unit. Thereby, the type of combination is varying strongly for each case. This leads to the circumstance that there is not one specific configuration of design elements that is describing “the innovation lab”. Innovation labs differ from CE programs which mostly have a clear scope of activities and typically a well-defined process in their program phases. In conclusion, an innovation lab can be seen as an umbrella term for units that combine different innovation-related activities (which may share or do not share elements of CE) rather than a specific type of an organizational design like the other elven types that were identified.

Having described why radical innovation units are not counted as CE programs, we will now use the framework presented in Subsection 5.3.6 to show how these organizational units are complementing the different types of CE programs in Figure 5.5.

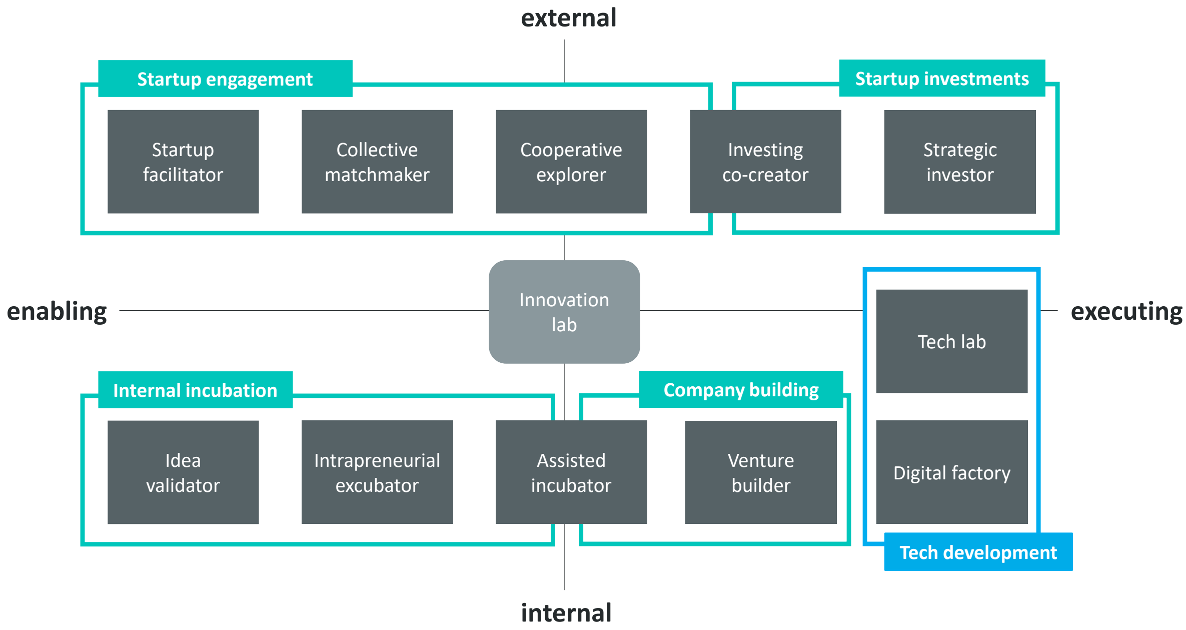

Figure 5.5: Overview of all organizational designs identified in our study

The innovation lab is placed in the middle of Figure 5.5 and is illustrated differently from the other organizational designs. This is done since the innovation lab is the most ambiguous type with various practical manifestations (e.g., combining internal and external activities).

The two remaining types are highlighted by the blue frame and the term *tech development*, which is describing their main activity. Both the *tech lab* and the *digital factory* show a strong focus on exploring and developing new technologies to make them accessible and usable for the core business.

To conclude, our results present nine distinct CE program types and three types of radical innovation units. The latter are related in some way to the concept of CE. These twelve types of organizational designs contribute to a better understanding of the different entrepreneurial and innovation activities of established companies.

5.4 Comparing the different types of CE programs

In Section 5.4, we compare the nine defined CE programs to understand their differences better. Even though radical innovation units are distinct from CE programs, they will be further considered in our analysis to understand *how* they differ from and maybe complement the activities of CE programs.

Our main aim is to answer RQ1b, which reads as follows - w*hich design elements are suited for distinguishing these CE programs?*

For this purpose, the nine types of internal and external CE programs and the three types of radical innovation units are compared by using a subset of design elements from Chapter 4. For each CE program category, we will focus on identifying a specific set of design elements that is suited to distinguish the different CE program types. The distinction will be made in Subsection 5.4.1 for internal CE programs, Subsection 5.4.2 for external CE programs, and Subsection 5.4.3 for radical innovation units.

The identification of design elements suitable to distinguish the different types of CE programs and radical innovation units is based on the morphological boxes created for each type. Two types of design elements are relevant for answering RQ1b.

- First, design elements that are *heterogeneous* across the different types in a CE program category. That is, each CE program type has a different element characteristic for the particular design element.
- Second, design elements that are distinct for a CE program type, such as when four out of five have the same element characteristics for a design element and one is different.

Design elements that are homogeneous across the CE program type are not considered as they do not contribute to the distinction between the different CE program types.

5.4.1 Distinguishing internal CE program types

For distinguishing internal CE programs, nine design elements belonging to five design categories are important to describe the differences between the four internal CE program types. The design elements that are appropriate for distinguishing them are illustrated in Figure 5.6. For each design element, the typical element characteristics are summarized in the field below the respective CE program type. In the case of design elements that show multiple element characteristics, all of them have been summarized in this field. In the case that a design element does not have any element characteristics that are typical, we have used the term "mixed" to represent this in the figure.

The main differences that are illustrated in Figure 5.6 are briefly summarized below for each CE program type of the internal category. Note that we changed the order of the internal CE program types in that we place the venture builder on place four instead of place one.

- *Idea validators* are short-term programs that focus on validating ideas (problem-solution fit) with the aim of transferring promising ideas back to the core business. In order to be able to transfer the ideas back, they have a rather strong relatedness to the core business and a strong focus on improving or complementing it with service and process innovations.
- *Intrapreneurial excubators* aim to support employees in implementing their ideas. The ideas typically focus on product or business model innovations. Their relatedness is rather unclear, which means that some ideas aim to solve current business needs, while others are rather independent businesses. This can be seen in the characteristics of the innovation flow, which are either inside-in (higher relatedness) or inside-out (lower relatedness). Given the focus on supporting individuals, a key activity is the education of entrepreneurial skills and methods, often through specific formats.
- *Assisted incubators* are geared to the needs of the core business, with a focus on market-oriented innovations (not process innovations) that are complementing or adjacent to the core business. As the main difference to the previously described CE program types, the assisted incubators employ their own innovation experts who become team members during the program phase and support the implementation of the innovation ideas with their specific skills (assisting).
- *Venture builders* differ from the three other internal CE program types in that they do not focus on supporting the employees of the core organization, but on creating new businesses themselves (*ideation* and *execution*). They are specialized units that employ the different roles needed (technical experts, business development, etc.) for developing new business, which is mostly adjacent to the core business or even independent of it. The innovation ideas mainly follow an inside-out innovation flow, which results in founding a corporate venture or creating a new business unit.

These brief descriptions, which are based on the elements (see Figure 5.6 for a summary of the differences between the internal CE program types), show that the four internal CE program types can be clearly distinguished using a subset of design elements (nine out of 26).

Design category	Design element	Idea validator	Intrapreneurial excubator	Assisted incubator	Venture builder
Scope	Innovation types	Service, process & product	Product & business model	Service, business model & product	Business model
	Innovation flow	Inside-in	Inside-out & inside-in	Inside-in	Inside-out
	Business relatedness	Complementing & improving	Mixed	Complementing & adjacent	Adjacent & independent
Process	Starting point	Batches	Mixed	Ongoing	Ongoing
	Program end	Validating problem-solution fit	Building product-market fit	Support initial business operations	Operate the business itself
	Preferred exit path	Transfer to core business	Become a spin-off or a business unit	Transfer to core business	Become a spin-off or a business unit
Governance	Governance mode	Program within hierarchy	Central office	Central office	Own legal entity
Operations	Key activities	Incubating	Incubating & educating	Assisting & incubating	Ideating & executing
People	Program participants	Employees from core business	Employees from core business	Employees CE program & core business	Employees CE program

Figure 5.6: Design elements distinguishing internal CE programs

5.4.2 Distinguishing external CE program types

The five external CE program types can be distinguished by twelve design elements that belong to six design categories. The design elements and their element characteristics for each external CE program type are illustrated in Figure 5.7.

Generally, it can be stated that external CE programs differ into types that aim at (a) collaboration with startups, (b) investing in startups, or (c) hybrid types that are combining both (see Section 5.2.6). Based on the design elements and their element characteristics, the differences for the five external CE program types are described briefly. The order of the five external CE program types is the same as given in Section 5.2.

- *Startup facilitators* show a clear focus on improving the core business, mostly with process innovations that are insourced from startups. The focus on optimizing the core business is distinguishing the startup facilitator from the other external CE program types, which focus on rather market-oriented innovations.
- *Collective matchmakers* are different from the other four external CE program types due to the fact that they are operated by multiple companies instead of one. Besides this key difference, they have a rather broad focus on different innovation types covering product, service, and process innovation.
- *Cooperative explorers* aim at developing product or service innovations together with startups to complement and extend the core business. Mostly, these CE programs do support the validation of the innovation potential as well as the development of a first MVP (minimum viable product). Within the development process, they support the teams consisting of internal employees and members of the startup.
- *Investing co-creators* differ from the other types in their hybrid focus on both collaboration with and investing in startups. They usually only invest in startups when they have a clear opportunity to collaborate with them. In this regard, investments are mainly made to strengthen the strategic partnership with the startup. The focus for collaboration is generally rather broad and not limited to a specific area.
- *Strategic investors* are geared towards investing in innovative startups that (a) are a financially promising investment and (b) show a strategic relevance for the core organization. The strong financial component and the primary focus on investments is distinguishing the strategic investor from other external CE program types.

These brief descriptions are based on the design elements and respective element characteristics for each of the five external CE programs. They show that the types can be clearly distinguished. Hence, the twelve design elements summarized in Figure 5.7 represent a subset of design elements that is sufficient to distinguish external CE programs.

Design category	Design element	Startup facilitator	Collective matchmaker	Cooperative explorer	Investing co-creator	Strategic investor
Purpose	Orientation	Strategic	Strategic	Strategic	Strategic	Balanced
Scope	Innovation type	Process	Product, service & process	Product & service	Product	Business model & product
	Relatedness to core business	Improve core business	Complement core business	Complement & extend business	Complement core business	Extend & create new business
	Innovation demand	Moderated pull	Moderated pull	Moderated pull and push	Push by CE program	Push by CE program
Process	Starting point	Mixed	Batches	Ongoing	Ongoing	Ongoing
	Program end	Validating problem-solution fit	Validating problem-solution fit	Creating product-market fit	With established cooperation	Exit of portfolio venture
Governance	Governance mode	Central office	Central office	Own legal entity	Own legal entity	Own legal entity
	Platform openness	Closed	Open for other industry partners	Closed	Closed	Closed
Operations	Key activities	Scouting & facilitating	Scouting, assisting & facilitating	Scouting, assisting & facilitating	Scouting, investing & facilitating	Scouting and investing
	Type of funding	Project funding	Project funding	Project funding or investment	Investment or project funding	Investment
People	Key contact points	All departments	R & D	R & D	Mainly R&D, all departments	CE program mainly

Figure 5.7: Design elements distinguishing external CE programs

5.4.3 Distinguishing radical innovation units

The three types that belong to the category of radical innovation unit have a subset of twelve design elements that come from all seven design categories. Thus, they are suited to distinguish the three types belonging to the radical innovation unit category, as illustrated in Figure 5.8.

Based on these twelve design elements and their element characteristics, a brief summary of the differences of each type is provided.

- *Digital factories*, as the name already implies, have a strong focus on supporting the digital transformation of the core organization. In contrast to the other types, their main focus is set on sales and marketing activities. A second key difference is that they are structured and organized to develop digital solutions as well as to operate them on their own.
- *Tech labs* are organizational units that have a clear focus on identifying and understanding new technologies and developments. They mainly differ from other organizational designs as they rather focus on technology than on the development of innovations. It means that they are not designed to develop market-ready innovations but to provide new technologies and know-how that may lead to developing such an innovation.
- *Innovation labs* can show both an inside-in and inside-out innovation flow which is mostly because they are used to bundle various innovation and digitalization activities, which do not fit into the structure or scope of the core business. The fact that multiple activities or CE programs are bundled can be seen as one characteristic of an innovation lab, which distinguishes it from other CE program types.

Similarly, to the internal and external CE programs in the previous sections, for the digital factories, it can be stated that a clear definition and distinction from other organizational configurations is possible. For the innovation lab, however, a definition, as well as a clear distinction, is more difficult. This is rooted in the circumstance that innovation labs are organizational units that bundle multiple activities or multiple CE programs. As the combination of activities is case-specific, there are no fixed design elements that are clearly distinguishing or defining an innovation lab in our data set.

Design category	Design element	Digital factory	Tech lab	Innovation lab
Purpose	Strategic logic	Exploration & exploitation	Exploration	Exploration
Scope	Innovation flow	Inside-in	Inside-in	Inside-in & outside-in
	Relatedness to core business	Improve & complement core business	Complement core business	Mixed
Process	Application process	Internal ideation & by order	Mainly push	Moderated pull and push
	Starting point	Mixed	Ongoing	Ongoing
	Program end	Develop and operate the digital solutions	Technical prototype or proof of concept	Building product-market fit, support operations
Governance	Governance mode	Own legal entity	Mixed	Mixed
Operations	Key activities	Ideating & idea executing	Technology scouting and execution	Mixed
	Different innovation formats	HR related activities	-	Multiple programs in one unit, HR activities
Idea support	Key contact points	Sales & marketing	R&D	Mixed
People	Key functions	Technical experts & project managers	Mainly tech-experts	Tech-experts, project managers, business developer, coaches
	Participants	Employees CE program	Employees core business	Employees core business, CE program, external startups

Figure 5.8: Design elements distinguishing radical innovation units

5.5 Comparing the background information

In this subsection, we focus on the background information for the different types of CE programs and radical innovation units that have been defined in this chapter. An initial overview of the background information was already provided on the level of the CE program category (see Subsection 3.3.2). However, a more detailed overview was not possible at that point in time since a more detailed understanding of the different organizational designs was not then available.

Now we are ready to read more information. In Table 5.13, the background information of (a) the number of employees, (b) the age of the organizational unit, and (c) the location will be provided for the twelve types described in Sections 5.1 – 5.3.

CE program category	**CE program type (# cases)**	**# of employees**			**Program age (a)**			**Outpost rate**[14]	**# cases closed**
		MIN	MAX	AVG	MIN	MAX	AVG		
Internal CE programs	Idea validator (4)	1.5	12.0	4.9	4.7	9.3	6.0	0%	0
	Intrapreneurial excubator (9)	1.0	21.0	7.4	2.8	6.0	4.0	11%	3
	Assisted incubator (7)	2.0	70.0	16.7	2.0	5.8	3.5	14%	1
	Venture builder (3)	10.0	30.0	19.3	2.3	4.9	3.3	0%	0
External CE programs	Startup facilitator (6)	2.0	13.0	6.3	1.8	8.2	4.8	0%	0
	Cooperative explorer (3)	5.0	45.0	19.0	3.0	17.7	8.3	33%	1
	Collective matchmaker (3)	9.0	31.0	16.3	2,1	8,4	4,9	0%	0
	Strategic investor (3)	10.0	28.0	18.0	4.0	9.3	5.8	100%	0
	Investing co-creator (5)	3.0	31.0	9.7	2.3	8.4	4.7	40%	0
Radical innovation units	Digital factory (4)	40.0	300.0	172.5	3.8	18.8	8.6	0%	0
	Innovation lab (5)	5.0	60.0	21.5	1.5	21.3	7.3	20%	3
	Tech lab (2)	8.0	40.0	24.0	20.3	24.8	22.5	100%	0

Table 5.13: Background for CE program types and radical innovation units

The information provided in Table 5.13 shows clear differences exist regarding the background information. In the sequel, the strongest differences will be described, starting with (A) the number of employees, followed by (B) the age of the different organizational designs, (C) the ratio of outposts, and (D) the terminated cases.

[14] Following the understanding presented in Chapter 3, an outpost describes a unit that is located in an innovation hotspot such as the Silicon Valley. They have the mission to be a representative of the company in that area and to understand and to sense trends and developments from early on.

A: Number of employees

For the internal CE programs, it can be seen that the assisted incubator (16.7 employees) and the venture builder (19.3 employees) have on average more than double the size of the idea validator (4.9 employees) and the intrapreneurial excubator (7.4 employees). This goes in line with the structural differences described in Section 5.1 – 5.3. In contrast, the idea validator and the intrapreneurial excubator focus on supporting employees of the core organization, the assisted incubator and the venture builder are either assisting or even executing the implementation of the innovation ideas. However, the capacity to assist or execute concrete innovation ideas requires more employees. This is reflected in the average size of the internal CE program types.

For the external CE program types, it can be stated that the average size of the CE program type is correlating with the scope of work. The startup facilitator and investing co-creator, mainly focus on scouting for relevant startups and on facilitating collaborations. This focused scope of work might explain why they have on average fewer employees than the three other external CE programs of cooperative explorer, collective matchmaker, and strategic investor. These latter three CE program types typically have additional activities, such as supporting pilot projects, organizing investments, and managing partner companies. These additional activities are reflected in the average number of employees, which is double the size of the startup facilitator and investing co-creator.

For the radical innovation units, it can be observed that the digital factories are much larger than the remaining CE program types and radical innovation unit types. On average, they employ 172.5 people. Comparing this number to the second-largest type in Table 5.12, which is the tech lab with 24 employees on average, shows that digital factories are an exception regarding their size. This strong difference can also be explained by the design of the digital factory as described in Subsection 5.3.1. Digital factories not only develop digital innovations but are also responsible for their operation as part of the core organization. This differs from the other CE programs and radical innovation units since they are designed to transfer the innovation ideas either to the core organization or into a new legal entity.

B: Age of the organizational designs

Regarding the age of the CE programs and the radical innovation unit types, the tech lab is showing a much higher age with an average of 22.5 years than all other types. The youngest average age can be observed for the venture builder with 3.3 years. For both types, this is in line with the current state of knowledge. Whereas tech labs are used by companies for several decades (Wang & Kleiner, 2005), the venture builder is the most recent type that is discussed in the field of CE and a comparably young phenomenon (Rathgeber et al., 2017). Another observation that can be made regarding the age is that the innovation lab shows the highest discrepancy with 1.5 years for the youngest case and with 21.3 years for the oldest one.

C: Location

For the location, we distinguish between CE programs and radical innovation units that are located in the DACH region (Germany, Austria, and Switzerland) or in an innovation hotspot, which in our case is the Silicon Valley. In the last column in Table 5.13, the rate of outposts shows the proportion of the cases from our data set that were located in Silicon Valley.

For the *internal CE program types*, it can be observed that out of 23 cases, only one intrapreneurial excubator and one assisted incubator are located in Silicon Valley. This observation is in line with the understanding of an innovation outpost, which has the mission to sense trends and developments in an innovative region mostly by external activities.

For the *external CE program types*, as it can be expected, a larger ratio of innovation outposts can be observed. In total, six out of the 20 cases were located in Silicon Valley. The six cases show the following distribution across the different external CE program types – three cases of the strategic investor, two cases of the investing co-creator, and one case of the cooperative explorer. This shows that only CE program types that focus on market-oriented innovation (not process innovation) are located in an innovation hotspot, with a focus on investing in startups. For the strategic investors, it must be stated that even though 100% of the cases were located in the Silicon Valley, there are many that operate in the DACH region. Two of the three cases in our data set did also have an office in Germany.

For the *radical innovation units*, there are three cases that are located in Silicon Valley. Two of them are tech labs, and one is an innovation lab. Even though tech labs show a rather internal focus, they are located in an innovation hotspot as their aim is (1) to identify and understand emerging technologies early on and (2) to transfer the know-how back to the core organization. Consequently, it is not surprising that these units are located in an area where many new technologies are being created.

D: Termination of CE programs

There are eight out of 54 cases that were terminated during our study. The eight cases that were terminated are distributed among the CE program categories as follows. Four of them are internal CE programs, one case is an external CE program, and three belong to the radical innovation unit category. As described in Subsection 3.2.2, there are two types of terminated cases. On the one hand, three cases were closed but replaced by successor programs, which were generally perceived as a successful CE program. On the other hand, the remaining five cases were closed because they did not meet the expectations of the core organization and consequently were perceived as being not successful. The distribution of the terminated cases across the different CE program categories and the respective CE program type or type of radical innovation unit is illustrated in the following Table 5.14. The first column of the table shows the CE program category, followed by the specific CE program in column two. The third column includes all terminated cases, and the fourth column lists only those cases that were perceived as unsuccessful.

CE program category	CE program type	All cases that were terminated	Terminated cases perceived unsuccessful
Internal CE programs	Intrapreneurial excubator	2 (reflecting 8.7%)	2 (reflecting 8.7%)[15]
	Assisted incubator	2 (reflecting 8.7%)	1 (reflecting 4.3%)
External CE programs	Cooperative explorer	1 (reflecting 5.0%)	0 (reflecting 0.0%)
Radical innovation units	Innovation lab	3 (reflecting 27.3%)	2 (reflecting 16.7%)

Table 5.14: Overview of cases that were terminated during our study

Table 5.14 shows that in our data set, the cases perceived as unsuccessful belong either to (a) the internal CE program category or (b) to the radical innovation unit category. For internal CE programs, a potential explanation may be rooted in the circumstance that the activities of internal CE programs have an overlap with the activities of the core business, e.g., creating new products or businesses. This may lead to more competitive thinking, in particular when the innovation ideas have a cannibalizing effect or lead to changes in the core organization. In

[15] The two cases of the intrapreneurial excubator are currently paused (for more than one year) due to the economic situation. So far, they have not been re-started which is the reason why they are grouped in the category perceived as unsuccessful.

addition, the innovation ideas that must be transferred back to the core business do often lead to tension as the processes and structures in the core organization are designed for the core business but not for innovation ideas that are more discontinuous.

For the innovation lab, which is the only type of the radical innovation unit category that was terminated, the reason may be found in their organizational design. As shown in Subsection 5.3.3, innovation labs are often used as a pool for innovation ideas and projects that do not fit to the core organization. Consequently, their organizational design is less clear than for the other types that were identified. This also comes in hand with a higher level of ambiguity regarding what they can be used, which may lead to misunderstanding and explains why three out of five innovation labs were terminated.

5.6 Discussion of the results

The results of this chapter show that there are in total nine different types of CE programs and three types that belong to the category radical innovation unit. Furthermore, we have seen that the design elements that were derived in Chapter 4 are suited for defining and distinguishing the different CE program types.

In the following three Subsections (5.6.1 – 5.6.3), we will be discussed how the results of our study can be embedded into existing literature about the organizational designs of CE programs and how we are contributing to a better understanding of CE.

5.6.1 Embedding internal CE programs within the existing literature

As shown in Section 4.1, there is only one internal CE program that is well-established in the literature – the internal corporate incubator. The concept of *incubation* is generally not limited to the field of CE but also used in similar fields such as entrepreneurship and innovation (Zedtwitz, 2003). Incubation is used to describe the support of nascent innovation ideas by providing them (1) an environment that is beneficial and (2) access to resources such as financing, coaching, etc. (Becker & Gassmann, 2006b). In the context of CE, the understanding of what is an internal corporate incubator is historically grown and has experienced a certain development over time (Selig et al., 2018). As it is the only well theoretically embedded concept for internal CE program types, it is used for a variety of different organizational designs (Becker & Gassmann, 2006a). Consequently, the internal corporate incubator can be seen rather as an umbrella term for the described types of activities than one specific configuration of a CE program.

This understanding fits to our results described in Subsection 5.1.5, showing that we identified three CE program types that are either fully or partly related to the concept of incubation. These are (1) the idea validator, (2) the intrapreneurial excubator, and (3) the assisted incubator (hybrid of internal incubation and company building). By providing a clear definition and description of these three internal CE program types (see Subsections 5.1.2 – 5.1.4) and linking them to the concept of incubation, we are providing a more nuanced understanding of the different types of organizational designs that are referred to as internal incubation. The three internal CE program types show clear differences, for example, regarding the duration, the scope of innovation, or the type of support through the CE programs. Hence, our findings do not contradict the existing understanding of internal CE activities but provide a more detailed view by providing more precise definitions covering the different organizational designs to support intrapreneurial employees that have emerged.

The fourth internal CE program type that has been identified and defined is the venture builder (see Subsection 5.1.1). The venture builder shows clear differences to the general concept of internal incubation as these programs focus on developing new business by themselves instead of supporting employees from the core business. The venture builder has been the topic of a few publications that are describing this recent phenomenon. Thereby, different names like company builder, corporate company builder, or venture builder are used (Gutmann, 2018; Peter et al., 2018; Rathgeber et al., 2017). We have selected the name venture builder to distinguish the CE program type from the phenomenon of independent companies that are designed to frequently found new ventures, which is often referred to as company building (Köhler & Baumann, 2015). By providing an empirically derived definition of the venture builder and a clear distinction to other internal CE programs, we are enhancing the current body of research and offer a more nuanced perspective on internal CE activities.

To conclude on the internal CE program types, it can be stated that the four types we have identified in our study are enhancing the current body of literature in at least two ways. First, they are providing a more nuanced understanding of the internal incubation concept. Second, they are clarifying how the venture builder differs from internal incubation and showing what is characteristic of the concept of company building.

5.6.2 Embedding external CE programs within the existing literature

In contrast to internal CE programs, there is a larger number of external CE program types that are well-embedded into literature, namely (a) the external corporate incubator, (b) the external corporate accelerator, and (c) corporate venture capital (see Subsection 4.1.2). The results of our studies are contributing to a better understanding of external CE program types by providing definitions of five distinct external CE program types. Thereby, the definitions build on the well-known CE programs but also cover novel organizational designs (see Subsection 4.1.2).

Starting with the two CE program types that focus on startup investments. The results of our study have revealed that two distinct types of CE programs that are investing in startups can be defined and distinguished, namely (1) the *strategic investor* and (2) the *investing co-creator*. Both of them are linked to the concept of corporate venture capital, which describes that companies are investing in startups for financial or strategic reasons (Maula, 2007). The *strategic investor* type can be clearly linked to prior studies on corporate venture capital which are describing institutionalized units for startup investing (Ma, 2020; Benson & Ziedonis, 2009; Dushnitsky & Lenox, 2006; Chesbrough, 2002). The *investing co-creator* as the second CE program type that invests in startups enhances the current discussion on corporate venture capital activities as follows. It shows a hybrid type CE program that combines investing and collaborating that is distinct from “traditional” corporate venture capital activities as it uses the investment as a vehicle to strengthen partnerships that show a direct relationship to the core business. The provided definition of the investing co-creator shows similarities with the external explorer described by Hill & Birkinshaw, 2008 in their publication on different configurations of corporate venturing units.

The three remaining types of CE programs which are (1) the startup facilitator, (2) the collective matchmaker, and (3) the cooperative explorer, can be counted as CE program that is focusing on engaging with startups. The collaboration with startups is also frequently discussed in the literature on external corporate incubators and external corporate accelerators. Consequently, we will discuss how these two types (or better concepts) are related to the three external CE program types we have identified in our study.

Similar to the internal corporate incubator, we understand the two types of *external corporate incubator* and *external corporate accelerator* rather as an umbrella term or general concept than a specific CE program type. The external corporate incubator appears to be a concept that has been replaced in recent years and is almost non-existent in practice. In our data set, there is only one case that declares itself as an external corporate incubator. This is in line with Becker & Gassmann, 2006b), who showed in their study that already then a large proportion of the incubators were terminated. A second publication did stress the circumstance that a new model of the incubator is emerging (Pauwels et al., 2016). In practice, it seems (based on our data set) that it has replaced the external corporate incubator. To conclude, our results suggest that the external corporate incubator in its traditional understanding (as a distinct CE program type) is not existent anymore.

A more recent concept frequently discussed in the context of startup engagement programs is the *external corporate accelerator* (Shankar & Shepherd, 2019; Moschner et al., 2019; Selig et al., 2018; Kanbach & Stubner, 2016). For external corporate accelerators, it can be stated that a different understanding exists (Moschner et al., 2019; Kupp et al., 2017), which is potentially rooted in the circumstance that the term is recently used by many different types of startup engagement. In its traditional understanding, it is an organizational entity that supports cohorts of external startups (in a batch-logic[16]) for a rather short period of time with access to resources, network, and in some cases, initial funding (Kohler, 2016). Over the past years, however, the term was used more broadly, which is a reason why we understand corporate acceleration rather as a concept than as a concrete CE program type. In order to avoid confusion stemming from the name of the CE program types, we decided not to use the term acceleration based on the reason described above.

Nevertheless, we build on the rich theoretical foundation provided by the literature on external corporate accelerators when defining the three CE program types that focus on startup engagement.

- The first CE program type, the *startup facilitator* is describing a rather novel phenomenon that focuses on the standardized collaboration with startups aiming at listing them as a supplier and thereby insourcing different types of external innovation. The startup facilitator provides a clear definition for a CE program type that is also discussed under the names of venture client model (Gimmy et al., 2017), startup

[16] Batch-logic is used in practice of CE for describing a program has fixed start and end dates.

supplier program (Kurpjuweit & Wagner, 2020), or corporate accelerator (Shankar & Shepherd, 2019).

- The second CE program type, the *collective matchmaker* is related to the startup facilitator but differs as it is organized as an open platform where multiple corporate join their forces to attract promising startups with the aim of insourcing external innovations. In a recent publication of Moschner et al. (2019), this CE program type is described as a consortium accelerator, whereby Daimler's Startup Autobahn is mentioned as a prominent example of it.
- The third CE program type, the *cooperative explorer* is a rather established type of startup collaboration with a clear focus on technology and product innovation, which makes this type different from the startup facilitator. This CE program type has a clear link to the R&D activities of the core organization and has been the topic of different studies, e.g., by Weiblen & Chesbrough (2015) with their description of the startup program (outside-in).

To conclude on the external CE programs, the results presented in this chapter are contributing to the existing literature in at least the following four ways. First, the results are enhancing the understanding of the different organizational designs that can be used to drive startup engagement by providing a definition and description for three distinct CE program types. Second, a more nuanced understanding of corporate venture capital is provided by showing that two different types exist that can be used to pursue strategic startup investments. Third, we have shown that the concept of external corporate incubation is not used in practice anymore in the DACH region. Fourth, external corporate acceleration can be understood as a general concept rather than a concrete CE program type since it is used to describe different organizational designs that are used in practice.

5.6.3 Embedding radical innovation units within the existing literature

The three types that were identified for the radical innovation unit category are distinct from the nine CE program types, as shown in Subsection 5.3.4. Even though they are not covered in our RQs, analyzing them has provided a better understanding of their organizational design.

Digital factories can be understood as a distinct form of structural ambidexterity that explicitly focuses on digital technologies and capabilities. Many digital factories focus on sales and market-related topics in combination with the development of digital capabilities required for the implementation and operation of digital solutions. For developing the digital capabilities, the recruitment of digital talent that would not be addressed by the core organization is an important aspect of their work. Describing and defining digital factories contributes to research on structural ambidexterity and digital transformation.

Tech labs are an organizational design that has been described in many previous studies, which were focusing on research activities of established companies. A prominent example that has been the subject of investigation in several studies is the XEROX Parc research facility (Heracleous et al., 2017; Weiser et al., 1999; Pake, 1985). With our results, we are contributing to the existing literature by providing a clear definition of tech labs and by distinguishing them from CE programs. Generally, they are rather understood as a tool of a company's research and development activities. Due to their location in an innovation hotspot, they also pursue trend scouting activities with a strong focus on technological developments.

Innovation labs are the most ambiguous organization design in the category of the radical innovation units. Innovation labs (sometimes also named digital labs) are currently experiencing a high level of attention in practice, as many companies are separating their digital transformation and digital innovation activities from the core business (Schmidt et al., 2014; Peter et al., 2018). Our results indicate that the term innovation lab is more of an umbrella term than a specific type of organizational design. Often, companies used the term innovation lab to describe one of the nine CE program types or organizational units that combine multiple CE program types (see van der Meer et al., 2021).

To *conclude* on the three types of organizational design from the radical innovation unit category, it can be stated that all three types show a certain relationship to CE, while at the same time they are different from CE program in various ways (see Subsection 5.3.4).

5.6.4 Limitation of the findings

Below we discuss two limitations that apply in our study.

A first limitation is that for some CE programs, it was difficult or even impossible to trace the history of their development, as they were launched several years or even decades ago and the person responsible for the respective CE program was often no longer involved at that time. Accordingly, information about the background of older CE programs is sometimes unclear or missing. However, since this information does not directly affect the current organizational design and strategy of the CE program, the influence on the quality and completeness of the data is relatively small.

A second aspect limiting the findings is the fact that rather young CE programs (< 3 years) were often still in the process of finding their "steady state", meaning that the organizational design was undergoing still some changes to adapt to the characteristics and needs of the core organization best possible. For most cases counting to this category, it was possible to conduct follow-up interviews with the same person or additional interviews with persons that were also involved in the respective CE program. However, for a few cases, this was not possible, which leads to a certain level of uncertainty regarding the organizational design elements that were identified and described. As mitigation of this uncertainty, an additional search for secondary data was conducted at a later time since most rather mature CE programs have a good web presence with extensive information, e.g., about their processes or examples of former participants. This information can be used to check the validity of the interview and, if necessary, also to add missing aspects.

5.6.5 Future avenues for research

Based on the results presented in this section, there are three avenues for future research that will be briefly described.

- First, the systematic approach to define and distinguish CE programs has revealed nine distinct types. This approach could also be applied for related organizational designs such as digital labs and digital hubs or to emerging CE programs in order to provide more clarity about the different organizational designs used by companies to develop innovation and to support their transformation.
- Second, for some CE program types, e.g., the venture builder or the strategic investor, we have only a limited number of cases. In order to strengthen the understanding of the organizational design, it is recommended to study a larger number of cases to understand the configuration of each of them.
- Third, future researchers may opt for a quantitative study based on the design elements and element characteristics. Previously, quantitative studies were accompanied by a certain degree of uncertainty since the various CE program types were not clearly defined, and different names and organizational designs were used

interchangeably, which makes it difficult to determine the subject of investigation with quantitative methods.

The results of our study are highly valuable for understanding the heterogeneity of CE programs from the organization design perspective and opens up new ways for researchers to further deepen this knowledge.

5.7 Concluding on the organizational designs of CE programs

The aim of Chapter 5 is to answer RQ1: *What are the different types of CE programs?*

For this purpose, a systematic approach to define and distinguish CE programs has been developed and applied to our data set that covers 54 cases. The study resulted in twelve organizational designs that were identified in the context of CE. Nine out of them are understood as CE programs, whereas the remaining three are classified as radical innovation units. By providing these definitions, the first sub-question, RQ1a (w*hat types of CE programs can be defined?*) was answered in full (see Sections 5.1 – 5.3).

The systematic approach to analyze and define the organizational designs did also serve as a basis for identifying design elements relevant for answering RQ1b (w*hich design elements are suited for distinguishing these CE programs?*). Comparing the morphological box for each organizational design revealed, for each CE category, a subset of design elements that is suited for distinguishing the different CE programs and radical innovation units (see Section 5.4).

By providing definitions for the different CE programs and a subset of design elements to distinguish them, the first RQ is answered with the results presented in this chapter.

6 The value creation of CE programs

Even though it is widely accepted that the value creation of CE is manifold (see Chapter 2), surprisingly little attention has been paid to understand the different types of value creation that can be achieved by CE programs.

In this chapter, we will answer RQ2: *What types of outputs are created by CE programs?*

Chapter 6 is based on the following four publications:

- C. J. Selig, T. Gasser and G. H. Baltes (2018) "**How Corporate Accelerators Foster Organizational Transformation: An Internal Perspective**", 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Stuttgart, 2018, pp. 1-9.
- C. J. Selig, T. Gasser and G. H. Baltes (2019) **"Effects of Internal Corporate Venturing on the Transformation of Established Companies"**, In: Baierl R., Behrens J., Brem A. (eds) Digital Entrepreneurship. FGF Studies in Small Business and Entrepreneurship. Springer, Cham, pp. 159 – 183.
- C. J. Selig and G. H. Baltes (2019) "**Towards an effective management of corporate entrepreneurship activities**", 2019 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Valbonne Sophia-Antipolis, France, 2019, pp. 1-9.
- C. J. Selig and G. H. Baltes (2020) "**Strengthening Organizational Ambidexterity through Corporate Entrepreneurship**", 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Virtual Conference 20202, pp. 1-9.

To deepen the understanding of the value creation we will focus on the outputs that can be created by CE programs. The importance of understanding the variety of outputs has been underlined by a literature review on the performance of CE.

The literature review concludes with the three recommendations (Bierwerth et al., 2015).

1) To use multiple performance indicators for measuring CE performance instead of making a summed index, which does not reflect the variety of motivations behind CE.
2) To use theories that are covering more than just financial objectives in order to fully understand the heterogeneity of CE activities.
3) To improve the alignment between the objective of CE activities and the respective performance measurement.

In particular, the first and second recommendations highlight the need for a better understanding of the variety of outputs to improve CE program performance measurement.

To investigate the value creation of the CE programs, we have structured this chapter as follows. Section 6.1 discusses the approach used to analyze the outputs. Section 6.2 will present the identified outputs. In Section 6.3, we provide an overview of the distribution of these outputs. Section 6.4 discusses the outputs and the limitations that must be considered. In Section 6.5, we show how the results contribute to answering RQ2.

6.1 Research approach for investigating outputs

Currently, we are experiencing the emergence of novel CE program types (see Chapter 5) and new use cases for which CE programs are utilized. This is accompanied by a lack of understanding of (1) the full range of outputs that can be created and (2) how the CE program types differ regarding these outputs (Hill & Georgoulas, 2016).

In our analysis, we focus on understanding the outputs of CE programs. Generally, there is a distinction between outputs and outcomes (see, e.g., van der Voordt et al., 2016; Vermeulen et al., 2003; Neely et al., 2000). Outputs are the concrete results delivered by an activity. This holds for a meal cooked by a restaurant as well as for a computer program. Outcomes, in contrast, describe the impact that results out of a particular output, e.g., a family is happy after having eaten meals from a restaurant. Mirroring this to the context of CE programs, outputs are direct results of the program, e.g., a new product or technology. The impact of the outcomes is to be understood as rather long-term effects resulting out of the outputs, such as a strengthened competitive position or an increased level of innovativeness. We will focus on outputs, as they can be directly observed in our study design.

Our analysis follows the grounded theory principles with its three coding steps of (A) open coding, (B) axial coding, and (C) selective coding (for details, see Chapter 3).

A: Open coding

In the open coding step, the focus was set on the different concepts that are related to the value creation of CE programs. It resulted in three themes: (1) results of the work of the CE program, (2) spill-over effects and changes in the core organization, and (3) performance measurement of CE programs. In total, the open coding step resulted in a number of 90 concepts (codes) that were identified.

B: Axial coding

In the axial coding step, the initial 90 concepts were further aggregated (according to similarities in their content) to create a first set of outputs to be observed for CE programs. The aggregation led to the creation of 39 codes that are reflecting the value creation of CE programs. At this point, (a) the different codes were not harmonized, and (b) it was not clear whether they were created by multiple cases or just by one.

C: Selective coding

In the selective coding step, the 39 codes were applied to our data set (54 cases, see Section 3.2). By continuous comparison and re-coding the cases, the codes were further harmonized. That process revealed that 13 codes were (a) either defined too narrow – leading to further aggregation with other codes – or (b) did only occur in an individual case. All 13 were removed from the final set. The 26 output codes were complemented by one additional output that was uncovered in the selective coding step. Consequently, a total number of 27 codes were identified. They will form the final set of outputs.

Thematic clustering of the outputs

The 27 outputs are reflecting the full range of strategic value that can be created by CE programs. The outputs were clustered according to thematic similarities. They led to the creation of seven overall output categories covering 27 outputs (see Table 6.1).

The clustering of the outputs was tested with three colleagues from the research institute to increase credibility and confirmability. The test did consist of the following two steps.

- In the first step, colleagues were individually asked to sort the 27 outputs into thematic clusters. Then, feedback was collected on difficulties in the clustering process and on the clarity of the output descriptions. This procedure reduced unclarities in the descriptions and unveiled new perspectives on how the outputs could be related.

- In the second step, each of the three colleagues was provided with the seven pre-defined output categories. They were asked to align and, if necessary, re-arrange the clusters based on our output categories. This step provided further insights into the clarity and traceability of the output categories.

After each test with a colleague, the feedback was used to improve the descriptions of the outputs and output categories.

6.2 Outputs created by CE programs

In this section, the seven output categories and 27 outputs will be presented. Table 6.1 is providing a first overview of the output categories and the associated outputs.

Output category	Outputs
1. Innovation capability	(1) Innovation services & expertise, (2) additional innovation path, (3) digital capabilities, and (4) roles or formats to support innovation
2. Innovation culture	(5) Sensitized senior management, (6) increased awareness for innovation, and (7) increased openness for innovation
3. Innovation ecosystem	(8) Strategic partnership, (9) venture portfolio, and (10) reputation within innovation ecosystem
4. Innovation know-how	(11) Intelligence on trends, and (12) technological know-how
5. Intrapreneurial empowerment	(13) Entrepreneurial skills & methods, (14) network of supporters, and (15) intrapreneurial community
6. New business offering	(16) Validated innovation concept, (17) new product, (18) new stand-alone business, (19) value adding service or feature, (20) new market, and (21) reconfigured business model
7. Organizational transformation	(22) Increased efficiency, (23) new ways of working, (24) digital infrastructure, (25) improved flexibility & speed, (26) improved corporate image, and (27) employer branding

Table 6.1: Output categories and associated outputs

The seven output categories are presented in the table in alphabetical order. The respective outputs per output category are sorted by frequency of occurrence in descending order, meaning that the first-mentioned output has the highest frequency of occurrence for the respective output category (based on Table 6.2 from page 161).

In addition to the 27 strategic outputs, there are also financial outputs that can be created by CE programs. We mentioned here the sales of new products and the increasing financial value of startup investments. However, these financial outputs are not investigated in our study for the following two reasons. First, the scope of our study focuses on strategic outputs that support the organizational transformation of a company (see the problem statement in Section 1.4). Second, relevant financial outputs require a long time to become visible and measurable. For example, when a new product is created, it can require multiple years until the full sales potential becomes clear. Consequently, the investigation of financial outputs would require a longitudinal study design rather than a cross-sectional study design. [17] This line of reasoning is underpinned by the fact that only 1% of the identified outputs were financial ones, supporting the assumption that they become visible after a long period of time.

The outputs categories will be presented in the following Subsections 6.2.1 – 6.2.7. Each output category contains multiple outputs (see Table 6.1), which will be described within the respective subsection. For describing the outputs, the following three aspects will be used: (a) description of the output, (b) explanation of (b1) practical manifestations of the output, and (b2) how the output can be achieved, and (c) a quote to underline the description.

6.2.1 Innovation capability

The category *innovation capability* focuses on the creation of structures and capabilities that are established alongside the core organization to support the development of innovation ideas that do not fit the core business. The output category consists of the four outputs: (1) innovation services & expertise, (2) additional innovation path, (3) digital capabilities, and (4) roles and formats to support innovation. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

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[17] We acknowledge the value of some strategic outputs might also occur after a rather long time (see distinction between outputs and outcome in Section 6.1). However, in contrast to financial value, e.g., the value of investment portfolio or profitable business, strategic outputs can be observed earlier and fit to our study design.

1 Innovation service & expertise

(a) Description: The expertise that is created through the CE activities is demanded and accessible for the core organization as a service that is provided by the CE program.

(b) Explanation: The innovation expertise generated within the CE program is used by other parts of the organization. Depending on the type of CE program, the expertise can range from evaluating startups or innovation ideas, over supporting the due diligence of acquisition targets, to a sparring partner for digitalization projects and strategy development. While in some cases, the service can be formally booked by other organizational units, in most cases, the support is more informal and based on goodwill.

(c) Quote: *“ […] business unit or a division wants to invest, we are the service provider who makes your investments. Not only service provider, but also sparring partner. That means, if they find a company and want to invest there, then we look at the company and in 90% of the cases we say, "don't do it"! [...] In other words, we still do, I would say, service providers and, I would say, sparring partners.”*

2 Additional innovation path

(a) Description: The company has established (formally integrated and in use) a new way to implement innovation ideas that is complementing the traditional R&D or innovation process.

(b) Explanation: The CE program has established itself as an additional innovation channel and is used by the core organization for a specific type of innovation. This can include both the internal development, e.g., creation of digital services, as well as the insourcing of external innovation, e.g., innovation purchasing of startup technologies. CE programs that are established as an additional channel have typically left the "discovery phase" and reached a more stable state (clear processes, structured transfer, etc.), in which the added value for the core organization is clear and demanded. Thereby, the traditional innovation or development processes of the company are complemented by the CE program.

(c) Quote: *“So in principle, the motivation was not to say that innovation doesn't work at [company], we have to do it now, but we have deliberately separated the innovation activities in the [CE Program] from the classical R&D […] But we have said that in order to prepare for the future, we simply have to do more things that are perhaps not in the area of classic R&D, tackle new topics, perhaps think about new business models and simply go a little further than we are doing today in classic R&D. And for this we used the [CE program].”*

3 Digital capabilities

(a) Description: New capabilities are being developed that encompass both a deep understanding of digitalization and the structures and concrete competencies for implementing digital innovations.

(b) Explanation: Digitalization demands changes in current business practices. Building up the required capabilities and creating an understanding of the effects of digitization is part of the work of CE programs. In particular, if no other unit in the core organization is responsible for the digitalization strategy or if the CE program has a strong digital orientation. Thereby, the creation of digital capabilities can either be achieved by building an environment that is attracting digital talents or through work on concrete digital innovations projects – training on the job. Capabilities often result in competence centers for certain digital topics, such as app development or user design, which are available in the core organization and the CE program.

(c) Quote: *"Exactly. Well, of course, you always come up against limits where even a new business model outside needs some enablers internally. Well, one of them is our data analytics hub or our app and web studio, where we realized early on that if we didn't have that we wouldn't even have to think about many things outside."*

4 Roles or formats to support innovation

(a) Description: New job roles or formats to promote innovation are transferred to the core organization, as they have proven valuable through the activities of the CE program.

(b) Explanation: The development of discontinuous innovations demands from companies to use different approaches and changes to the traditional innovation process. As a part of their work, CE programs explore and implement new approaches in their context. As the value of these new approaches applies not only to innovation within the CE program but to the entire organization, new roles or new programs/formats are being established in parts of the company. These new roles or new formats are designed to increase the innovativeness within the core organization and typically focus on innovation closer to the core business.

(c) Quote: *"There are now also individual initiatives from the business units themselves, where smaller programs are created in such a way that topics that are now closer to the business units [...] in order to let them really mature for a certain time before they are exposed to the standard criteria. That is definitely the case."*

6.2.2 Innovation culture

The category *innovation culture* is focusing on the changes that are caused by the CE program's activities that lead to a more innovation-friendly culture on all levels of the core organization. This category consists of the three outputs: (1) sensitized senior management, (2) increased awareness for innovation, and (3) increased openness for innovation. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Sensitized senior management

(a) Description: Senior management has regular contact with innovative topics, often involved as a jury member or in investment boards, which is sensitizing them for innovation.

(b) Explanation: In many CE programs, the C-level or the higher management (depending mostly on the size of the company) is involved at a certain point in the activities of the CE program. Mostly this is the case for the evaluation of the innovation ideas. Another case is the involvement in the investment decision into an external startup or the spin-off decision of a corporate venture. Due to this involvement, the senior management is using a part of their time for new technologies, different business models, or other types of innovation, which is sensitizing them for the relevance of innovation and potential consequences for the company.

(c) Quote: *"The great thing is that they [top management] really enjoy it. So, they were happy to spend this day with me in [city]. So, it was really like that. I think I had already talked to the CTO [business unit] about it and then he said, Really, I want to be there, I don't want to get out of it, I would be rather offended if I had to get out of it and so on."*

2 Increased awareness for innovation

(a) Description: Activities are undertaken that increase the awareness of the employees for innovation, trends, and technologies and their impact on the organization.

(b) Explanation: One activity of many CE programs is to show the relevance of the topics of innovation and entrepreneurship, e.g., by organization events with well-known keynote speakers or pitching sessions. The activities mainly aim at promoting the necessity of their own work (raison d'être) and communicating their offer to the employees, e.g., when employees can apply with their idea for participation in the program itself. In addition, these activities do also lead to an overall increased awareness for innovation, as employees of the core organization have more points of contact to innovation topics and entrepreneurship.

(c) Quote: *"For example, there is now a regular [CE program] session for all [company] employees, a virtual session that we do once a month. And once a month we are looking for a topic of the month, where [company] colleagues can experience a [CE program] session. It's either a start-up that presents something, or a partner of ours, or a coach of ours, or we say."*

3 Increased openness for innovation

(a) Description: Employees of the core organization are more open to new ideas innovations as well as for the opening of the innovation process towards external partners.

(b) Explanation: The CE program's activities contribute to an increasing openness for discontinuous innovation ideas. This output is related to the output increased awareness for innovation; however, their causes appear to be different. More openness was mostly found in connection with the concrete innovation projects in which employees of the core organization were involved. Positive experiences and results from the collaboration lead to the employees involved recognizing the value and becoming more open to these new topics.

(c) Quote: *"Well, that has changed a lot, that you don't believe anymore that they are just beginners, they are just students […startups from Silicon Valley]. That has changed very much. The acceptance of not making technology oneself, but taking it from someone else and industrializing it, that is a completely new concept, that didn't exist before."*

6.2.3 Innovation ecosystem

The output category *innovation ecosystem* focuses on external linkages that are built by the CE program as a basis to opening up the innovation process and to make more use of external means. The category consists of the three outputs: (1) strategic partnership, (2) venture portfolio, and (3) reputation within innovation ecosystem. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Strategic partnership

(a) Description: The company has established strategic partnerships with startups to increase the innovativeness of the core organization.

(b) Explanation: The CE activities have led to the development of a strategic partnership with startups. Thereby, different types of partnerships can be created, e.g., rather transactional customer-supplier relationships but also co-development partnerships that aim at joint commercialization of a new product that is created together. The strategic value of these partnerships can either be created on the product level – e.g., by accessing technologies that are new to the company – or on the process-level – e.g., by using technologies to optimize the processes of the company.

(c) Quote: *"And that is the position we [as a corporate investor] come in and say, look, we could do this [commercialization of a technology] for you. For us, that is totally good, because we get innovations that we cannot develop ourselves, simply because everyone has his limitations. And for the startups, it is good because they do not have to do the capex-intensive stuff and all the boring stuff where you don't find many people here [Silicon Valley]."*

2 Venture portfolio

(a) Description: The company has built a portfolio of corporate ventures or independent ventures (including the contractual option to invest) that show a strategic relevance.

(b) Explanation: The creation of a portfolio of (a) independent startups or (b) corporate ventures can be achieved in various ways. CE programs that focus on startup investing by nature focus on creating a portfolio of startups. However, also startup engagement programs can create a portfolio of startups, e.g., small equity investments as a part of their support services or the option (contractual) of having a priority as an investor in the next investment round. In addition, a portfolio of corporate ventures can be achieved through the continuous founding of corporate ventures. Whereas for some corporate ventures, the strategic value for the core organization is clear, others are seen as a financial investment or have the option of spinning them in again when the strategic fit to the core organization becomes clearer.

(c) Quote: *"We have passed through 18 ideas. No, 18 plus four more. 22 have been passed. That means until February 2020 and six spin-offs, so to speak. So, I would count the two that are in spin-offs at the moment, too, exactly."*

3 Reputation within innovation ecosystem

(a) Description: The company is known and has a positive reputation for working together with or investing in startups.

(b) Explanation: To successfully working with or investing in startups, it is important that the respective company is acknowledged as being a good partner. In particular, when the company aims at working with the best-in-class startups (this output was especially relevant for CE activities in the Silicon Valley). Having a well-defined collaboration model or a good track record of previous, successful projects, companies can build a good reputation in an innovation ecosystem through their CE activities.

(c) Quote: *"And so, I think we quite have a very good reputation outside. And that also is visible when we start the scouting. Because basically, every year we have been decreasing the budget we use in terms of pushing the message out. Because sometimes also the message goes itself, because already your name is well known and people usually know what are the timelines, what are the requirements."*

6.2.4 Innovation know-how

The output category *innovation know-how* focuses on know-how gained through the activities of the CE program, with a clear focus on innovation-related topics such as new technologies, trends, or changing customer behavior. The category consists of the two outputs: (1) intelligence on trends, and (2) technological know-how. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Intelligence on trends

(a) Description: Market and technology trends are identified, analyzed, and transferred back to the core organization to create a better understanding of potential future developments.

(b) Explanation: In volatile market environments, it is important for companies to identify or anticipate trends and developments that potentially affect the organization. Since CE programs deal with new topics in their daily work, they serve, among other things, as a means to identify trends about relevant technologies and social developments that may impact the business and to transfer this knowledge back to the core organization.

(c) Quote: *"But of course, if we come across interesting things, say new types of technology elements that are used somewhere else in another industry and where we could then combine this with our knowledge to create a new product for the [industry name] as well, then of course we also proactively approach our business units and point out to them that there could be something interesting where they have perhaps not yet thought about it."*

2 Technological know-how

(a) Description: Technological know-how, which is relevant for the company's future product development, is built or absorbed to make it available for the core organization.

(b) Explanation: This output describes the development of technological knowledge that will serve as a basis for future innovation developments. CE programs can be used to acquire this knowledge internally or to make it available to the core organization through cooperation with external partners. In general, it is important to consider whether the technology is one that allows the company to stand out from the competition or whether it is a commodity that is freely available on the market.

(c) Quote: *“So, that technology when they first started it was hard for the rest of the organization to kind of understand and get their minds around. And it was not until the group actually packaged it as a [technology] like this say in the [use case] that the business leaders in the meeting said, Okay, well I understand that now and I get that. Let's now take this to market.”*

6.2.5 Intrapreneurial empowerment

The output category *intrapreneurial empowerment* has mainly an internal focus as it aims at supporting the employees of the core organization in developing innovation ideas to leverage internal innovation potentials. For this purpose, the CE program fosters intrapreneurial activities on the individual-level and serves as a network for like-minded employees. The category consists of the three outputs: (1) entrepreneurial skills & methods, (2) network of supporters, and (3) intrapreneurial community. Starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Entrepreneurial skills & methods

(a) Description: Employees are taught entrepreneurial thinking and methods, either through dedicated workshop formats or through training on the job by working on their ideas.

(b) Explanation: CE programs educate their participants in the use of entrepreneurial and innovation methods such as design thinking, lean startup, or agile working methods. Thereby, the intensity of teaching these methods and thinking can range from formalized curricula of workshop formats, do-it-yourself toolboxes with methods and advice, or regular coaching and mentoring of the intrapreneurial teams. In some cases, the method training was open to all employees of the organization, whereas in other cases, the CE program focused on their participants only.

(c) Quote: *"And then we have our innovation programs, these 75 projects. They had about five to eight members each, so you could say 100 of them, definitely got 75. And then we had a little program of that [method name]. Maybe seven or eight hundred people were involved in the innovation programs, a thousand people in the network [...]."*

2 Network of supporters

(a) Description: A network of internal and or external mentors, coaches & promoters that are supporting innovation ideas with their expertise, know-how, and power is created.

(b) Explanation: This output describes the activity of connecting intrapreneurial employees with supporters. The supporters either provide methodological know-how and expertise in driving innovation within an established organization or have the formal power to push promising innovation ideas through the organization. Creating such as network is one part of the work of CE programs in order to ensure successful innovation ideas that survive after they have left the program again.

(c) Quote: "*These are people, as I said, mostly alumni, who are an [CE program] promoter at the [unit] and who are not only able to methodically support us internally […] they are an incredibly, completely underestimated element of what we are doing and a huge lever into the respective decentralized organizational units*."

3 Intrapreneurial community

(a) Description: Intrapreneurial employees of the company have the possibility (physically or virtually) to connect and exchange with other intrapreneurs.

(b) Explanation: The CE program is creating a platform, which can either be digital or physical events, that is supporting intrapreneurial employees in finding and connecting with other like-minded people. Regular events, also for alumni of the CE program, are helping in building a community of intrapreneurial employees across the different organizational units/silos.

(c) Quote: "*We founded a [community name] three or four years ago [...] (laughs) And I think the people who are there, they are very emotionally connected to our unit and they are also very proud. And I think that [community name & location] works as our home base and that has a spreading effect*."

6.2.6 New offering

The output category *new offering* includes market-related innovations created by CE program activities, which are enhancing or adjusting the business offering of the company. The innovations show a wide variety, ranging from (a) new innovative features added to existing products to (b) complete new businesses that are created. The category consists of the following six outputs: (1) validated innovation idea, (2) new stand-alone business, (3) new product, (4) value adding service or feature, (5) new market, and (6) reconfigured business model. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Validated innovation idea

(a) Description: Innovation ideas are evaluated using entrepreneurial methods, according to their feasibility, fit to the company, or market chance as a basis for resource allocation decisions.

(b) Explanation: Following the principle of "fail early, fail cheap" – one output of activities in CE programs is the validation (or falsification) of an innovation idea or concept. Fast learning and an early decision about the continuation of a project is not only linked to gaining new knowledge but also that a more entrepreneurial attitude is being established.

(c) Quote: *"[During the CE program...] So, for the first time there is the possibility to stop. That is important at this point. Or one says, so the sponsors for this topic say okay, understood, these are the findings. At the beginning we had a project that started with waving flags, because it was somehow clear that it would have to be technological this and that. It just came out, the customer actually needed something completely different and that is a completely different one. So, this pivoting has already taken place at that point."*

2 New stand-alone business

(a) Description: Innovations are developed, which build the basis for a new business that typically remains outside the core organization or becomes a new business unit.

(b) Explanation: One reason for initiating CE programs is the development of discontinuous or non-core business innovation. Due to the circumstance that these innovations do not fit into the core organization, they often result in the creation of an entirely new business, which shows either a strategic relevance or is financially promising. Mostly, these new businesses are transferred into a new business unit or spun off into their own legal entity.

(c) Quote: *“So, if they were in the incubator, there are three possibilities. One is the spin-off. That happened once, now in / I don't want to say anything wrong. When was that? In June, I think. In June we made the very first spin-off from [company name]. We were all very, very proud of it. That happens very rarely at Corporates. And even (laughs) less frequently at [company name]. That's why it happened the first time.”*

3 New product

(a) Description: New products are developed, which are transferred back into existing units within the core business to complement or adjust the current product offering.

(b) Explanation: The development of innovations is one key task of CE programs. Not every innovation idea has the potential for creating a new business unit or spin-off. In such a case, they are often transferred back to the core organization as a new product that is complementing the existing product portfolio.

(c) Quote: *“Many topics [run by the CE program] are currently project business, and you can then convert that into a product business and develop a SaaS platform next to it, where massive scaling is possible or things like that, that's what we do.”*

4 Value adding service or feature

(a) Description: Product features or (digital) services are developed that enhance the current product offering to serve changing customer needs and to ensure a digitalized product offer.

(b) Explanation: The digitization of products often leads to hybrid constellations that combine hardware products and digital services. For most established companies, the development of digital services requires new know-how and new capabilities, which are often built up as part of a CE program. As a result, the activities of a CE program can lead to the development of digital services that complement the existing product portfolio of the core organization.

(c) Quote: *“This means that someone in our service department can receive a notification. "Hey, watch out. The [product] is now ten thousand hours running. Why don't you give us a call, because in two months it will somehow reach the limit of its lifetime. Just give us a call". Proactively do service. Proactively maybe even put a spare part in stock. You don't have to have a big date, do machine learning. Just to know the basics.”*

5 New market

(a) Description: New customer groups or markets are opened up, either by establishing additional sales channels or by leveraging existing technologies into new markets.

(b) Explanation: Expanding the core business into new markets is one way to foster growth. This can either be achieved by (a) establishing additional sales channel, often e-commerce, mobile commerce, or platforms, which is supporting companies in their digital transformation and enables them to access new customer groups or by (b) leveraging their current technologies or products through the collaboration with startups into new market areas. In this case, startups are building their innovation on top of existing technologies/infrastructure. One example is the introduction of 5G technology, where telecommunication providers leverage the use cases of the technology through startup collaboration.

(c) Quote: *“Exactly. So, what we actually do, I would say "direct to consumer" has two tasks, on the one hand it has the task of acquiring new customers, where we have no chance via B2B, so direct consumers. And the second is, of course, to create new revenue channels or, yes, to exploit new revenue streams in which we cannot exploit in B2B, e.g., via own e-commerce, marketplace, and retail.”*

6 Reconfigured business model

(a) Description: The existing business model of the core organization is reconfigured to meet changing requirements.

(b) Explanation: Besides the development of entirely new businesses, the reconfiguration of the existing business or business models is a key challenge for many companies. The digital-enabled trend moving from selling products to offering them value as a service is often a core activity of CE programs.

(c) Quote: *“I know that this one was the service thing, which was our project last year. And where we found by chance a start-up that does this whole financial thing, a FinTech start-up. And then we found a [subsidiary] that is interested in the topic. We have piloted the topic in [country] this year. That means [product name - as-a-service] and we have already made a lot of money there. So that is, if you look at the money, by far our most successful project.”*

6.2.7 Organizational transformation

The output category *organizational transformation* is focusing on how the activities of CE programs lead to transformation and changes in the core organization's structure, processes, and capabilities. The category consists of the following six outputs: (1) increased efficiency, (2) new ways of working, (3) digital infrastructure, (4) improved flexibility & speed, (5) improved image, and (6) employer branding. The order is starting with the output that has the highest frequency of occurrence within the output category (based on the values in Table 6.2).

1 Increased efficiency

(a) Description: The activities result in optimizing the core organization by leveraging efficiencies through the use of digital technologies.

(b) Explanation: With the emergence of new, mostly digital technologies, many processes in the core organization can be digitalized, leading to an increasing level of automation. Some innovation ideas in CE programs focus on how new technologies support the optimization and automation of existing processes, which ultimately leads to increased efficiency.

(c) Quote: *"The colleagues in [city], for example, have brought a [technology] platform into the [company] that controls server utilization more intelligently, so that if several processes are running, not all servers are used simultaneously, and so on. And this clearly has nothing to do with the front end, it is a background process, but so far, it has cost the [company] a lot of money. And is then a real cost saver on the side."*

2 New ways of working

(a) Description: New methods, approaches, and ways of collaboration, which were introduced in the CE program, are transferred to and adopted by the core organization.

(b) Explanation: Within the CE program, different working methods are employed than in the core organization. These methods typically include design thinking, lean startup, and agile methods, but also different forms of organizing teams that are helpful in the development of rather discontinuous or non-core business innovations. Through the work of the CE program, the value of these new working methods for the core organization becomes clearer and some methods or elements of them are adopted by the core organization. This can be done either through the adoption of methods by an organizational unit or through the formalized integration of workshops and training by the human resources department.

(c) Quote: *“Or working methods, working with personas, such agile procedures, story maps. In a new project, our [unit director] has even adapted this and tried to implement it. And even there, rather/the others look at it, see that it has substance, that makes sense in terms of content, there is also a better success in the end.”*

3 Digital infrastructure

(a) Description: Digital tools and technologies are implemented, building the basis for the overall digital transformation of the core organization.

(b) Explanation: In many cases, the discontinuous innovations of the CE program have a strong digital focus. Dealing with these digital innovations requires certain basics, e.g., the availability of data, design principles to develop apps or tools to use machine learning. Since the know-how about these digital technologies is often not available, CE program must explore and develop the digital basics on their own as a prerequisite for creating digital innovations. As a result, these digital technologies and basics are also available and used by the core organization.

(c) Quote: *“Because we have been working with [company name] IT for long enough and know what we can or cannot expect from them and so on, then things just happen. Design system [developed by CE program] that we don't reinvent the button for every app, there is now a design system where you double-click, and you have the code.”*

4 Improved flexibility & speed

(a) Description: Processes and structures within the core organization are adjusted to serve the need for becoming more flexible and faster to support the company’s innovation activities.

(b) Explanation: The activities of the CE program are leading to the adjustment of processes and structures within the core organization. They are becoming more flexible and faster. Two different reasons can be identified for these adjustments in the core organization. First, the CE program challenges the status quo by giving an example of how a modern organization can be designed and triggers change activities. Second, processes and structures are adjusted to ensure that innovation ideas out of the CE program can be transferred successfully to the core organization. Thereby, the concrete innovation ideas are trigger points for changes.

(c) Quote: *“We have introduced lean corporate governance for our issues [for the CE program], which of course is within the [company name], who said "hey, how do they manage to do it all* *at once so fast"? So, they did a content project to learn from us how to be leaner. A communication in IT, something like slack or what you use to survive normally, the [company name] sees and thinks "hey, why don't we do that"?"*

5 Improved image

(a) Description: The CE program has a positive impact on the company's image and reputation, as it is being recognized to be innovative by relevant stakeholders.

(b) Explanation: In addition to the influence on employer branding, CE activities can also have a positive effect on the company's general reputation. Various stakeholders such as politicians, other companies (partners or customers), but also shareholders of the organizations recognize the activities as important and associate positive connotations with the CE program.

(c) Quote: *"[Company manager] he brings executives, 30 executives from the German [industry]. So, from [different company types] and so on, who will be allowed to do Design Thinking here in two days, they will be there / are very enthusiastic and will go out of [CE program] and so on like on cloud number nine. So, there's already cooperation at this point."*

6 Employer branding

(a) Description: The CE program makes the company more attractive for employees (often digital talents) who previously did not feel attracted by the company.

(b) Explanation: The activities of the CE program are perceived as innovative and attractive for potential employees that have a digital-driven mindset, e.g., having a favor for the "new work" concept. Thereby, the CE program itself can be used as a pool to attract talents from the outside. However, it can also be observed that the existence of a CE program has a positive impact on the overall company.

(c) Quote: *"But on the other hand, and this is the next topic, an unintended positive side effect is the topic of employer branding. Well, I was once told by the personnel department that by now an enormous number of applicants, when they are asked: "Why do you want to work in the [company]," they say: "Well, you have the [CE program], which means you are super innovative. Especially young employees, who you might not get otherwise. And when they join the company, it also contributes to the cultural change."*

6.3 Distribution of the outputs

The seven output categories and 27 outputs described in Section 6.2 have been applied to the 54 cases from our data set. Through this coding, 952 text passages describing an output were identified. In total, we coded 450 outputs across all cases. The difference between the 952 text passages and the 450 outputs can be explained as follows. When an output was mentioned multiple times during an interview, we have multiple text passages coded for one output, which explains why the total number of text passages is twice that of outputs.

In this section, the frequency of occurrence of the outputs and their distribution across the output categories will be described. Figure 6.1 shows that the general distribution of the seven output categories is rather balanced. Still, the output categories that account for the highest shares are (a) *new offering* with 22%, (b) *innovation culture* with 19%, and (c) *organizational transformation* with 16%. Together, these three output categories comprise more than 50% of all coded outputs. However, the meaning of the pure distribution of outputs is limited since the output categories cover a different number of outputs. For example, *innovation know-how* consists only of two different outputs, whereas *new offering* covers seven outputs.

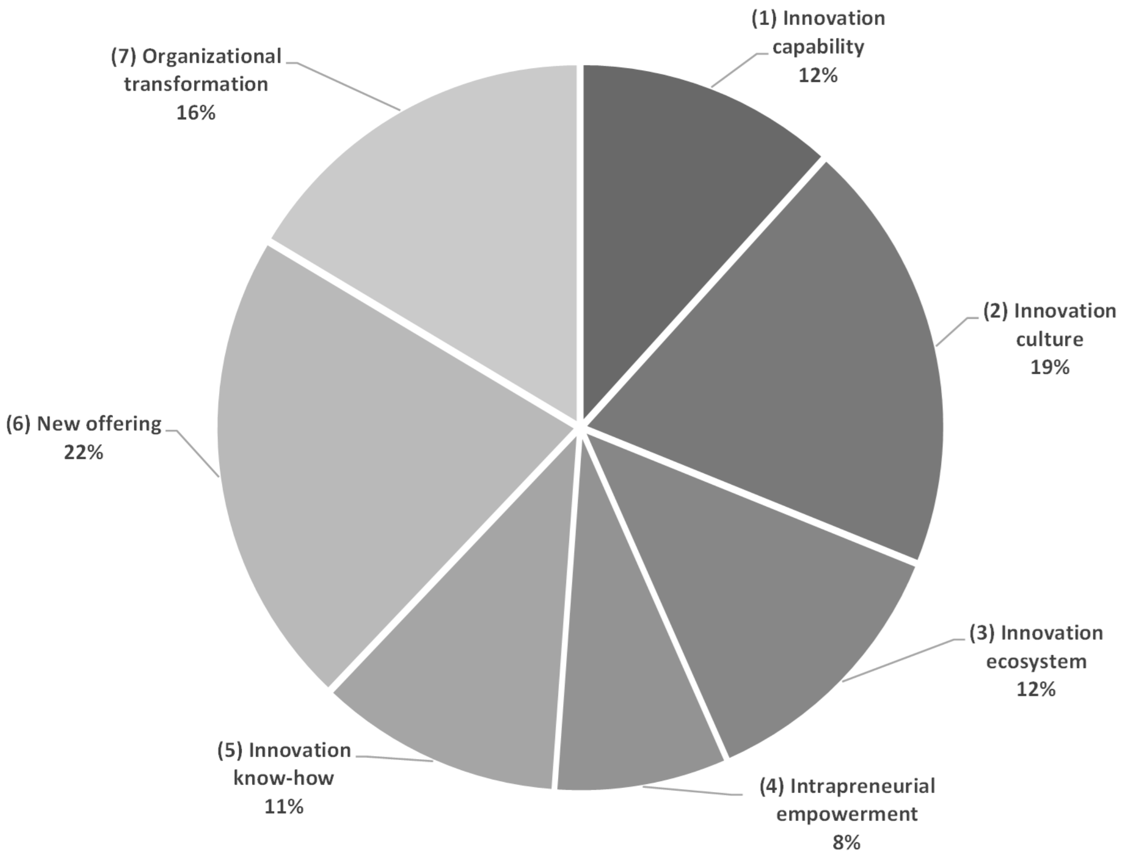

Figure 6.1: Distribution of output categories

Figure 6.1 shows that CE programs (a) lead to the creation of new businesses and new products, (b) support the transformation of the organization, and (c) strengthen the innovation capabilities of a company. This finding is also highly relevant when looking at the performance measurement of CE programs since turnover or growth seem not to represent the broad range of value (outputs) that is created by them.

In Table 6.2 (see next page), the distribution of all 27 outputs is listed and the frequency of occurrence is given. It is important to note that the outputs in the table are not ordered according to the output category but according to their frequency of occurrence across all cases in descending order. This means that an output with 100% would have been identified in all 54 cases. For example, the output *entrepreneurial skills & methods*, which has a frequency of occurrence of 50%, can be found in 27 cases.

The three most common outputs (highest frequency of occurrence) are (1) the *sensitized senior management* with 80%, followed by (2) *validated innovation idea* with 74%, and (3) *increased awareness for innovation* with 67%. On the contrary, the output with the lowest frequency of occurrence is the *reconfigured business model* with 7%, which is at the same time the only one that is scoring lower than 10%.

Based on Table 6.2, it can be stated that a major part of the outputs does not occur across the various cases and consequently neither across the various CE program types. Only six outputs have a frequency of occurrence higher than 50%. This supports the initial assumption of our study that the value creation between the CE program types is different.

The 27 outputs that are described in this section build the basis for identifying how exactly the CE program types differ regarding their value creation by linking them with the respective outputs. This will be done in Chapter 7 by linking the 27 outputs from this chapter with the twelve types of organizational design presented in Chapter 5.

Outputs	Frequency of occurrence
Sensitized senior management	80%
Validated innovation idea	74%
Increased awareness for innovation	67%
Strategic partnership	61%
Intelligence on trends	59%
Entrepreneurial skills & methods	50%
Technological know-how	48%
Increased openness for innovation	44%
Innovation service & expertise	43%
New stand-alone business	41%
New product	41%
Additional innovation path	35%
Value adding service or feature	35%
Increased efficiency	33%
Venture portfolio	31%
Improved flexibility and speed	28%
Digital infrastructure	28%
New ways of working	28%
Improved corporate image	28%
Positive reputation within innovation ecosystem	28%
Digital capabilities	22%
Employer branding	17%
Roles or formats to support innovation	15%
Intrapreneurial community	13%
New market	13%
Network of supporters	13%
Reconfigured business model	7%

Table 6.2: Outputs and frequency of occurrence (descending order) across all cases

6.4 Discussion of the results

In this section, we will discuss the findings that were presented in Section 6.2. Therefore, Subsection 6.4.1 will describe the limitations that must be considered regarding our results. In Subsection 6.4.2, we will discuss how the results can be embedded into the literature. This is followed by a practical perspective on the results in Subsection 6.4.3.

6.4.1 Limitations of the results

In this subsection, the three limitations will be described that must be considered with respect to the results that were presented in Chapter 6.

Limitation 1 – Size of the data set

The identified output categories and outputs were inductively derived from our data set. Even though the data set covers the full heterogeneity of CE program types, the number of cases per CE program type is rather small, e.g., the collective matchmaker with three cases or the venture builder with three cases. The rather small number of cases for some CE program types may imply that a few types of output were not found. However, we assume that the chance of outputs or even output categories is not covered in our data set is rather small, as most outputs are created by multiple CE program types.

Furthermore, a larger number of cases could also lead to outputs that were previously excluded because they were too low in occurrence (fewer than 2 cases) being included again in the harmonized set of outputs. In our study, this applies to two outputs that were not included in the final set of outputs in the last coding step (selective coding). These outputs are (a) identifying and managing entrepreneurial talents, which was observed in one case, and (b) a redefined status quo, which was observed in two cases.

For (a) holds: The output *identifying and managing entrepreneurial talents* is describing the result that by running a CE program, the company identifies entrepreneurial talents within its organization and uses this knowledge, e.g., when it comes to the staffing of certain projects that require non-standard profiles.

For (b) holds: The output *redefined status quo* is describing the circumstance that the activities and results of the CE program leading to a reconsideration of company-own standards and values may no longer fit the changing market environment. For example, by demonstrating that even in a highly restricted industry, general terms and conditions can be reduced to two pages, which was previously considered impossible because it would not be legally secure.

Generally, it might be that with a larger or different data set, these two outputs described above could occur more often. However, due to the large number of cases covered in our data set, we consider that the 27 outputs described in Section 6.2 are the ones that are most common for CE programs.

Limitation 2 – Study participants

The second limitation comes in hand with the design of the study itself. The interviews were conducted with members of CE programs themselves. In most cases, they were well aware of the innovation ideas that were participating in the program. However, after the program has ended, the insights into the development of the respective innovation idea did decrease.

Based on the selection of the interview partners (focus on the CE program only) some outputs might not be identified. This is in particular the case for outputs that do not directly result from the CE program but emerge a while after an innovation idea has left the program. It means that the CE program might have an initial effect on an output that is later also influenced by factors outside the CE program. Such indirect outputs are not covered in our study as it is unclear to what extent the output can be attributed to CE programs or to the conditions after the innovation idea left that program.

The scope of the CE program only limits insights into the effect of the concrete innovation ideas. A previous study that was analyzing the CE programs and the corporate ventures resulting from the program shows that additional outputs exist on the venture-level, e.g., *creation of entrepreneurial role models* (Selig et al., 2019). A second study did highlight that there are also learning and capability outputs from corporate ventures that were discontinued and hence often interpreted as failed (Keil et al., 2009).

Identifying these outputs would have required a set of additional interviews per CE program, which was not possible in our study due to the limited availability of time and access.

Limitation 3 – Impact of time

A third limitation comes in hand with the focus on outputs. They typically have rather direct and short-term effects. However, focusing on the short-term effects does not reflect the full potential of the different CE activities. A broader understanding would require that the long-term outcomes (see Section 6.1 for a distinction) are also investigated. For example, when multiple corporate ventures are founded as an output of a CE program, it is not covered how their products and businesses are having an impact on the core business. One of the reasons for this is that the business of a corporate venture would have to be relatively large and mature in order to be able to assess the impact on the core company. A practical example from the automotive industry is illustrating this circumstance.

Example: *In 2009, Daimler AG started its car-sharing activities called Car2Go. They were operating and scaling this service for nearly ten years until, in 2019, they decided to merge their car-sharing activities with their competitor BMW and their services, previously called Drive Now. While car-sharing was perceived in its early days as one crucial element in the growth of both car manufactures, in 2020, they stated that they will increase their focus on luxury cars again and did reduce their efforts in the area of mobility as a service.*

This example shows that it is initially difficult to evaluate the long-term outcome that arises out of the output new business. For understanding the full impact of CE, in particular, with a focus on the long-term influence on the core organization, it seems that a longitudinal research design is recommended.

6.4.2 Embedding the outputs into CE concept

The outputs described in this chapter show a broad range of different types of value creation that can be achieved through CE programs. The variety ranges from the creation of new businesses, over intrapreneurial empowerment, to the transformation of the core organization. This goes in line with the three sub-categories of CE, which are (a) corporate venturing, (b) strategic entrepreneurship, and (c) corporate nurturing (see Section 2.1). Table 6.3 illustrates how the outputs categories can be linked with the three CE sub-categories and shows that a better understanding of the outputs is also contributing to more clarity of the CE concept.

CE sub-category	Sub-category definition	Output categories
(a) Corporate venturing	… is defined as all structures and processes that are entrepreneurial approaches to develop rather discontinuous innovations in the context of an established company	New offering
		Innovation capability
(b) Strategic entrepreneurship	… is focusing on the transformational aspect of entrepreneurial activities within an established company.	Organizational transformation
		Intrapreneurial empowerment
		Innovation culture
(c) Corporate nurturing	… is defined as all means to gain access to external innovations of new ventures, either by direct insourcing of innovations or indirectly by securing the option to access them.	Innovation ecosystem
		Innovation know-how

Table 6.3: Mapping CE sub-categories and output categories

The assignment of the output categories to the three CE sub-categories is based on the respective definitions. We focused on the highest overlap between the output category and the CE sub-categories. However, it must be noted that this assignment is not exclusive, meaning that an output category might also have an overlap with another CE sub-category. An example of this is the *innovation know-how* category (assigned to corporate nurturing), which includes understanding trends and know-how for new technologies. These outputs do also contribute to the development of innovations, which are part of the *new offering* category (assigned to corporate venturing). This brief example shows that the output categories have links to several CE sub-categories.

Table 6.3 provides a first indicator of how the value creation of the three CE sub-categories differs and shows that each sub-category can provide a distinct value for the core organization. However, we also see that regarding the value creation there are no clear boundaries between the three sub-categories. The lack of a clear distinction between CE sub-categories was also stated by Kuratko and Hoskinson (2019), which recommend understanding the CE sub-categories rather as lenses by which CE is being studied than clearly distinguishable concepts.

A better understanding of the differences may be provided after linking the outputs with the respective CE program types, which will be done in Chapter 7.

Moreover, the results of this chapter suggest that the three recommendations made through a literature review on CE performance are also valid for CE program outputs. In Table 6.4, we use our results to evaluate to what extent we agree with the three recommendations.

Recommendation by Bierwerth et al. (2015)	**Evaluation of the three recommendations**
To use multiple performance indicators for measuring CE performance instead of making a summed index, which does not reflect the variety of motivations behind CE.	The 27 strategic outputs, which can be grouped into seven categories, cover a wide variety of value that can be created. It is unlikely that the full value of CE programs can be measured with one summed index. Hence, we agree with the first recommendation.
To use theories that are covering more than just financial objectives in order to fully understand the heterogeneity of CE activities.	In our results, only 1% were financial outputs, whereas the remaining 99% were strategic ones. Hence, we agree with the second recommendation. It is crucial to focus more on the strategic value creation of CE.
To improve the alignment between the objective of CE activities and the respective performance measurement.	Our results did not focus on the objectives of CE programs. Nevertheless, the broad range of value that can be created suggests that an alignment between objectives and performance measurement is important. Hence, we also agree with the third recommendation.

Table 6.4: Evaluating the recommendations for the performance measurement of CE

6.4.3 Practical perspective on the identified outputs

Generally, it is important to acknowledge that the described outputs can be achieved in various ways, whereby CE programs are just one potential way to do so. For example, many of the HR-related outputs, such as *entrepreneurial skills & methods* or *increased awareness for innovation* can also be achieved through training programs or similar HR development activities. Another example is accessing new *technological knowledge*, which can also be accomplished by merger & acquisition of other companies (not exclusively startups) or within a radical innovation unit. Hence, if the intent is to create a certain output, the corporate management should evaluate the different options in addition to implementing a CE program.

We chose to focus on defining and then comparing outputs of different CE programs rather than comparing how some outputs can be achieved through CE or other strategic options.

Future research may pick up the questions of what the alternative ways or approaches are that companies can use to create the 27 outputs, which were presented in this chapter.

A second important topic is the temporary nature of some outputs. Due to the ongoing digital transformation, established companies are challenged to re-invent themselves and their business. In our results, two outputs did show a strong digitalization focus, which are (a) the *digital infrastructure* and (b) the *digital capabilities*. It is not surprising that CE programs, which are implemented to drive innovation, are frontrunners for some digitalization topics. However, given the ongoing transformation of companies and the development of the required digital capabilities and infrastructures, it can be assumed that, over time, companies will not need a CE program anymore to create these outputs as they have become part of the core organization. This shows that some outputs may have a rather temporary nature, whereas other outputs, such as *intelligence on trends* or building *strategic partnerships*, may last longer as companies have a continuous need for them.

To conclude on the outputs of CE programs. There is a broad variety of different outputs that can be created. For the effective use of CE programs, it must be clear which objectives should be achieved and what types of outputs belong to this objective. In addition, it seems to be crucial to evaluate if the desired outputs could also be created by other means.

6.5 Concluding on the outputs

The aim of this chapter is to answer RQ2: *What types of outputs are created by CE programs?*

By presenting a set of outputs which consists of seven output categories and 27 outputs, we provide an answer to the second RQ of our study. The identified output categories and outputs show that CE programs create a wide range of values that support the organizational transformation of a company.

For a deeper understanding of the outputs, next, we will explore the relationship between them (see Chapter 7) and the different types of CE programs (see Chapter 5). This will contribute to a more detailed understanding of how CE programs differ in their value creation.

7 Mapping CE programs and their outputs

This chapter aims at answering RQ3: *Can causal relationships between CE programs and their outputs be identified?* To answer RQ3, it is divided into the following three sub-questions.

- RQ3a: What relationships between CE programs and outputs can be identified?
- RQ3b: Do structural or contextual elements influence the occurrence of outputs?
- RQ3c: Which CE programs are suited to achieve certain types of outputs?

Chapter 7 is based on the following three publications:

- C. J. Selig, T. Gasser and G. H. Baltes (2018) "**How Corporate Accelerators Foster Organizational Transformation: An Internal Perspective**", 2018 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Stuttgart, 2018, pp. 1-9.
- C. J. Selig, T. Gasser and G. H. Baltes (2019) **"Effects of Internal Corporate Venturing on the Transformation of Established Companies"**, In: Baierl R., Behrens J., Brem A. (eds) Digital Entrepreneurship. FGF Studies in Small Business and Entrepreneurship. Springer, Cham, pp. 159 – 183.
- C. J. Selig and G. H. Baltes (2020) "**Strengthening Organizational Ambidexterity through Corporate Entrepreneurship**", 2020 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Virtual Conference 2020, pp. 1-9.

For analyzing the relationships between the CE programs and the outputs, we used the content management program NVIVO. It offers the function to create automated reports that are comparing different variables, in our case, the CE programs and the respective outputs.

To answer the three sub-questions of RQ3, the following steps are undertaken. Section 7.1 describes six different types of relationships as a basis for our analysis. In Section 7.2, the relationships between CE programs and outputs will be described (answering RQ3a). Section 7.3 examines the role of structural and contextual elements in influencing the occurrence of certain outputs (answering RQ3b). Section 7.4 focuses on identifying the CE programs that are suited best to create the respective outputs (answering RQ3c). In Section 7.4, we will conclude on the findings and their contribution by answering the original RQ3.

7.1 Different aspects of relationships

We briefly describe six aspects of relationships that are potentially relevant for answering our research question (see, e.g., Allen, 2017; Frey et al., 1999)

(A) *Uniqueness of relationship*: Describes the exclusivity of a relationship between two or more variables.

(B) *Direction of relationship*: Describes in which direction the relationship between the variables can be observed.

(C) *Strength of relationship*: Describes the quality (or strength) that can be identified between the variables.

(D) *Mechanisms of relationship*: Describes how the relationship between two variables can be explained by focusing on the cause and the effect.

(E) *Time aspect of relationship:* Describes impact time can have on the relationship between two variables.

(F) *Form of the relationship:* Describes how the two variables behave to each other, which can have different functions.

The six aspects of relationships will be briefly described to set a common basis for our investigation. When analyzing the relationships between the CE programs and the outputs, these different aspects of relationships will serve as a basis to identify potential patterns.

A: The uniqueness of relationship

The understanding of the uniqueness of relationships is illustrated in Figure 7.1. It shows types of relationships between two variables A and B that are potentially relevant in our work, whereby A reflects the CE programs and B the outputs. The underlying assumption of this work is that CE programs have different sets of outputs. In some cases, it is expected that an output might be obtained by all CE programs, which is a special case of many-to-many relationships. The four types of relationships (many-to-one, many-to-many, one-to-one, and one-to-many) in Figure 7.1 are ideal types. In addition to them, it is also possible for CE programs to have hybrid relationships that are combinations of several of the four types from the figure.

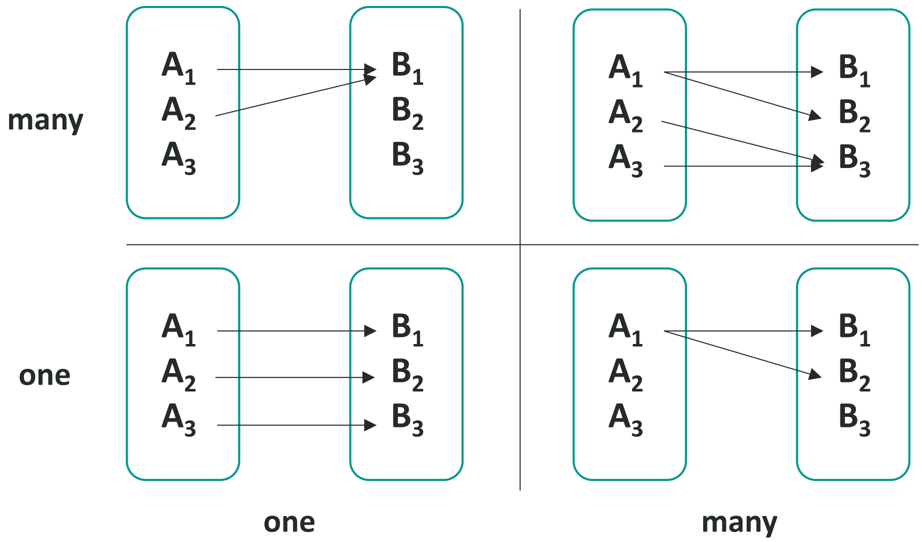

Figure 7.1: Different types of relationships between two variables A and B

For our results, it is expected that (a) the different CE program types (A_1 to A_4) show multiple relationships to outputs (B_1 to B_4) and that (b) each CE program type shows a different set of relationships to outputs (see Figure 7.2, 1 to 4). For example, in (1) CE program A_1 with the outputs B_1 and B_2, whereas in (2) CE program A_2 shows a relationship to outputs B_2 and B_3.

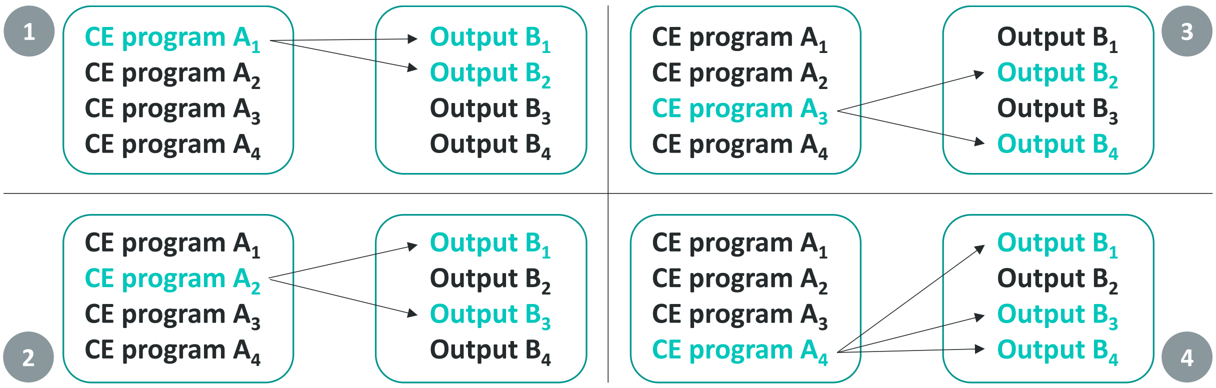

Figure 7.2: Expected relationships for CE program types and outputs

B: The direction of the relationship

For the direction of the relationship, we distinguish between unidirectional relationships and bidirectional relationships. A real-world example would be the radio as a unidirectional relationship, where a message is sent without feedback, whereas the telephone would be an example for a bidirectional relationship, as messages can be sent in both directions.

For our study, we focus on unidirectional relationships between CE programs and outputs with the aim to answer the question if the respective CE programs lead to certain outputs.

C: The strength of the relationship

In general, there are several conceivable ways how the *strength of the relationship* can be defined. On the one hand, measurement instruments can be created to define whether a relationship is weak or strong, e.g., a questionnaire with a rating scale of 1 - 5 for each variable. On the other hand, the strength of a relationship can also be described by the frequency of occurrence by which the relationship can be observed, e.g., how often does A lead to B.

For CE programs, different approaches seem to be appropriate for studying their relationship to outputs, such as assessing the fit between the outputs and the objective (intended output) or using the subjective evaluation by the company's employees. Based on the available data in our study, we decided to use the frequency of occurrence of an output in order to define the strength of a relationship.

For example, how often does the output *new stand-alone business* occur in relation to the CE program type *venture builder*. In general, all values between 0% – 100% are possible. To distinguish between a weak and a strong relationship we used a limit of >50%, meaning only relationships occurring in more than half of the cases are considered as strong relationships.

We define a strong relationship as follows.

> **Definition 7.1** A *strong relationship* is defined as a relation between an output and a CE program type that has a frequency of occurrence higher than 50% across the examined cases per CE program type.

D: The mechanism of the relationship

The *mechanism of the relationship* focuses on how the relationship between two variables can be explained. Can certain elements be identified and used to explain the underlying principles behind the relationship, and how do variables A and B influence each other? Understanding the mechanism between two variables is necessary to study the causality of a relationship. Applied to our study, the mechanism of relationship can be identified by examining elements of the structure or context of a CE program (Section 7.2) that are the cause of a particular effect, i.e., that can be used to explain the creation of particular outputs.

E: The time aspect of the relationship

The *time aspect of a relationship* is focusing on the impact that time can have on the relationship between two variables A and B. This aspect of a relationship generally can have various occurrences. For example, what is the time interval required to observe a relationship between the two variables, or is the relationship between the two variables changing over time? As previously already mentioned, for the direction of the relationship, there is a difference between outputs (near-term) and outcomes (long-term). In our study, we focus on the outputs, which are expected to be observed after a rather short period as a result of the CE program's activities. The aspect of time seems to be relevant when investigating rather young CE programs as it might be possible that not all outputs can be observed directly from the beginning, in particular, compared to CE programs, which are much older.

F: The form of the relationship

The *form of a relationship* describes the behavior between two variables, which can follow different forms. While some variables have a linear relationship, such as a craftsman who is paid by the hour, meaning every hour, the price increases by the same amount (discounts not considered). Other variables may have an exponential relationship, such as in the Corona pandemic, where the number of infected people doubled each week once it reached an "R number" higher than 1.0 (describing how many people are infected by a patient). In CE programs, there can be different forms of relationships depending on the type of outputs being created. For example, if events are held to raise awareness of innovations, there may be an optimal number of events because it is expected that there will not be an infinite number of participants. This means that beyond a certain point, new people will not be attracted even if the number of events is increased.

The six aspects of relationships (A-F) will be considered when answering the original RQ3.

7.2 Understanding relationships of CE programs and outputs

The first part of the analysis focuses on RQ3a, which reads as follows*: What relationships between CE programs and outputs can be identified?*

We will analyze the relationships for each CE program category separately. The analysis will focus in a first step on describing the general relationships between CE program types and outputs and in a second step on the strong relationships that can be identified. Subsection

7.2.1 begins with the general analysis for internal CE program types, followed by Subsection 7.2.2, which focuses on the strong relationships between internal CE programs and their outputs. This procedure is repeated for external CE program types in Subsections 7.2.3 and 7.2.4 and for radical innovation units in Subsections 7.2.5 and 7.2.6.

7.2.1 Internal CE program types and their outputs

Table 7.1 (see page 174) is illustrating the relationships between the internal CE program types and the outputs. The output categories and the respective outputs are listed in the first two columns of the table, followed by the four CE program types of the internal category (See Subsection). Behind the name of each CE program type, the number of investigated cases is shown between the brackets.

For each CE program type, two different kinds of information are provided in a separate column below the CE program's name. The first column shows the number of cases[18] in which the respective output was created. The second column shows the frequency of occurrence for the respective output. To highlight differences in the frequency of occurrence, automated color-coding was applied.

Table 7.1 shows that all 27 outputs (rows in Table 7.1) are created by at least one of the internal CE program types. Twelve out of the 27 outputs were created by all four CE program types, whereas six outputs are created by two or fewer CE program types. Internal CE programs show one-to-many and many-to-many relationships but no one-to-one or many-to-one relationship.

The CE program type that created the most different outputs (number of rows in Table 7.1) is the intrapreneurial excubator, with 24 out of 27 outputs, reflecting 88.9 % of all possible outputs. Followed by the assisted incubator and the venture builder, both with 23 out of 27 outputs (85.2%). The idea validator has the lowest number with 16 out 27 outputs (59.3%). Based on this, it can be stated that the three CE program types of the intrapreneurial excubator, assisted incubator, and venture builder can be considered as allrounders regarding their value creation, whereas the idea validator is more focused.

[18] The absolute number of the underlying cases must also be considered for the evaluation of the meaningfulness of the frequency of occurrence that is shown in the tables of this chapter.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation capability	Innovation services & expertise	1	25%	2	29%	5	56%	3	100%
	Additional innovation paths	2	50%	4	57%	5	56%	1	33%
	Digital capabilities	0	0%	2	29%	1	11%	1	33%
	Roles or formats to support innovation	1	25%	0	0%	4	44%	0	0%
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
	Increased awareness for innovation	3	75%	6	86%	6	67%	1	33%
	Increased openness for innovation	1	25%	2	29%	5	56%	2	67%
Innovation ecosystem	Strategic partnership	2	50%	2	29%	4	44%	2	67%
	Venture portfolio	0	0%	0	0%	3	33%	2	67%
	Reputation within innovation eco-system	0	0%	1	14%	0	0%	1	33%
Innovation know-how	Intelligence on trends	0	0%	3	43%	4	44%	2	67%
	Technological know-how	0	0%	3	43%	4	44%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
	Intrapreneurship community	1	25%	2	29%	2	22%	1	33%
	Network of supporters	2	50%	0	0%	3	33%	0	0%
New offerings	Validated innovation idea	4	100%	6	86%	9	100%	3	100%
	New product	1	25%	5	71%	5	56%	1	33%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%
	Value adding services or feature	2	50%	2	29%	1	11%	1	33%
	New market	0	0%	1	14%	0	0%	0	0%
	Reconfigured business model	0	0%	0	0%	1	11%	1	33%
Organizational transformation	Increased efficiency	2	50%	3	43%	3	33%	0	0%
	New ways of working	0	0%	2	29%	5	56%	2	67%
	Digital infrastructure	2	50%	1	14%	0	0%	3	100%
	Improved flexibility & speed	0	0%	3	43%	2	22%	2	67%
	Improved corporate image	0	0%	3	43%	1	11%	1	33%
	Employer Branding	0	0%	2	29%	1	11%	2	67%

Table 7.1: Relationships between internal CE programs and outputs

7.2.2 Strong relationship of internal CE program types and their outputs

To gain a deeper understanding of the value creation of the internal CE programs, the next step will focus on strong relationships (frequency of occurrence higher than 50%). In total, ten outputs did not meet the >50% criteria and were removed. This step resulted in Table 7.2, which covers a reduced set of 17 outputs that have a strong relationship (highlighted in gray) to at least one of the internal CE program types.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation capability	Innovation services & expertise	1	25%	2	29%	5	56%	3	100%
	Additional innovation paths	2	50%	4	57%	5	56%	1	33%
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
	Increased awareness for innovation	2	50%	6	86%	6	67%	1	33%
	Increased openness for innovation	1	25%	2	29%	5	56%	2	67%
Innovation ecosystem	Strategic partnership	2	50%	2	29%	4	44%	2	67%
	Venture portfolio	0	0%	0	0%	3	33%	2	67%
Innovation know-how	Intelligence on trends	0	0%	3	43%	4	44%	2	67%
	Technological know-how	0	0%	3	43%	4	44%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
New offering	Validated innovation idea	4	100%	7	100%	9	100%	3	100%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%
	New product	1	25%	5	71%	5	56%	1	33%
Organizational transformation	New ways of working	0	0%	2	29%	5	56%	2	67%
	Digital infrastructure	2	50%	1	14%	0	0%	3	100%
	Improved flexibility & speed	0	0%	3	43%	2	22%	2	67%
	Employer Branding	0	0%	2	29%	1	11%	2	67%

Table 7.2: Outputs with strong relationships to internal CE programs

The CE program type with the most outputs that show a strong relationship is the venture builder, with 14 out of 17 outputs (82.4%). Followed by the intrapreneurial excubator with ten outputs (58.8%), the assisted incubator with seven outputs (41.2%), and the idea validator with three outputs (17.6%) that show a strong relationship. Below, we (A) discuss the similarities and differences in the value creation, (B) we show outputs with a strong relationship to the category of internal CE programs, and (C) we conclude on internal CE programs and their outputs.

A: Similarities and differences in the value creation of internal CE programs

Analyzing the overlap outputs of the CE program types with a strong relationship will be used to identify similarities and differences in their value creation. Table 7.2 shows that three CE program types of (a) idea validator, (b) assisted incubator, and (c) intrapreneurial excubator share many similarities in their value creation, whereas (d) the venture builder differs from them. Figure 7.3 illustrates the overlap in the value creation of the three CE programs (a to c).

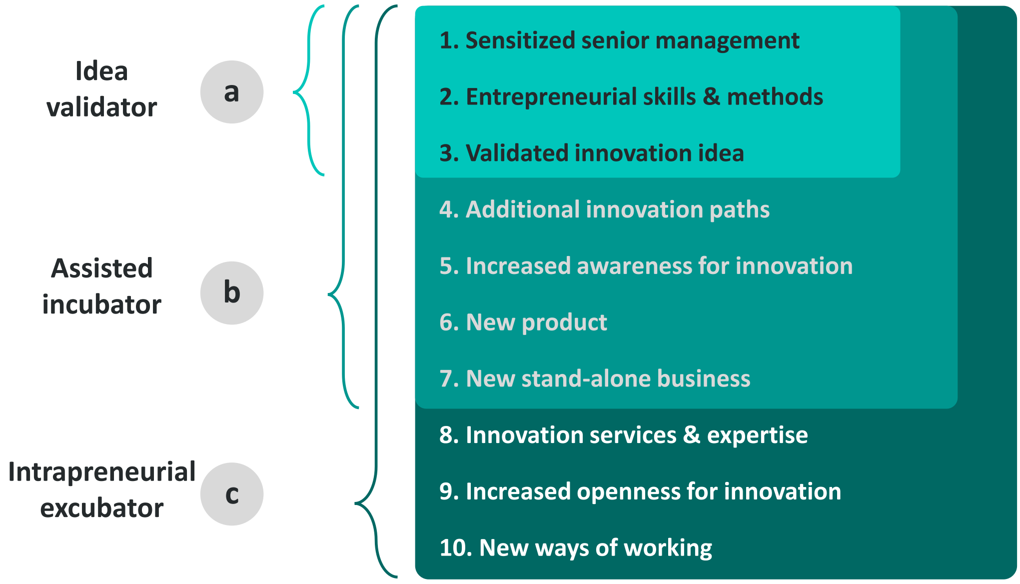

Figure 7.3: Similarities in value creation of CE program types belonging to internal incubation

As shown in Figure 7.3, the idea validator has three outputs with a strong relationship. These three outputs do also show a strong relationship to the assisted incubator and to the intrapreneurial excubator, which leads to a 100% overlap. The assisted incubator has seven outputs with a strong relationship. All of these seven outputs do also show a strong relationship with the intrapreneurial excubator, which again leads to a 100% overlap. For these three CE program types, it can be stated that output-wise, they show a high level of similarity. This finding on the organizational design shows that these three types can be counted to the internal incubation concept (see Subsection 5.1.5).

Table 7.2 also reveals that the venture builder shows a clear difference regarding the value creation to the other three internal CE program types. In total, the venture builder shows 14 strong relationships, of which seven (50%) have no overlap with another type of internal CE programs. Again, this goes in line with the findings from Chapter 5, showing that the organizational design of the venture builder is different from that of the incubation concept.

Nonetheless, the venture builder does also share some similarities in the value creation with the other internal CE program types. The venture builder and the intrapreneurial excubator have the highest overlap with six outputs with a strong relationship to both of them. A potential explanation for this might be found in the organizational design of the two CE program types. Both of them share the characteristic of an inside-out direction as the main innovation flow, e.g., by creating spin-offs, and are focused on creating new businesses.

B: Category of internal CE program and outputs with a strong relationship

Below, we switch the perspective and present the outputs that have a strong relationship to at least three of the four internal CE program types. Based on this we identify the outputs that are most likely to be created by the category of internal CE programs. The outputs that meet this criterion are summarized in Table 7.3. They are the four outputs of (a) sensitized senior management, (b) entrepreneurial skills & methods, (c) validated innovation ideas, and (d) new stand-alone business. The table allows no indication of the differences of the CE programs.

Output category	Outputs	Idea validator (4)		Assisted incubator (7)		Intrapreneurial excubator (9)		Venture builder (3)	
Innovation culture	Sensitized senior management	3	75%	4	57%	9	100%	3	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	4	100%	6	86%	9	100%	1	33%
New offering	Validated innovation idea	4	100%	7	100%	9	100%	3	100%
	New stand-alone business	1	25%	5	71%	8	89%	3	100%

Table 7.3: Outputs with a strong relationship to the internal CE program category

C: Conclusion on internal CE programs and their outputs

Concluding on the results for the internal category, it can be stated that there are clear similarities and differences in the value creation of the four CE program types (see Table 7.2). Thereby, the differences in the value creation seem to be aligned with the findings on the organizational designs (internal incubation vs. company building, see Subsection 5.1.5).

Next, as a natural sequel, we will apply the same analysis for external CE programs and radical innovation units.

7.2.3 External CE program types and their outputs

In this subsection, we focus on describing the relationships between the external CE program types and the outputs. The external CE programs consist of the five types of (1) startup facilitator, (2) collective matchmaker, (3) cooperative explorer, (4) investing co-creator, and (5) strategic investor (for more details, see Subsection 5.2.6).

As illustrated in Table 7.4, 24 of the 27 outputs show a relationship to at least one of the five external CE program types.

Unlike the internal category, there are three outputs that do not show any relationship with the external CE program types. These three outputs are (a) intrapreneurship community, (b) reconfigured business model, and (c) new ways of working. Further, six outputs do show a relation to two or fewer CE programs. This implies that external CE programs are less broad in their focus than the CE program types from the internal category.

Generally, the relationship between the external CE program types and the outputs can be characterized as a hybrid of one-to-many and many-to-many relationships. For eight outputs, we see that they are created by all five external CE program types (see Table 7.4). External CE programs show no one-to-one or many-to-one relationship.

The startup facilitator and the investing co-creator show the highest number of outputs created by an external CE program type, at 19 outputs (70.4%). They are followed by the cooperative explorer and collective matchmaker with 18 outputs (66.7%) and ending with the strategic investor having a relationship to 14 outputs (51.9%).

Based on this, it can be stated that in contrast to the internal CE programs (intrapreneurial excubator with 88.9% and assisted incubation & venture builder with 85.2%), the external CE program types are less allrounder regarding their value creation.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation capability	Innovation services & expertise	2	33%	0	0%	2	67%	3	60%	1	33%
	Additional innovation paths	2	33%	1	33%	1	33%	1	20%	0	0%
	Digital capabilities	1	17%	1	33%	0	0%	1	20%	0	0%
	Roles or formats to support innovation	1	17%	0	0%	2	67%	0	0%	0	0%
Innovation culture	Sensitized & educated higher management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	3	100%	1	33%	5	100%	1	33%
	Increased openness for innovation	3	50%	1	33%	3	100%	3	60%	0	0%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Venture portfolio	2	33%	1	33%	1	33%	4	80%	3	100%
	Reputation within innovation eco-system	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	2	67%	3	100%	4	80%	3	100%
	Technological know-how	2	33%	2	67%	3	100%	3	60%	2	67%
Intrapreneurial empowerment	Entrepreneurial skills & methods	0	0%	0	0%	0	0%	1	20%	1	33%
	Intrapreneurship community	0	0%	0	0%	0	0%	0	0%	0	0%
	Network of supporters	1	17%	1	33%	0	0%	0	0%	0	0%
New offerings	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
	New product	1	17%	2	67%	3	100%	1	20%	0	0%
	New stand-alone business	0	0%	0	0%	0	0%	1	20%	2	67%
	Value adding services or feature	1	17%	2	67%	2	67%	1	20%	0	0%
	New market	0	0%	1	33%	1	33%	0	0%	1	33%
	Reconfigured business model	0	0%	0	0%	0	0%	0	0%	0	0%
Organizational transformation	Increased efficiency	6	100%	2	67%	1	33%	1	20%	1	33%
	New ways of working	0	0%	0	0%	0	0%	0	0%	0	0%
	Digital infrastructure	2	33%	0	0%	0	0%	1	20%	0	0%
	Improved flexibility & speed	2	33%	1	33%	0	0%	1	20%	2	67%
	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%
	Employer Branding	0	0%	0	0%	1	33%	0	0%	0	0%

Table 7.4: The relationships between external CE programs and outputs

7.2.4 Strong relationship of external CE program types and their outputs

Having described the general distribution of outputs, they are next examined for strong relationships. For this purpose, all outputs are removed that do not meet the criteria for a strong relationship. This step results in Table 7.5, whereby the outputs with a strong relationship are highlighted in gray. In total, there are 17 outputs covered in Table 7.5 that show a strong relationship to at least one of the external CE program types.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation capability	Innovation services & expertise	2	33%	2	67%	0	0%	3	60%	1	33%
	Roles or formats to support innovation	1	17%	2	67%	0	0%	0	0%	0	0%
Innovation culture	Sensitized senior management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	1	33%	3	100%	5	100%	1	33%
	Increased openness for innovation	3	50%	3	100%	1	33%	3	60%	0	0%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Venture portfolio	2	33%	1	33%	1	33%	4	80%	3	100%
	Reputation within innovation ecosystem	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	3	100%	2	67%	4	80%	3	100%
	Technological know-how	2	33%	3	100%	2	67%	3	60%	2	67%
New offering	New product	1	17%	3	100%	2	67%	1	20%	0	0%
	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
	New stand-alone business	0	0%	0	0%	0	0%	1	20%	2	67%
	Value adding services or feature	1	17%	2	67%	2	67%	1	20%	0	0%
Organizational transformation	Increased efficiency	6	100%	1	33%	2	67%	1	20%	1	33%
	Improved flexibility & speed	2	33%	0	0%	1	33%	1	20%	2	67%
	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%

Table 7.5: Outputs with strong relationships to external CE programs

Of the five CE program types in the external category, the cooperative explorer shows the highest number of strong relationships with twelve of the 17 outputs (70.6%), followed by the collective matchmaker with eleven of 17 outputs (64.7%). The investing co-creator shows a strong relationship with nine outputs (52.9%), and the strategic investor with eight outputs (47.1%). The startup facilitator has the lowest number, with five of 17 outputs (29.4%).

The fact that the startup facilitator shows, on the one hand, the lowest number of strong relationships and, on the other hand, the highest number of general relationships to the outputs is surprising at first glance. A possible explanation might be found in the narrow focus of the startup facilitator. It is geared to support the validation of innovation ideas of startups, which is seen as a potential starting point for a partnership between the startup and the core organization. Many outputs are case-specific since they depend on the innovation idea that is validated. For example, when a technology is improving the service of an existing product, the output is different from that of a technology that is automating processes.

Consequently, there are only a few outputs that frequently occurred (strong relationship), such as strategic partnership, whereas the results of the partnership mainly depend on the innovation ideas themselves and hence are not reflected in the strong relationships.

Below, we (A) discuss differences between internal and external CE programs, (B) we compare startup engagement types, (C) we compare startup investment types, (D) we highlight the differences between startup engagement and startup investing, (E) show outputs with a strong relationship to the external CE program category, and (F) conclude on external CE programs and their value creation.

A: Differences between internal and external CE program types

Twelve of these outputs from Table 7.5 have an overlap with the ones identified for internal CE program category (see Table 7.1). In addition, there are five outputs (with a strong relationship) that are identified exclusively for external CE program types. These outputs are (a) roles and formats to support innovation, (b) reputation within innovation ecosystem, (c) value adding services or features, (d) improved corporate image, and (e) increased efficiency. Subsequently, we will briefly discuss potential explanations for this difference.

The two outputs *reputation within innovation ecosystem* and *improved corporate image* are directed outward which fits to the locus of opportunity of external CE program types and could explain why they are not created by internal ones. For the two outputs *value adding services or features* and *increased efficiency*, a potential explanation for showing a strong relationship to external CE programs but not to internal ones may also be found in the locus of opportunity. Internal CE programs are mainly used to complement the R&D activities of a company and to develop innovations that have a strong market orientation, e.g., new products or new services. In contrast, external CE programs have a broader innovation scope, as they focus on identifying startups that have an innovation that could be relevant for the core organization. Thereby, the type of innovation can also focus on improving the companies processes or on features that are complementing existing products.

B: Comparing startup engagement types

For the analysis, we have grouped the five CE program types according to their two main activities *startup engagement* and *startup investing* (see Subsection 5.2.6). The three CE program types that belong to the startup engagement group are (a) startup facilitator, (b) collective matchmaker, and (c) cooperative explorer. Correspondingly, the two CE program types (d) investing co-creator and (e) strategic investor belong to the startup investing group.

We start our analysis with the group of startup engagement. Figure 7.4 is illustrating the overlap between the three CE program types belonging to this group. The outputs in the figure are ordered according to their association to the three CE program types (a to c).

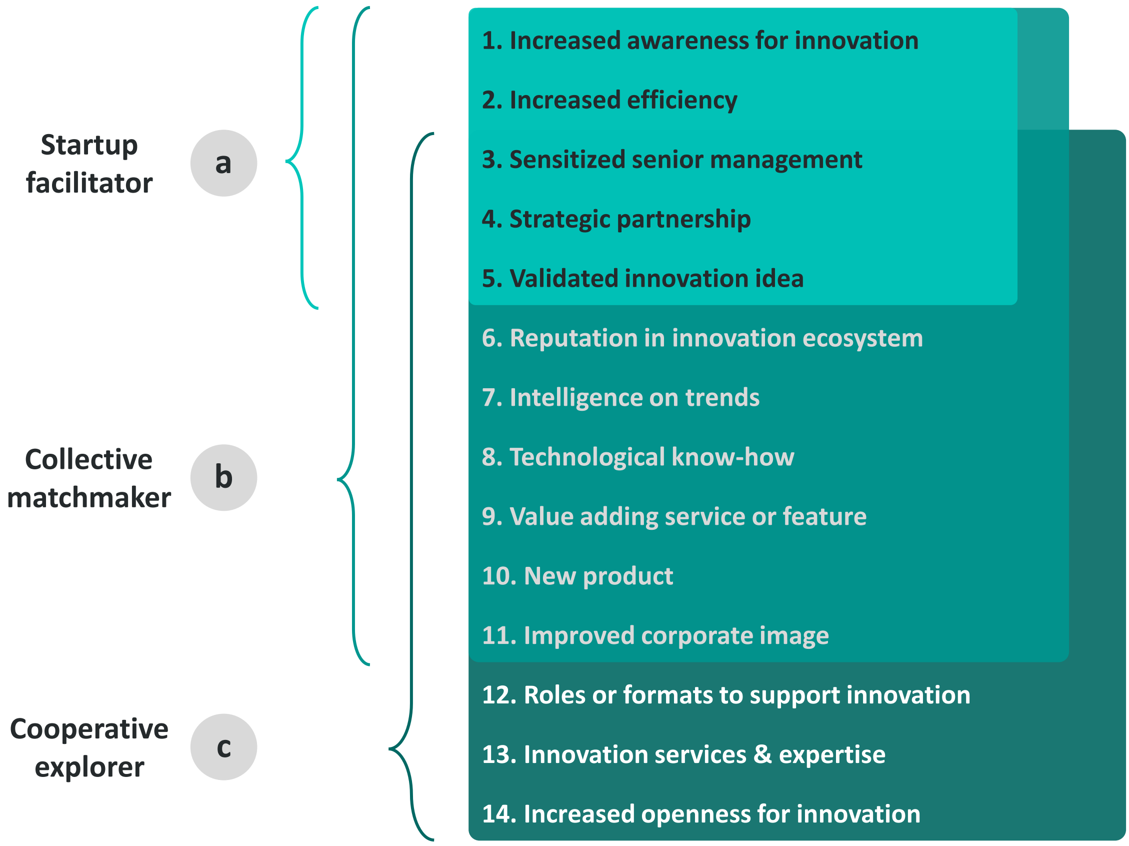

Figure 7.4: Similarities in the value creation (strong outputs) of three startup engagement types

Based on Figure 7.4, the following three observations can be made.

1) The startup facilitator has 100% overlap with the collective matchmaker and around 60% of the strong outputs are in common with the collaborative explorer.
2) The collective matchmaker has an overlap of around 80% with the cooperative explorer regarding the outputs with a strong relationship.
3) The cooperative explorer shows a strong relationship to three outputs that are different from the other two CE programs (highlighted with white color in Figure 7.4).

The similarities and differences in the value creation can be traced back to the organizational design of the three CE program types. The startup facilitator is focusing mainly on process innovation, which explains why outputs such as product innovation, new business, or intelligence on trends show no strong relationship.

In contrast, the cooperative explorer focuses mainly on product and service innovation but not on process innovation. This seems to explain why the two CE program types have a rather low overlap in their value creation and also serves as an explanation for the cooperative explorer's strong focus on outputs centered on product innovation and technologies.

The collective matchmaker can be understood as a hybrid CE program type regarding its focus as it addresses both process and product or service innovation simultaneously. This is also reflected in the value creation of the collective matchmaker, which has a high overlap with both the startup facilitator and the cooperative explorer.

C: Comparing startup investment types

We will now focus on the two types that belong to the startup investment group. Figure 7.5 (on the next page) shows the twelve outputs have a strong relationship to at least one of the two CE program types. Five of the twelve outputs (5-9) have an overlap, meaning they show a strong relationship to both of them, whereas seven outputs show a strong relationship to only one of the two CE program types.

A key activity of the two types of (d) investing co-creator and (e) strategic investor is to identify startups that show a strategic value for the core organization and to invest in them. This activity is reflected in the common outputs of venture portfolio, strategic partnership, technological know-how. However, the two CE program types differ in the reasons for the investments. Whereas the investing co-creator is investing in startups to strengthen or enable collaboration with them, the strategic investor acts similar to an institutional investor and has a main focus on the investment itself.

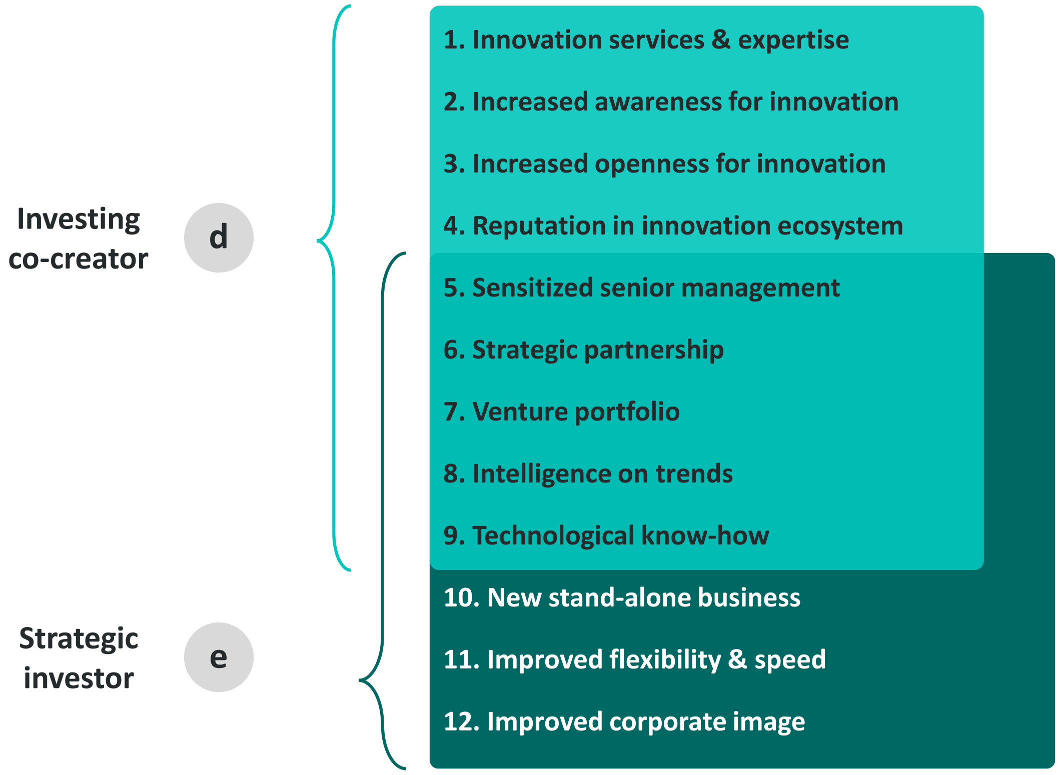

Figure 7.5: Similarities in the value creation (strong outputs) of two startup investing types

The focus on collaboration and investment by the investing co-creator serves as an explanation for the differences in outputs. Successful collaboration requires that the core organization is willing to collaborate with the startup and that the need or relevance of potential collaboration is clearly understood. This is reflected in the two outputs increased *awareness for innovation* and *increased openness to innovation*.

Furthermore, due to the strong interaction with the core organization, the know-how and expertise of the investing co-creator are recognized and demanded, which explains the strong relationship to the output *innovation services & expertise*.

The fact that the output *reputation in innovation ecosystem* shows only a strong relationship to the investing co-creator but not to the strategic investor might be explained by the circumstance that all strategic investors in our data set were located in the Silicon Valley, which is home to a number of world-renowned investors and companies, making it much more difficult to build a good reputation than in the DACH region.

The strategic investor shows a strong relationship with three outputs that are different from those of the investing co-creator. These three outputs are (a) new stand-alone business, (b) improved flexibility and speed, and (c) improved corporate image.

Regarding the output new stand-alone business, it may be expected that this is also created by the investing co-creator, since it is also aimed at developing new products or businesses. One reason why this is not the case could be that the investing co-creators mostly target joint development projects that involve rather long development cycles, while the strategic investors had a focus on joint commercialization of innovations that were more mature in their development and required less development effort to bring them to market. It is expected that over time, the activities of the investing co-creator will also lead to the creation of new products and new businesses.

D: Differences between startup engagement and startup investing types

For the two groups of *startup engagement* programs and *startup investing* programs, the following observation can be made. Startup engagement programs show more short-term outputs, as they do also focus on rather transactional relationships to startups that can be understood as a customer-supplier relationship. In such cases, no or only a few development efforts are required to use the solution of the startup, which consequently leads to more direct results that can be observed in the outputs such as increased efficiency, value adding service or feature, or new products (using white-label products or through distribution agreements).

Startup investments do not necessarily lead to the direct creation of new products or services, but they do seem to provide the foundation for innovations, e.g., accessing new technologies by creating strong partnerships (investments) with startups. Depending on the maturity of the startup and their technology, the time horizon of observable results for new products or new businesses might be more mid-or long-term.

E: Category of external CE programs and outputs with a strong relationship

Table 7.6 summarized that outputs that show a strong relationship to three or more external CE program types. These outputs are considered as being likely to be created when operating external CE programs. In total, eight outputs can be identified that meet this criterion, which are illustrated below.

Output category	Outputs	Startup facilitator (6)		Collective matchmaker (3)		Cooperative explorer (3)		Investing co-creator (5)		Strategic investor (3)	
Innovation culture	Sensitized senior management	4	67%	3	100%	3	100%	4	80%	3	100%
	Increased awareness for innovation	4	67%	3	100%	3	33%	5	100%	1	33%
Innovation ecosystem	Strategic partnership	6	100%	3	100%	3	100%	5	100%	3	100%
	Reputation within innovation ecosystem	1	17%	2	67%	2	67%	4	80%	1	33%
Innovation know-how	Intelligence on trends	3	50%	3	100%	2	67%	4	80%	3	100%
	Technological know-how	2	33%	3	100%	2	67%	3	60%	2	67%
New offering	Validated innovation idea	6	100%	3	100%	3	100%	2	40%	0	0%
Organizational transformation	Improved corporate image	0	0%	2	67%	2	67%	0	0%	2	67%

Table 7.6: Outputs with a strong relationship to the external CE program category

External CE program category shows twice the number of outputs that have a strong relationship to the overall category (compared to internal CE programs). External CE programs seem to be suited well for creating outputs belonging to the three output categories of *innovation culture*, *innovation ecosystem*, and *innovation know-how*. These three categories consist of a total of eight outputs, whereof six outputs show a strong relationship to the overall category of external CE programs, as shown in Table 7.6.

F: Concluding on external CE program types

To summarize the results presented in this subsection, external CE programs exhibit a wide range of value creation, especially in terms of outputs with a strong relationship. Moreover, the results show that external and internal CE programs exhibit clear differences. Understanding these differences is critical to selecting the organizational design that is best suited to achieve the intended objective.

In addition, we have seen that the five CE program types clearly differ in their value creation. However, the results also show that it is important to deepen the understanding of the quality of the outputs. For example, the output *strategic partnership*, which describes a relationship between a startup and the core organization is created. This relationship can have different manifestations, such as a customer-supplier relationship or a joint development agreement, which are rather different in quality and intensity.

7.2.5 Radical innovation units and their outputs

This subsection will describe the relationships between the outputs and the organizational design belonging to the radical innovation unit category. Even though they are not directly contributing to answering RQ3, it is supportive to understand how they differ from the various internal and external CE program types to ensure a more effective management.

The three types that belong to the radical innovation unit category are (1) the digital factory, (2) the innovation lab, and (3) the tech lab (for more detail, see Subsection 5.3.4)

For the radical innovation units, 24 of the 27 outputs show a relationship to at least one of the three organizational designs belonging to this category. The three outputs that show no relationship to are (a) roles and formats to support innovation, (b) network of supporters, and (c) increased efficiency.

For nine outputs, the relationship can be observed for all three types, whereas eight outputs do show only a relationship to one or no type (see Table 7.7). The relationships between the radical innovation unit types and the outputs can be characterized as a hybrid of one-to-many and many-to-many relationships, but not as one-to-one or many-to-one.

The innovation lab shows with 22 outputs (81.5%) the highest number of different outputs (rows in the table) that are created. Followed by the digital factory with 17 outputs (62.9%) and the tech lab with 13 ones (48.1%).

The fact that the innovation lab has the highest number of relationships to the different outputs can be explained by the variety of organizational designs that are covered under this type. Typically, an innovation lab consists of multiple CE and innovation activities, which consequently lead to a higher number of outputs than a more focused type such as the digital factory and tech labs.

All in all, this means that the innovation lab seems to be the most allrounder organizational form (as well as the most ambiguous, see Subsection 5.3.4) of the radical innovation units.

Output category	Outputs	Digital factory (4)		Innovation lab (5)		Tech lab (2)	
Innovation capability	Innovation services & expertise	1	25%	2	40%	1	50%
	Additional innovation paths	1	25%	0	0%	1	50%
	Digital capabilities	4	100%	1	20%	0	0%
	Roles or formats to support innovation	0	0%	0	0%	0	0%
Innovation culture	Sensitized senior management	1	25%	4	80%	2	100%
	Increased awareness for innovation	3	75%	4	80%	0	0%
	Increased openness for innovation	1	25%	2	40%	1	50%
Innovation ecosystem	Strategic partnership	0	0%	2	40%	1	50%
	Venture portfolio	0	0%	1	20%	0	0%
	Reputation within innovation eco-system	0	0%	1	20%	2	100%
Innovation know-how	Intelligence on trends	4	100%	2	40%	2	100%
	Technological know-how	1	25%	2	40%	2	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	1	25%	4	80%	0	0%
	Intrapreneurship community	0	0%	1	20%	0	0%
	Network of supporters	0	0%	0	0%	0	0%
New offerings	Validated innovation idea	1	25%	4	80%	1	50%
	New product	1	25%	2	40%	1	50%
	New stand-alone business	0	0%	2	40%	0	0%
	Value adding services or feature	3	75%	2	40%	1	50%
	New market	3	75%	0	0%	0	0%
	Reconfigured business model	1	25%	1	20%	0	0%
Organizational transformation	Increased efficiency	0	0%	0	0%	0	0%
	New ways of working	3	75%	2	40%	1	50%
	Digital infrastructure	4	100%	2	40%	0	0%
	Improved flexibility & speed	0	0%	2	40%	0	0%
	Improved corporate image	0	0%	3	60%	1	50%
	Employer Branding	2	50%	1	20%	0	0%

Table 7.7: The relationship between radical innovation units and outputs

7.2.6 Strong relationship between radical innovation units and their outputs

Next, we will focus on the outputs that show a strong relationship to at least one of the three types. After having removed all outputs without a strong relationship, 13 outputs (highlighted in gray) are remaining, which are summarized in Table 7.8.

Output category	Outputs	Digital factory (4)		Innovation lab (5)		Tech lab (2)	
Innovation capability	Digital capabilities	4	100%	1	20%	0	0%
Innovation culture	Sensitized senior management	1	25%	4	80%	2	100%
	Increased awareness for innovation	3	75%	4	80%	0	0%
Innovation ecosystem	Reputation within innovation ecosystem	0	0%	1	20%	2	100%
Innovation know-how	Intelligence on trends	4	100%	2	40%	2	100%
	Technological know-how	1	25%	2	40%	2	100%
Intrapreneurial empowerment	Entrepreneurial skills & methods	1	25%	4	80%	0	0%
New business offering	Validated innovation idea	1	25%	4	80%	1	50%
	Value adding services or feature	3	75%	2	40%	1	50%
	New market	3	75%	0	0%	0	0%
Organizational transformation	New ways of working	3	75%	2	40%	1	50%
	Digital infrastructure	4	100%	2	40%	0	0%
	Improved corporate image	0	0%	3	60%	1	50%

Table 7.8: Strong relationships between radical innovation units and outputs

For the outputs that have a strong relationship, the digital factory shows the highest number with seven out of 13 outputs (53.8%), followed by the innovation lab with five outputs (38.5%) and the tech lab with four outputs (30.8%). The fact that the innovation lab has a relationship to 22 outputs but only four outputs with a strong relationship may be explained by its organizational design and which shows various manifestations leading to different outputs. For the tech lab, the low number of outputs with a strong relationship seems to be rooted in the narrow focus on understanding new technologies.

For the digital factory, it can be observed that the outputs show a strong focus on digital topics, e.g., digital capabilities, digital infrastructure, or intelligence on trends. At the same time, the transformative impact is shown with the outputs of new ways of working as well as new market, which in all cases covers the creating of new, digital sales channels.

The innovation lab, on the other hand, shows a strong value creation for a company's innovation culture, the individual skills of the employees, and the corporate image. Regarding the development of product or service innovation, an innovation lab seems to be suited well for validating innovation ideas but rather not for their implementation.

The last type of this category is the tech lab. This form has a strong focus on exploring new technologies and understanding trends that might be relevant for the company. Tech labs focus on the development of new technological know-how that is transferred back into the core business. In both cases, the tech lab was located in the Silicon Valley, which improved the company's reputation in the innovation ecosystem as well as regular contact with the senior management, leading to sensitization for trends and current development.

The results of this subsection show that the radical innovation units do not only differ strongly regarding their organizational designs as compared to the CE programs but also regarding their value creation. The focus on technology and on digitalization makes them complementary to the value creation of CE programs.

7.2.7 The relationship between CE programs and outputs

The results presented in this section show that there are clear differences in the value creation of CE programs. For each organizational design, a subset of outputs that show a strong relationship to the respective form has been identified. Thereby, the relatedness in the organizational designs, for example, between the idea validator and assisted incubator, can be used as an indicator for similarities regarding the outputs that are created by CE programs.

Furthermore, three outputs have no strong relationship to any CE program type. These outputs are (a) *intrapreneurship community*, (b) *network of supporters,* and (c) *reconfigured business model*. For (a) and (b) it seems that they are rather supporting outputs that are used to achieve a primary objective. Since there are also other ways to support the work of the CE program, this might explain why they show no strong relationship. For the reconfigured business model, it can be observed that this output was created by different CE programs. As it requires a high transformative effort to change the business model, it is not surprising that this output has the lowest number across all outputs of the new offering category.

In addition, we have seen that some outputs have a rather weak relationship with CE programs, while others have a higher-than-average frequency of occurrence (defined as a strong relationship). Figure 7.6 provides an overview of the output categories and outputs that show such a strong relationship for more than 50% of the CE program types within the respective category. This overview shows that the internal and external CE program categories are clearly distinct but complementary in their value creation. In contrast, the category of radical innovation units is rather an additional way to create the respective outputs.

Output category	Output	Internal CE programs	External CE programs	Radical innovation units
Innovation culture	Increased awareness for innovation		X	X
	Sensitized senior management	X	X	X
Innovation ecosystem	Strategic partnership		X	
	Venture portfolio		X	
	Reputation within innovation ecosystem		X	
Innovation know-how	Intelligence on trends		X	X
	Technological know-how		X	
Intrapreneurial empowerment	Entrepreneurial skills & methods	X		
New offerings	New stand-alone business	X		
	Validated innovation idea	X	X	
Organizational transformation	Improved corporate image		X	

Figure 7.6: Distribution of strong relationships between CE program categories and outputs

7.3 Influence of contextual and structural elements

Having analyzed the relationships between the CE programs and the outputs, this section will focus on the question of how these relationships may be influenced by certain contextual or structural elements. This provides an answer to RQ3b, which reads as follows: *Do certain structural or contextual elements influence their occurrence?*

For answering this research question, the section is split into Subsection 7.3.1, which focuses on the influence of structural elements of CE programs can have on the occurrence of the outputs. Subsection 7.3.2 investigates the potential influence of contextual elements on the occurrence of certain outputs.

7.3.1 Influence of structural elements

In this subsection, we will focus on the question if certain structural elements can explain differences in the relationships between CE programs and the outputs they are creating. The term structural element is based on the configuration theory (see Subsection 2.2.3) and refers to what we have described as design elements[19](see Section 4.2). Consequently, we will investigate if design elements (DE) are suited to explain the occurrence of certain outputs (O). The expected type of relationship is visualized in Figure 7.7.

Figure 7.7: Visualization relationship between a design element and certain outputs

Below we will (A) discuss the analysis of two similar CE program types to investigate the influence of design elements, (B) present a first example of an output that seems to be influenced by a design element, (C) present a second example of an output that seems to be influenced by a design element, and (D) conclude on the influence of design elements on the occurrence of certain outputs.

A: Analyzing similar CE program types

For understanding how design elements may influence the relationship with certain outputs, we focus on CE programs that have a high degree of similarity in terms of their organizational design and outputs. We expect that the causes of differences between rather similar CE programs can be identified and explained more clearly than for CE program types with stronger differences.

Two CE program types that exhibit a high degree of similarity are (a) the *assisted incubator* and (b) the *intrapreneurial excubator.* They are similar in terms of their outputs (see Figure 7.3) and their organizational design (see Subsection 5.1.3 & 5.1.4). We will focus on these two CE program types to better understand how design elements influence particular outputs.

[19] Henceforth, we will use the term *design element* and *structural element* interchangeably.

For identifying design elements that are likely to explain the occurrence of a certain output, we focus on outputs that have a strong difference in their relationship between the two CE program types, e.g., an output that shows a relationship only to one of the CE program types. Two outputs that fulfill this criterion are (1) *roles or formats to support innovation* and (2) *sensitized senior management*.

Next, we will investigate if the difference in the relationship to the two outputs might be explained by differences in the organizational design of the two CE program types.

B: Example 1 – Roles or formats to support innovation

The output *roles and formats to support innovation*[20] is distinct for the two CE programs. The intrapreneurial excubator shows a frequency of occurrence of 44%, whereas in the case of the assisted incubator no relationship (0%) to this output was identified.

A deeper look at the organizational design of both CE programs reveals that the difference in the output may be explained by different types of support the two programs are offering (represented by the design element *key value proposition*).

- The intrapreneurial excubator offers resources, time (capacity), and a clear structured process that supports the innovation teams in validating and implementing their idea.
- The assisted incubator offers the same support and in addition, the temporary involvement of CE program's employees who complement the innovation teams and add missing competencies to the team.

Offering a support service where employees of the CE program support the innovation teams is much more resource-intensive than the support services offered by the intrapreneurial excubator. This higher resource intensity of the assisted incubator might be a reason why this format is not adopted by departments from the core organization, whereas the rather "lean" concept of the intrapreneurial excubator has been adopted in 44% of the. This difference suggests that the design element *key value proposition* can be used to explain differences in the relationships between the two CE program types and their outputs.

[20] Definition: New job roles or formats to promote innovation are transferred to the core organization, as they have proven valuable through the activities of the CE program.

C: Example 2 – Sensitized senior management

The second output is the sensitized senior management[21]. The activities of the intrapreneurial excubator frequently lead to the creation of new business units or spin-offs (reflected in the output *venture portfolio*). Both typically require the involvement of the companies' top management, mostly C-level. In this process, the senior management is confronted with new technologies, new business models, new markets that are building the basis for the investment decision. This confrontation is not only sensitizing them for current trends but also educates them in more entrepreneurial thinking and recent innovation topics.

For the intrapreneurial excubator in 100% of the cases, the output sensitized senior management was identified. On the contrary, for the assisted incubator only 57% of the cases did show this output. A potential explanation for this difference can be found in the design element *preferred exit path*. As mentioned above, the intrapreneurial excubator often leads to the creation of new business units or corporate spin-offs. The assisted incubator, in contrast, is designed to transfer the innovation idea back to the core business. The process of transferring the idea back does not necessarily require the involvement of the highest management of the company. If the senior management is involved, then most of the respective business unit that receives the innovation idea. The design element *preferred exit path* seems to explain differences in the output between the two CE program types.

D: Concluding on the influence of structural elements

As shown in this subsection, the design elements identified in Chapter 4 are not only suitable for defining and distinguishing the different types of CE programs but can also be used to explain differences in their value creation. However, since explaining the difference in the relationships between CE program types and their outputs was not the intention when deriving the design elements, there might be other ones that are better suited. Hence, further research is needed to deepen the understanding of which design elements show a relationship with the different outputs.

[21] Definition: Senior management has regular contact to innovative topics, often involved as a jury member or in investment boards, which is sensitizing them for innovation.

7.3.2 Potential influence of contextual elements

In this subsection, we will focus on the influence of contextual factors on the relationship between CE programs and their outputs. Following the configuration theory (see Subsections 2.2.3), the context of an organizational unit is characterized by multiple elements. As shown in Figure 7.8, the context elements (variable C) can be divided into two groups.

First, the company-external context, meaning the environment in which the company is acting, e.g., the competitive situation or type of industry. Second, the company-internal context, that describes the characteristics of the parent organization in which the CE program is embedded, e.g., the size of the company or the ownership structure. We assume that both types of contextual elements can have a moderating influence on the relationship between CE programs and outputs (illustrated in Figure 7.8).

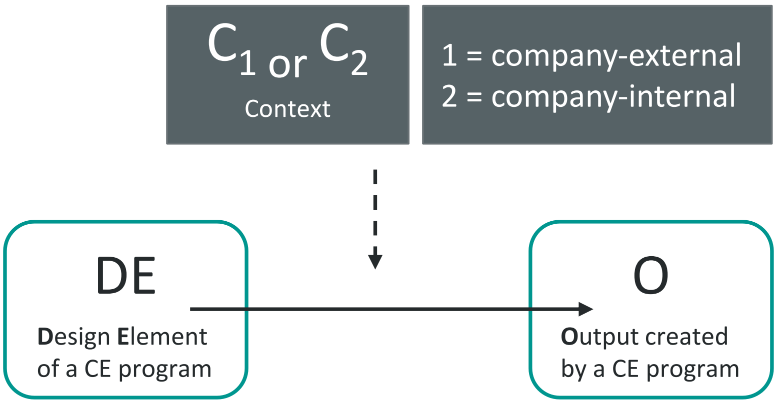

Figure 7.8: Influence of contextual elements on the "CE program – output" relationship

To understand the moderating influence of contextual elements on the relationship between CE programs and certain outputs, we will analyze (A) the industry class as a company-external context element and (B) the company size as a company-internal context element. In (C), we will conclude on the influence of context elements on the occurrence of outputs.

A: Industry class as a company-external context element

We will start with the influence of company-external context elements on the relationship between CE programs and outputs. For this purpose, we have selected the *industry type* as one company-external element, as it is available for all our cases of our data set.

Companies show different behaviors that can be traced back to the type of industry they are acting in (see, e.g., Gilsing et al., 2011; Andras & Srinivasan, 2003). Hence, we assume that depending on the characteristics of an industry, certain outputs of a CE program might vary as well. Generally, there is a difference between companies that are developing and creating new hardware products and companies that are using these products to deliver their services. For example, a company that is building trucks has much longer product development cycles than a logistics company that is using these trucks to offer transportation services.

We also expect differences within the group of manufacturing companies. There are some industries that are particularly research and capital intensive. This is the case, e.g., for chemical & pharmaceutical companies and for automotive manufacturers. They often have long product development cycles of several years, while companies that manufacture comparatively simpler products, e.g., consumer electronics, release new products every year. Based on this consideration, we expect that depending on the type of industry in which a company operates, the results of the same type of CE program will vary.

For the investigation, we have selected the three internal CE programs of (a) idea validator, (b) intrapreneurial excubator, and (c) assisted incubator for this analysis. From an organizational design perspective, they belong to the group of internal incubation (see Subsection 5.1.5, the assisted incubator is a hybrid between internal incubation and company building) and they share similar outputs (see Subsection 7.1.1). We expect that due to the high level of similarities, variances in the outputs can be better traced back to external factors such as the industry class the company is operating in. In total, 20 cases belong to the internal incubation type of CE programs.

The 20 cases were clustered according to their industry classes (using the NAICS codes presented in Subsection 3.2.1). Internal incubation programs are focused on supporting the development of new businesses or products. By comparing the different industry classes, we have seen that in some cases, CE programs did not only focus on new products or businesses but also on process innovation, which is reflected in the output *optimization and efficiency*.

This output occurred in seven of the 20 cases studied. In all seven cases, the CE programs belong either to companies operating in research- and capital-intensive manufacturing industries (automotive, chemicals & pharmaceuticals, and medical equipment and supplies) or in service-oriented industries (finance & insurance, and transportation & warehousing).

Potential explanations for these differences might be based on the product characteristics of the respective industries.

- For service-oriented companies, process innovation is more than "saving costs" since it also leads to improved services that can be offered to their customers. Hence, process innovation leads to an improved product offering and is highly relevant.
- For research- and capital-intensive manufacturing companies, especially the chemical-pharmaceutical and automotive manufacturers, the product offering is concentrated on a few and expensive key products that are developed in the core organization. It is unlikely that a core business product (cars or medicine) is developed in a CE program.

As a result, CE programs must focus on other areas of innovation beyond the core products. Among other aspects, this can also include process innovation which is reflected in the output *optimization and efficiency*. This line of reasoning is further supported by the fact that the output *value-added services or features*. This output was created five times by internal CE programs, whereof three of them by CE programs belonging to the chemical & pharmaceutical or automotive industry. The difference in the types of innovation indicates that the industry type can have a moderating effect on the relationship to certain outputs.

B: Company size as a company-internal context element

In contrast to the company-external context elements, we could not identify any direct moderating influence of a company-internal context element on the relationship between CE programs and specific outputs. One possible explanation could be that the companies are highly diverse in terms of their organizational design and characteristics, and the dataset is too small in size to allow this variety to be studied well.

However, applying a broader perspective for investigating if company-internal contextual elements have an influence on the occurrence of outputs unveils an indirect moderating influence. Analyzing the company size in relation to the CE programs reveals that the choice of which CE program is initiated seems to be influenced by the size of the core organization.

The analysis shows that companies with less than 10,000 employees are running only one CE program at a time, whereas larger companies tend to have multiple ones in parallel (see Subsection 3.2.2). In addition, the share of external CE programs initiated by smaller companies is considerably lower than in large companies. Out of the nine CE programs that are operated by companies smaller than 10,000 employees, only two have an external focus (22.22%). The two companies operating an external CE program are subsidiaries of larger corporations. Some CE programs appear to be operated rather by large companies, such as the strategic investor with an average number of 184,434 employees in the entire company or the collective matchmaker with an average number of 202,308 employees.

These findings suggest that also company-internal context elements, in this case, the size of the company, have an influence on the occurrence of certain outputs. Since smaller companies show a strong focus on internal CE programs, this has an indirect effect on the outputs, as internal and external CE programs show a clear difference in the outputs they are creating (see Figure 7.6 in Subsection 7.2.7).

C: Concluding on the influence of context elements

To conclude, the examples presented in this subsection show that the company-external and company-internal context can have an influence on the relationship between CE programs and their outputs. In our study, a difference between a direct influence for company-external context and an indirect influence for company-internal context was observed.

The results show that it is important to understand the context in which a company is operating. For example, when deciding on the innovation focus of a CE program, it is crucial to consider both (a) the readiness of the market and customers for new products and (b) how well do these new products fit the company's overall strategy. This is in line with the configuration theory that focuses on both the internal and the external fit of an organizational unit for understanding their performance (see Subsection 2.2.3).

Since the context was not the main scope of our work, there is a need for more studies focusing on context elements. Similar to our results for the organizational designs and the outputs of CE programs, it would be important to understand which company-external and company-internal elements exist and to identify the ones that have a rather strong impact on the occurrence of the outputs created by CE programs.

7.4 Which CE program to use for the creation of certain outputs

In this section, we focus on understanding the "output – CE program relationship" from an output perspective. The aim is to answer RQ3c that reads as follows: w*hich CE programs are more suited to achieve the respective outputs?*

We start with an overview of the CE program types that have the highest frequency of occurrence for the seven output categories, meaning they are most likely to create outputs of the respective category. In Table 7.9, the five CE program types with the highest frequency of occurrence are illustrated for each of the seven output categories. In the case that CE program types show the same frequency of occurrence, this is indicated by using the same number in the column before the CE program's name.

Output category	**CE program types (overall frequency of occurrence)**									
Innovation capability	1	Intrapreneurial excubator (41.7%)	1	Venture builder (41.7%)	1	Cooperative explorer (41.7%)	4	Digital factory (37.5%)	5	Assisted incubator (28.6%)
Innovation culture	1	Investing co-creator (80%)	2	Cooperative explorer (77.8%)	2	Collective matchmaker (77.8%)	4	Intrapreneurial excubator (74.1%)	5	Venture builder (66.7%)
Innovation ecosystem	1	Investing co-creator (86.7%)	2	Strategic investor (77.8%)	3	Collective matchmaker (66.7%)	3	Cooperative explorer (66.7%)	4	Venture builder (55.6%)
Innovation know-how	1	Cooperative explorer (100%)	1	Tech lab (100%)	3	Strategic investor (83.3%)	4	Investing co-creator (70.0%)	5	Venture builder [22] (66.7%)
Intrapreneurial empowerment	1	Idea validator (58.3)	2	Intrapreneurial excubator (51.9%)	3	Assisted incubator (38.1%)	4	Innovation lab (33.3%)	5	Venture builder (22.2%)
New offering	1	Venture builder (50.0%)	1	Cooperative explorer (50.0%)	3	Assisted incubator (47.6%)	4	Intrapreneurial excubator (44.4%)	4	Collective matchmaker (44.4%)
Organizational transformation	1	Venture builder (55.6%)	2	Digital factory (37.5%)	3	Assisted incubator (33.3%)	3	Innovation lab (33.3%)	5	Collective matchmaker (27.8%)

Table 7.9: CE program types with strongest overall relationship to the seven output categories

The results in Table 7.9 show that depending on the output category, there are different CE program types that are more likely to create the respective outputs. For some output

[22] For innovation know-how category, the 5th rank is shared by collective matchmaker and the venture builder.

categories internal CE programs seem to suit better, e.g., innovation capability, whereas for other output categories, external CE programs show a better fit, e.g., innovation ecosystem.

Having presented the rather high-level relationships between CE program types and the output categories, we will focus on each of the seven output categories separately. Subsections 7.4.1 – 7.4.7 will analyze for each category, which of the nine CE programs and the three radical innovation units[23] are suited best to create the respective outputs.

7.4.1 CE programs and innovation capability

The output category *innovation capability* includes four outputs. They account for 12% of all coded outputs and were found in 29% of the cases studied. Table 7.10 shows the CE program types that have the highest frequency of occurrence for each output. If the output is created by less than five CE programs, the remaining columns are filled with (-). For being included in this consideration, only strong relationships were counted.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Innovation services & expertise	Venture builder (100%)	Cooperative explorer (67%)	Investing co-creator (60%)	Intrapreneurial excubator (56%)	Innovation lab (43%)
Additional innovation paths	Intrapreneurial excubator (67%)	Assisted incubator (57%)	Idea validator (50%)	Startup facilitator (33%)	Venture builder (33%)
Digital capabilities	Digital factory (100%)	Venture builder (33%)	Collective matchmaker (33%)	Assisted incubator (29%)	Investing co-creator (20%)
Roles or formats to support innovation	Cooperative explorer (67%)	Intrapreneurial excubator (44%)	Idea validator (25%)	Startup facilitator (17%)	-

Table 7.10: CE programs to create innovation capability outputs

CE program types with a strong relationship to the outputs are highlighted in gray. The table shows that both internal and external CE program types are suited for creating outputs of the *innovation capability* category. It must be stated that generally, the outputs in this category score low when it comes to strong relationships. For three outputs, only two or one CE program type show a strong relationship to them. Regarding the output *digital capabilities,*

[23] Henceforth, radical innovation units are included when mentioning CE programs or CE program types.

we see only a strong relationship to the digital factory type (radical innovation unit category), meaning that there is no CE program that has a strong relationship to this output.

7.4.2 CE programs and innovation culture

The output category *innovation culture* is covering three outputs, which comprise 19% of all coded outputs and was found in 64% of the investigated cases. Table 7.11 shows a fairly balanced distribution of internal and external CE programs suitable to create outputs in this category, with a slight majority of external ones.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Sensitized senior management	Intrapreneurial excubator (100%)	Venture builder (100%)	Cooperative explorer (100%)	Collective matchmaker (100%)	Strategic investor (100%)
Increased awareness for innovation	Collective matchmaker (100%)	Investing co-creator (100%)	Assisted incubator (86%)	Digital factory (75%)	Intrapreneurial excubator (67%)
Increased openness for innovation	Cooperative explorer (100%)	Venture builder (67%)	Investing co-creator (60%)	Intrapreneurial excubator (56%)	Startup facilitator (50%)

Table 7.11: CE programs to create innovation culture outputs

Furthermore, it can be observed that the output *sensitized senior management* has an average frequency of 100% for all five CE program types listed in the table. In particular, when decisions have to be made about investments or spin-offs of companies, the top management of the company is involved. The table shows that CE programs can support cultural change at all levels of the company, as they lead to increased points of contact for innovative topics and current developments that have a certain relevance for the company.

7.4.3 CE programs and innovation ecosystem

The output category *innovation ecosystem* is covering the three outputs. They comprise 12% of all coded outputs and were found in 40% of the investigated cases.

The following Table 7.11 is illustrating the top five CE programs with the highest frequency of occurrence for the respective outputs. The CE program types with a strong relationship to the three outputs are highlighted in gray.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Strategic partnership	Investing co-creator (100%)	Strategic investor (100%)	Collective matchmaker (100%)	Cooperative explorer (100%)	Startup facilitator (100%)
Venture portfolio	Strategic investor (100%)	Investing co-creator (80%)	Venture builder (67%)	Collective matchmaker (67%)	Intrapreneurial excubator (33%)
Reputation within innovation ecosystem	Tech lab (100%)	Investing co-creator (80%)	Collective matchmaker (67%)	Cooperative explorer (67%)	Strategic investor (33%)

Table 7.12: CE programs to create innovation ecosystem outputs

For the *innovation ecosystem* category, it can be stated that external CE program types are suited better to create the three outputs (eleven out of 13 CE programs with a strong relationship are external ones). In particular, the investing co-creator and the collective matchmaker are suited well, as they show a strong relationship to each of the three outputs.

For the strategic investor, we see a strong relationship to the first two outputs, but not to the *reputation within innovation ecosystem* output. As elaborated in Subsection 7.2.4, this seems to be rooted in the circumstance that all cases of the strategic investor were located in the Silicon Valley, which makes it more challenging to create a positive reputation than it might be in the DACH region. Increasing the number of cases for the strategic investor with ones located in the DACH region would eventually lead to another conclusion regarding the most suited CE program types for this category.

7.4.4 CE programs and innovation know-how

The output category *innovation know-how* is covering the two outputs (a) intelligence on trends, and (b) technological know-how. They comprise 11% of all coded outputs and were found in 54% of the investigated cases. Table 7.13 illustrates the top five CE program types with the highest frequency of occurrence for the respective output.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Intelligence on trends	Strategic investor (100%)	Cooperative explorer (100%)	Digital factory (100%)	Tech lab (100%)	Investing co-creator (80%)
Technological know-how	Cooperative explorer (100%)	Tech lab (100%)	Strategic investor (67%)	Venture builder (67%)	Collective matchmaker (67%)

Table 7.13: CE programs to create innovation know-how outputs

Table 7.13 shows that external CE programs are particularly suitable for creating the two outputs belonging to the innovation know-how category (6 out of 10 are external CE program types). One possible explanation for this can be found in the high rate of new (often digital) technologies that are currently emerging in practice. In this context, it hardly seems possible to build up the technological know-how for all technologies that are potentially relevant in-house. The opening of the innovation process is often discussed as one way to deal with current developments (see Bogers et al., 2019; Chesbrough, 2004).

7.4.5 CE programs and intrapreneurial empowerment

The output category *intrapreneurial empowerment* is covering the three outputs as shown in Table 7.14. The three outputs comprise 8% of all coded outputs and were found in 25% of the investigated cases.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Entrepreneurial skills & methods	Intrapreneurial excubator (100%)	Idea validator (100%)	Assisted incubator (86%)	Innovation lab (80%)	Venture builder (33%)
Intrapreneurship community	Venture builder (33%)	Assisted incubator (29%)	Idea validator (25%)	Intrapreneurial excubator (22%)	Innovation lab (20%)
Network of supporters	Idea validator (50%)	Intrapreneurial excubator (33%)	Collective matchmaker (33%)	Startup facilitator (17%)	(-)

Table 7.14: CE programs to create intrapreneurial empowerment outputs

As shown in Table 7.14, especially internal CE program types seem to be suited to create the outputs belonging to this category. As already indicated by the name of the category, the outputs focus on supporting intrapreneurial employees, and hence, it is not surprising that the outputs are mostly created by internal CE program types.

In addition, the table shows that only the output *entrepreneurial skills & methods* has a strong relationship to four CE program types, whereas for the other two outputs, no strong relationship was identified. This might be explained as the two outputs *intrapreneurship community* and *network of supporters*, seem to be outputs that support the operation of the programs themselves instead of outputs that are intended as a result of the activity.

7.4.6 CE programs and new offering

The output category *new offering* covers six outputs. The outputs belonging to this category comprise 21% of all coded outputs and were found in 36% of the cases. Table 7.15 is illustrating the five CE programs with the highest frequency of occurrence for the outputs.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Validated innovation idea[24]	Idea validator (100%)	Intrapreneurial excubator (100%)	Assisted incubator (100%)	Venture builder (100%)	Startup facilitator (100%)
New product	Cooperative explorer (100%)	Assisted incubator (71%)	Collective matchmaker (67%)	Intrapreneurial excubator (56%)	Venture builder (33%)
New stand-alone business	Venture builder (100%)	Intrapreneurial excubator (89%)	Assisted incubator (71%)	Strategic investor (67%)	Innovation lab (29%)
Value adding services or feature	Digital factory (75%)	Collective matchmaker (67%)	Innovation lab (57%)	Idea validator (50%)	Venture builder (33%)
New market	Digital factory (75%)	Collective matchmaker (33%)	Cooperative explorer (33%)	Strategic investor (33%)	Assisted incubator (14%)
Reconfigured business model	Venture builder (33%)	Digital factory (25%)	Innovation lab (14%)	Intrapreneurial excubator (11%)	-

Table 7.15: CE programs to create new offering outputs

[24] The two CE program types *investing co-creator* and *collective matchmaker* do also show a 100% frequency of occurrence for this output. Meaning we have in total seven CE program types with the same strong relationship to this output.

The outputs category *new offering* is strongly associated with the concept of corporate venturing (creation of new business within the pursuit of an existing company, see Guth & Ginsberg, 1990). The outputs show strong relationships with each of the three CE program categories, whereof the internal CE program types have the highest share (9 out of 19).

The output *validated innovation idea* is created in total by seven different CE program types. Depending on the locus of opportunity, the validation focuses on innovation ideas for new products or services (internal focus) or on innovative solutions/technologies that can be insourced to solve challenges in the core business (external focus). Whereas *new stand-alone business* is dominated by internal CE program types, the remaining outputs show a balance between internal and external ones. For the output *new market*, which often refers to new sales channels, there is only one strong relationship to the digital factory type.

7.4.7 CE programs and organizational transformation

The output category *organizational transformation*, which consists of six different outputs, comprises 17% of all coded outputs that can be found in 28% of the investigated cases. In Table 7.16, these CE programs with the highest frequency of occurrence are summarized.

Output	CE programs (frequency of occurrence of respective output)				
	1	2	3	4	5
Increased efficiency	Startup facilitator (100%)	Collective matchmaker (67%)	Idea validator (50%)	Assisted incubator (43%)	Cooperative explorer (33%)
New ways of working	Digital factory (75%)	Venture builder (67%)	Intrapreneurial excubator (56%)	Innovation lab (43%)	Assisted incubator (29%)
Digital infrastructure	Venture builder (100%)	Digital factory (100%)	Idea validator (50%)	Startup facilitator (33%)	Innovation lab (29%)
Improved flexibility & speed	Venture builder (67%)	Collective matchmaker (67%)	Strategic investor (67%)	Assisted incubator (43%)	Startup facilitator (33%)
Improved corporate image	Collective matchmaker (67%)	Strategic investor (67%)	Cooperative explorer (67%)	Innovation lab (57%)	Assisted incubator (43%)
Employer branding	Venture builder (67%)	Digital factory (50%)	Cooperative explorer (33%)	Assisted incubator (29%)	Intrapreneurial excubator (22%)

Table 7.16: CE programs to create organizational transformation outputs

In general, it can be observed that this output category has the highest proportion of outputs with a strong relationship to radical innovation unit types of all seven output categories. One reason for this is the need to support the digital transformation, for which the digital factory appears to be well suited. A distinction must be made between outputs that lead to changes within the core organization, e.g., digital infrastructure, improved flexibility or speed, and new ways of working, while an improved corporate image and employer branding do not require changes in the organization itself.

In this context, it is surprising that the venture builder, the internal CE program with the highest degree of autonomy (structural separation), shows the highest number of strong relationships with outputs that require changes in the core organization. One explanation could be the fact that in all three cases, the venture builder was embedded directly under the CEO/CDO of the company. Based on its focus on creating new businesses adjacent to the core business, the venture builder developed a kind of "thought leadership" role and served as an example of good practice in creating an organization focused on digital innovation.

One output that tends to stand out from the other five is increased efficiency. The high rate of new technologies and innovations on the one hand and the historically grown structures, processes, and infrastructures of established companies, on the other hand, show great potential for optimization by using new technologies. External CE programs can be used as facilitators that identify internal innovation potentials and bring them together with innovative startups. This contributes to the digital transformation of the corporate structure and processes, even if the degree of innovation is rather low since, in most cases the startup and the established companies enter into a supplier-customer relationship.

7.4.8 The selection of a suited CE program

This section has shown that depending on the outputs, different CE program types are suited better to create them. The results can be used as a basis for selecting the CE program type that is suits best the intended objective (which can consist of multiple outputs). For example, the objective to foster bottom-up driven innovation in the company, which might cover different outputs such as entrepreneurial skills and methods, increased awareness for innovation and validated innovation ideas. Tables 7.10 -7.16 can serve as a basis for selecting suited CE programs after having defined the objective and outputs that should be created.

7.5 Chi Square test

We conducted a Chi-Square test to understand whether the CE program types differ statistically significantly regarding the distribution of outputs. Generally, the null hypothesis of a Chi-Square test states there is no difference between the distribution of two variables, in our case, the outputs and CE program types. Meaning the relative proportions of outputs are the same between the different CE program types. In other words, a Chi-Square test can be used to examine how likely a relationship is based on chance.

Due to the relatively small number of cases in our data set (compared to quantitative research), we have applied the Chi-Square test on the level of the output categories (see Section 7.2) and the four groups of CE program types (internal incubation, company building, startup engagement, and startup investing – see Subsection 5.2.6). By analyzing our data on this higher level (grouping the data together), we were able to meet the prerequisite for using a Chi-Square test, which is that the expected value must be greater than 5 (McHugh, 2013).

In total, for each of the seven output categories, a Chi-Square test was conducted to evaluate whether certain outputs occur more frequently with some groups of CE program types than with others. The results of these seven tests are represented in Table 7.17. For declaring a significant difference, we have chosen a confidence interval of 95%.

Output category	Chi-Square value	P-value
(a) Innovation capability	8.8686	0,262227171
(b) Innovation culture	3.4567	0,839785151
(c) Innovation ecosystem	39.3097	0,000001706 ***
(d) Innovation know-how	15.8016	0,026991398 **
(e) Intrapreneurial empowerment	36.9530	0,000004788 ***
(f) New offering	20.2536	0,005047028 ***
(g) Organization transformation	17.1571	0,016410552 **

Table 7.17: Chi-square test for the seven outputs categories and four CE program groups

The results show that for five out of seven output categories (c – g), the distribution of output categories differs significantly between the four CE program groups. For the two output categories of (a) innovation capability and (b) innovation culture, no significant difference in their distribution could be identified.

Both observations are in line with the findings from Section 7.2. The results show that for some output categories, there are clear differences between the CE program types and some output categories show a rather balanced frequency of occurrence across all CE program types (see, e.g., Figure 7.6). Table 7.18 provides an overview of the frequency of occurrence (%) and the total number of outputs created for the seven output categories in relation to the four CE program groups that were used in the Chi-Square test.

The overview shows that there is a rather balanced frequency of occurrence for the two output categories (a & b) across all four CE program types. In contrast, the differences in the frequency of occurrence are stronger for the remaining output categories (c – g).

Output category	**Internal Incubation**		**Company Building**		**Startup Engagement**		**Startup Investing**	
(a) Innovation capability	19	37%	13	33%	13	27%	6	19%
(b) Innovation culture	27	69%	18	60%	25	69%	16	67%
(c) Innovation ecosystem	9	23%	8	27%	21	58%	20	83%
(d) Innovation know-how	8	31%	10	50%	15	63%	12	75%
(e) Intrapreneurial empowerment	21	54%	10	33%	2	6%	2	8%
(f) New offering	32	41%	28	47%	25	35%	8	17%
(g) Organization transformation	16	21%	24	40%	19	26%	8	17%

Table 7.18: Frequency of occurrence for output categories across the four CE program groups

The results of the Chi-Square test underline that the four CE program groups, namely (1) internal incubation, (2) company building, (3) startup engagement, and (4) startup investing, are not only similar regarding their organizational design but also in regard to their value creation.

To conclude, the Chi-Square test shows that the distribution of outputs differs significantly between the CE program groups. This suggests that the relationships between CE program types and the outputs described in Sections 7.2 to 7.4 are likely not caused by chance.

7.6 Concluding on the relationship between CE programs and outputs

The aim of Chapter 7 is to answers RQ3, which is divided into three sub-questions. For each of the three sub-questions, a separate section was used to provide the answer. Below, the answers are briefly summarized.

Answering RQ3a, which reads as follows*: What* relationships *between CE programs and outputs can be identified?*

Tables 7.1 – 7.6 have shown that the different CE program types share different relationships to the output that were identified in Chapter 6. Furthermore, Tables 7.2 and 7.5 show that some outputs are being created more likely than other ones, which are defined as “strong relationships”. Depending on the organizational design, the relationships and the number of relationships did show different manifestations.

Answering RQ3b, which reads as follows*: Do certain structural or contextual elements influence their occurrence?*

In Subsection 7.2.1, it was shown that context elements (internal and external) could influence the occurrence of certain outputs. The two examples used suggest that the moderating influence might occur at different levels. For the external context (the industry), a direct influence on the occurrence of an output, while the example for the internal context (company size) influenced the choice of CE program, which is a rather indirect effect on the occurrence of the outputs.

Subsection 7.2.2 examined whether certain design elements (structural elements) can be used to explain differences in the occurrence of outputs between the various CE program types. For this purpose, two rather similar CE programs were used to show that the differences in their outputs can be explained by certain design elements that did distinguish their organizational designs.

The two Subsections 7.2.1 and 7.2.2 did show that both contextual and structural elements can influence the occurrence of outputs. While a moderating influence was found for contextual elements, structural elements are suitable to explain differences in the value creation of CE program types.

Answering RQ3c, which reads as follows*: Which CE programs are more suited to achieve the respective outputs?*

Table 7.9 provides an overview showing that different CE program types are suited to create the outputs of the seven output categories. In Subsections 7.3.1 – 7.3.7, for each of the outputs, the respective CE program types are listed that are suited most to create the output.

Answering RQ3, which reads as follows: *Can causal relationships between CE programs and their outputs be identified?* To a certain extent, the results presented in this chapter answer the question regarding the causality between the CE program types and the various outputs. In Section 7.2, we show that there is a strong relationship between the CE program type and outputs. In addition, the results in Section 7.3 show that certain design elements can be used to explain the difference in the outputs that are created. This provides first insights into the mechanisms of the relationships between CE program types and the outputs. Nevertheless, further research is required to explain causality for all CE program types and outputs as well as to understand how the mechanisms can be investigated appropriately.

Having presented that last part of the empirical results, the next chapter will focus on evaluating how these results did contribute to answering the problem statement and research questions of this study. Furthermore, the limitation and the contributions of this study as well as the future avenues for research will be discussed.

8 Concluding on the effective management of CE programs

In this chapter, the answers to the three research questions (RQs) and to the problem statement (PS) will be given.

In Section 8.1, the answers to the three RQs, as given in Chapters 4 to 7, will be reviewed and discussed briefly. In Section 8.2, our answer to the problem statement will be presented. Section 8.3 focuses on the limitations that must be taken into account for our study. Section 8.4 will highlight the scientific contributions, and Section 8.5 will do the same for the practical contributions. In Section 8.6, avenues of future research will be given.

8.1 Answering the three research questions

The aim of this thesis is to understand the heterogeneity of CE programs better. For this purpose, we distinguish and define different types of CE programs to explore the heterogeneity of the organizational design of CE programs (RQ1). By identifying different types of outputs created by a CE program (RQ2), a more detailed understanding of the value creation is provided. This formed a solid basis for successfully mapping the CE program types onto the outputs (RQ3) to create a holistic and comparative understanding of their differences. The answers to each of the three RQs are provided in Subsections 8.1.1 to 8.1.3.

8.1.1 Understanding the organizational designs of CE programs

In Chapter 4, the unclarities of the CE programs have been discussed and it has been shown that the heterogeneity of the organizational designs is at the moment not well understood. There are at least two reasons why a better understanding of the types of CE programs and their differences is important.

First, there is ambiguity regarding novel CE programs that emerge in practice. Often, multiple names describe the same phenomenon, or the same name is used for different organizational designs. This ambiguity makes it difficult to understand which knowledge base already exists and can lead to misinterpretations and unclarities (cf. Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019; Moschner et al., 2019; Gimmy et al., 2017).

Second, in practice, it is often unclear which CE program types are being operated by a company. Hence, it is rather difficult for practitioners to learn from new scientific insights and improve the management of CE programs based on these insights (see Hill & Georgoulas, 2016). To address these issues, the RQ1 was formulated as follows.

RQ1: What are the different types of CE programs?

By deriving relevant design elements to define and distinguish CE program types and developing a systematic approach for analyzing them, Chapter 4 served as a basis for answering RQ1. The approach uses a morphological analysis combined with 26 design elements that were derived from literature and our data set. The analysis offered a systematic way to compare and distinguish CE programs clearly.

In Chapter 5, the approach was applied to the 54 cases from our data set. Using the approach resulted in identifying nine CE program types and three types of the radical innovation unit (no CE programs, see 5.6.3). The analysis did also unveil distinct design elements that are suited for clearly distinguishing the CE program types. For each CE program type, an overview was provided (see Section 5.4), which uses these design elements to illustrate the differences between the organizational designs.

The nine CE program types that provide an answer to RQ1 will be briefly presented below. The three types belonging to the category of radical innovation units will not be considered since they are not counted as CE programs and hence do not answer our RQ. The nine CE program types are split into (A) internal CE programs and (B) external CE programs (see Figure 8.1) and are described below.

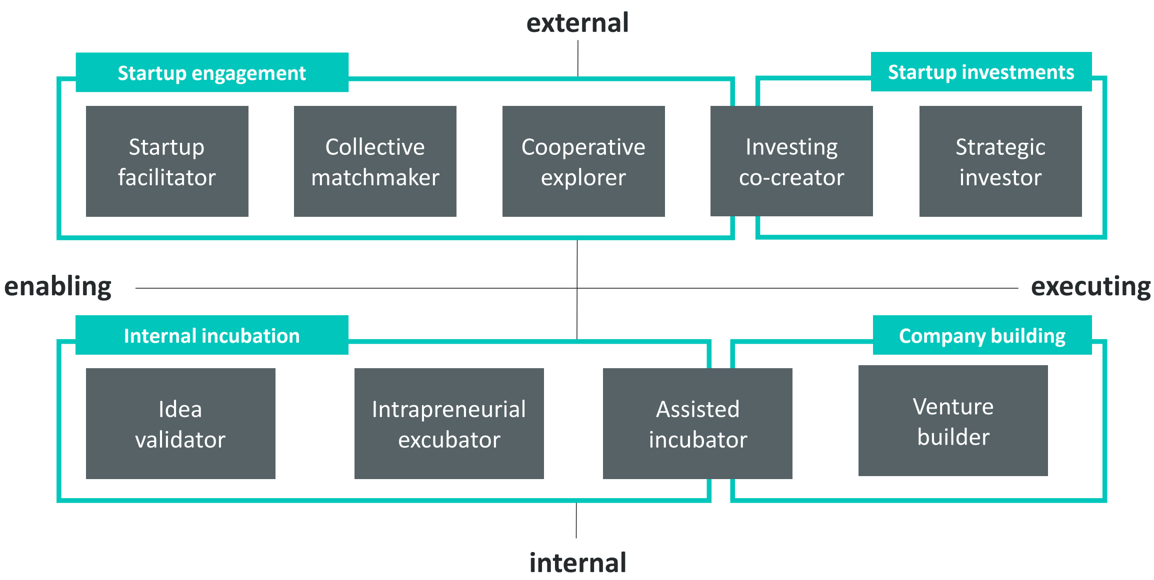

Figure 8.1: Overview of the nine CE program types

A: Overview of internal CE programs

- *Idea validators* support the core organization in validating innovation ideas with an unclear fit to the core business. In order to create a decision basis whether or not to terminate the ideas, their business fit is validated using entrepreneurial methods.
- *Intrapreneurial incubators* support entrepreneurial employees in developing innovations beyond the core business by providing them with incubation services such as access to resources, training, autonomy, or a supportive environment.
- *Assisted incubators* enable the core organization to develop innovation ideas that require new capabilities by providing incubation services and support of CE program specialists who temporarily join innovation teams of the core organization.
- *Venture builders* create and implement rather discontinuous innovation ideas themselves with the aim to build new businesses that usually result in new companies (spin-offs) or new business units.

B: Overview of external CE programs

- *Startup facilitators* identify startups with innovative solutions that address company-internal challenges and organize proof-of-concept projects with the core organization as a starting point to enable a potential customer-supplier relationship.
- *Collective Matchmakers* are open innovation platforms where several established companies with a common thematic focus join forces to gain access to external innovation by attracting startups and collaborating with them.
- *Cooperative explorers* scout and explore relevant startups with promising technologies that form the basis for collaboration or joint innovation development to expand and open up the company's research and development process.
- *Investing co-creators* collaborate and invest in startups that have strategic relevance to the core business. Therefore, investments are mainly made to strengthen a partnership and enable the co-creation of new solutions.
- *Strategic investors* scout and invest in financially promising startups that show a strategic relevance for the core organization. The scope is rather broad, and the main focus is set on the investments themselves.

8.1.2 Understanding the value creation of CE programs

Table 8.1 shows the seven outputs categories and 27 outputs created by CE programs that were identified in the course of my research.

Output category	Category description	Outputs
Innovation capability	New capabilities and structures that are created to support and enhance the development of discontinuous innovation	(1) innovation services & expertise
		(2) additional innovation path
		(3) digital capabilities
		(4) roles or formats to support innovation
Innovation culture	Changes in the culture and openness of core organization towards becoming more innovation-friendly	(5) sensitized senior management
		(6) increased awareness for innovation
		(7) increased openness for innovation
Innovation ecosystem	External links to startups that are established through the activities	(8) strategic partnership
		(9) venture portfolio
		(10) reputation within innovation ecosystem
Innovation know-how	Exploration of relevant know-how for the company's future business	(11) intelligence on trends
		(12) technological know-how
Intrapreneurial empowerment	Impact the activities have on intrapreneurial employees and their network	(13) entrepreneurial skills & methods
		(14) network of supporters
		(15) intrapreneurial community
New business offering	Changes in a company's product offering that are impacting the current and future business	(16) validated innovation idea
		(17) new product
		(18) new stand-alone business
		(19) value adding service or feature
		(20) new market
		(21) reconfigured business model
Organizational transformation	Changes within the core organization to support the overall transformation	(22) increased efficiency
		(23) new ways of working
		(24) digital infrastructure
		(25) improved flexibility & speed
		(26) improved corporate image
		(27) employer branding

Table 8.1: Output categories and outputs created by CE programs

Previous studies have shown that the value creation of CE activities is manifold (see Section 2.1). At the same time, CE's performance measurement in literature mainly focused on financial performance indicators. However, this financial focus does not reflect the diversity of value creation and the use of CE programs in practice (see Bierwerth et al., 2015).

The lack of understanding about the full potential of value creation leads to different challenges. From a practical perspective, it is unclear what kind of value creation can be expected from CE programs. This unclarity can lead to ineffective or incorrect use of CE programs by management. From a scientific perspective, the focus on financial performance neglects the diversity of contributions and may lead to misguided findings of the effectiveness and the adequate use of CE programs. To address these challenges, the second RQ was formulated as follows.

RQ2: What types of outputs are created by CE programs?

In Chapter 6, we focused on answering RQ2 by examining the types of outputs that can be created by CE programs. For this purpose, we analyzed which outputs were created by the 54 cases of our data set. As a result, a harmonized set of seven output categories and 27 outputs, that are mutually exclusive and applicable across the CE program types was identified (see Table 8.1). The seven output categories and 27 outputs provide an answer to the RQ2.

For a definition and detailed description of the 27 outputs, see Section 6.2. While the 27 outputs were derived directly from the coding process, the seven output categories are based on thematic clustering. Regarding the categories, it should be noted that generally, different categories are possible depending on the focus of the clustering of the outputs.

In general, CE programs are used to create outputs that would be difficult or even impossible for the core organization to create. However, when looking at the 27 outputs individually, it seems that some of the outputs (e.g., increases awareness for innovation, employer branding, or new products) could also be created in the core organization using other means such as HR activities or in R&D departments. At the same time, a major part of the outputs, e.g., the creation of a new stand-alone business or entrepreneurial skills & methods, seems rather difficult to be created by the core organization.

CE programs are typically not initiated to create a single output but rather a combination of different outputs (mirrored in their objectives). If the intended outputs could also be created by other means, it should be questioned whether a CE program is an appropriate choice whereas if outputs focus on rather discontinuous innovations (see Definition 1.2), CE programs seem to be suited well for their creation. For companies, it is crucial to gain a clear understanding of the objectives and the related outputs for which the results of Chapter 6 form a sound basis.

8.1.3 Describing the relationships between CE programs and their outputs

Having understood the heterogeneity of the organizational designs (RQ1) and the outputs of CE programs (RQ2), next, we focused on their relationships. Investigating the relationship between these two aspects will contribute to a better understanding of how the CE program types differ regarding their value creation (Hill & Georgoulas, 2016). To address this problem, the third RQ was formulated as follows.

RQ3: Can causal relationships between CE programs and their outputs be identified?

In Chapter 7, this research question was partly answered. Between the CE program types and the outputs, different relationships have been identified. In general, it can be observed that the different CE program types did show a specific set of outputs, whereby each set is different (see Section 7.2).

Each CE program type did show strong relationships to a certain subset of the 27 outputs (defined based on the frequency of occurrence), which can be used as an indicator to evaluate how likely an output is being created by the respective CE programs (see Section 7.2 and 7.4). In addition to the CE program types themselves, we have shown that (a) the design elements can also be used to explain differences in the output creation and (b) the company-internal and company-external context influences the occurrence of certain outputs.

Generally, our results describe the organizational designs of CE programs on four levels: (1) on the category-level (internal CE programs and external CE programs, see), (2) on the group-level that describe a thematic cluster of CE program types, (3) on the program-level of the CE program type (see Subsection 8.1.1), and (4) on the design element-level (see Subsection 7.3.1). Figure 8.2 illustrates the different levels at which the CE programs were analyzed.

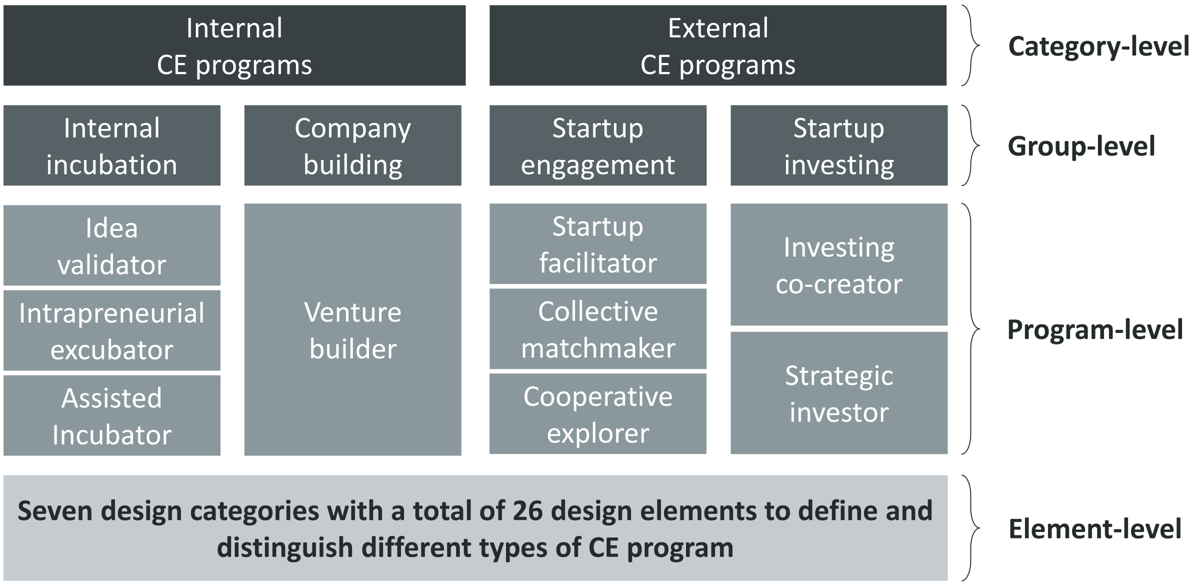

Figure 8.2: Different levels to describe organizational designs of CE programs

From a managerial perspective, the level of the CE program types is most useful when deciding what type of objectives should be achieved and which organizational designs are suited best to create the respective outputs for the objective. The level of the design elements itself is essential when it comes to implementing a CE program. Depending on the objective and the company's context, certain design elements can be adjusted to fit the company's needs.

Even though our results showed that different types of relationships between CE programs and outputs exist, e.g., regarding the strength or distribution among CE program types, our study did not prove causality between them. The results from Subsection 7.3.1 (influence of design elements) indicate that there might be causal relationships explained by the structure of a CE program. We have shown that some design elements can explain the mechanism of the relationships, which is a crucial aspect of understanding the causality between CE program types and outputs. In addition, the context of the CE program (see Subsection 7.3.2) seems to play an essential role as it seems to influence the occurrence of certain outputs as well as the decision on which CE program type is implemented.

However, further research seems to be required for better understanding causality in the relationships between CE programs and the various outputs. It would be important to understand the mechanisms that are leading to the creation of certain outputs, which allows (a) to investigate causality and (b) provides operational insights into the management of CE programs and how certain outputs can be achieved more effectively.

8.2 Answering the problem statement

The results of this study aim to answer the problem statement (PS), which reads as follows.

> **PS: How can established companies effectively use CE programs to support their organizational transformation?**

The answer for the PS is given based on the three results of the three RQs that were presented in Chapters 5 to 7. For the effective use of CE programs, two basic things are important, (a) a clear understanding of the different organizational designs that are available for implementation and (b) the various outputs that can be achieved through these CE programs. Building on this knowledge, the final answer for the PS can be provided by linking the different CE programs with the outputs. Below, we will describe how the results of this study contribute to answering the problem statement in at least the following three ways.

- First, by identifying the various types of outputs that can be created by CE programs, it becomes clearer what the value proposition of CE programs actually is. This serves as a basis for defining more appropriate objectives (intended output or combination of outputs). Without clear objectives, it is difficult to align CE program activities with those of the core organization, which can lead to challenges in transferring outputs back or getting the core organization to recognize the value of CE programs. The set of outputs indicates what results can be expected from CE programs in general and thereby manages expectations. Organizations are often disappointed with the results of CE program activities (see Burgelman & Välikangas, 2005). To some extent, this disappointment might be caused by a lack of knowledge about possible outputs.
- Second, by defining the nine different types of CE programs, the ambiguity regarding different organizational forms has been resolved. By using a systematic approach to studying and describing CE programs, it is possible to clearly identify them. As a result, researchers can be more precise when examining CE activities at the program level, and managers have more clarity about their options for using and designing CE programs to meet their needs.
- Third, by linking CE programs and outputs, it becomes clear (a) how CE programs differ in their value creation and (b) which type of CE program is better suited to achieve a particular objective. For the effective use of CE programs, this is a basic requirement, as it is essential to ensure that the objective matches the organizational design.

Furthermore, the results have shown that, in addition to the objective, the contextual factors of a CE program also influence the selection, and companies are partially limited in their choices.

Generally, it seems rather obvious to align the two dimensions of (1) the organizational designs (CE program types) with (2) the objectives (intended outputs). However, due to the lack of a basic understanding of the heterogeneity of CE programs, previous to this thesis, this was not possible. The results of our study allow CE programs to be used more effectively because it has become clearer for what type of value creation they can be applied and which CE program type is better suited to create the intended outputs.

8.3 Limitations of the study

Having described how the results contribute to answering the RQs and the PS, we will now discuss the limitations associated with our study. Starting with a general limitation, which is then followed by specific limitations for each of the three RQs.

The focus was set on established companies, which means that they exist already for several decades (average age of 108 years). These companies have a core business that is either focused on hardware or services but not on digital businesses by their origin. Resulting out of the ongoing digital transformation, these companies must renew their organization to ensure competitiveness in a digital age. This impacts the transferability of the results, in particular to companies that are rather young, e.g., the case for many Chinese companies, or to companies that have their core business in the digital domain, e.g., Microsoft or Apple, which can also be described as established companies but with a digital business at their core.

Besides this rather general limitation of our study, there are additional ones that have an impact on the respective RQs. Next, these limitations will be discussed.

Limitations for RQ1: For RQ1, which focused on understanding the heterogeneity of CE programs by defining and distinguishing the different types of their organizational design, the following limitation apply. The data set is comparatively large for a qualitative study and was well suited to understanding the heterogeneity of the different CE program types. However, the number of cases for each CE program type individually can be rather small. While up to nine cases were collected for some CE program types (e.g., the intrapreneurial excubator), the definitions of other types are based on only three cases (e.g., the venture builder). The rather small number of cases may not capture the full range of design elements, and the identified configurations may be slightly adjusted with an increasing number of cases.

Limitations for RQ2: For RQ2, which focuses on the value creation and outputs of CE programs, the following three limitations must be considered.

First, the study did focus only on the program-level of CE activities. All interviews were conducted with employees of the CE program. Hence, only the information that is known by the people working in the CE program is covered. The venture perspective, which focuses on the specific innovation ideas of the CE program, is not fully covered. Based on this observation, it can be assumed that there might be some outputs that were not identified in our study. In particular, (a) the outputs that can be observed after a rather long time when the innovation has left the CE program and (b) the outputs that occur within the core organization as a result of the specific innovation idea. Hence, more outputs are possible but not identifiable when focusing on the CE program perspective.

Second, the strength of the outputs is not fully evaluated in our investigation as the focus was set on using the frequency of occurrence as a measurement for the strength of a relationship. For example, when a new business is created, it is not investigated how this impacts the core business. Questions like “is the new business cannibalizing the existing one?” or “is it a new business that supports the diversification?” were not directly considered, since the aim was to understand the variety of the value creation and not to create a measurement of different strengths. However, for understanding the value creation in more detail, it is important to also consider the impact or strength of the outputs.

Third, the larger a company is, the less clear it becomes whether (a) the observed outputs are caused only by the respective CE program, or if there are other mechanisms that cannot be observed, and (b) whether the outputs are valid for the whole company or just for certain departments or business units. For example, when a business unit is running a CE program, that contributes to increased awareness. Is this also the case for other business units, or does the effect remain within the boundary of the one that is operating the programs?

Limitations for RQ3: For the third RQ, which aims at understanding the relationship between the CE programs and the different outputs, the following two limitations must be considered.

First, for describing the relationships between the CE programs and outputs, the ones that show a frequency of occurrence higher than 50% were declared as being strong ones. This comes in hand with the limitation, that in particular for the CE program types with a small number of cases the impact of the statistical failure is rather high. In particular, for the CE program types that cover only three cases, an observed relationship that occurs by coincidence has an impact of 33% and consequently a strong impact on the declaration of whether a relationship is strong or not.

Second, due to the focus on the frequency of occurrence, the results from RQ3 do only show which CE programs are more likely to create a certain type of output. This, however, does not imply the effectiveness of the CE program in creating the output nor the strength of the outputs themselves. Future studies may focus on developing a measurement instrument that allows the evaluation of the effectiveness in achieving an output and its strength. Hence, additional information would be helpful when selecting a suited CE program type.

8.4 Theoretical contributions

In this section, the theoretical contributions will be described. They are split into (a) contributions that are adding to the existing knowledge about CE and CE programs in Subsection 8.4.1, (b) a brief discussion on the generalizability of the results in Subsection 8.4.2, and (c) contributions to the research method in Subsection 8.4.3.

8.4.1 Adding to corporate entrepreneurship research

The results of our study contribute to research on CE in the following five ways.

A: Improved understanding of the organizational designs

First, the results improve the understanding of the different organizational designs of CE programs. In Chapters 4 and 5, we showed that there was a certain level of ambiguity regarding the different organizational designs of CE programs. The ambiguity was rooted in at least the following two reasons.

1) Novel types of CE programs emerged in practice, which did lack empirical investigations at all.

2) Some existing and well-established CE programs have been defined rather vaguely and broadly, e.g., the corporate incubator or the external corporate accelerator (see Subsection 5.6.1 and 5.6.2).

On the one hand, our results contribute to a better understanding by providing nine clearly defined CE program types and presenting design elements that are suited to distinguish them. By providing a systematic approach to analyze CE programs and an updated overview about the current types, the ambiguity regarding rather novel CE programs is resolved that are currently discussed under different names (see Kurpjuweit & Wagner, 2020; Shankar & Shepherd, 2019; Gimmy et al., 2017).

On the other hand, established concepts of CE have been understood in a more nuanced way, e.g., the *idea validator*, the *assisted incubator*, and the *intrapreneurial excubator* for internal incubation (see Subsection 5.1.5) or the *investing co-creator* and the *strategic investor* for startup investment (see Subsection 5.2.6).

The nine CE program types can be used in future studies to improve the clarity of the findings on CE on the program-level as they resolve the ambiguity about the subject of investigations.

B: Improved understanding of the value creation

The results contribute to the knowledge about the value creation of CE programs by presenting a harmonized set of outputs that reflects the variety of values that can be created. Moreover, the detailed distinction into different types of outputs shows that a pure focus on financial performance indicators, which are often used in the field of CE, is not sufficient (see Bierwerth et al., 2015). Applying pure financial performance indicators (e.g., turnover, profit, or cost savings) is not sufficient to cover the positive impact that CE activities have on the culture, the capabilities, or the transformation of an organization and may lead to wrong decisions when focusing only on them.

By offering a harmonized set of outputs that reflects this heterogeneity, the results can build the basis for future studies to develop more precise and more diverse measurement instruments to assess the performance of CE activities. For this purpose, researchers may use concepts from related fields, such as human resource management or marketing, to evaluate the performance, which typically goes beyond pure financial indicators. This would also impact the goal-setting of a CE program. Based on the set of outputs, more realistic objectives can be defined that (a) match with the respective CE program type and (b) are more accurate, which means the different aspects of value are covered in the objective.

C: Differences in the value creation of CE program types

The results contribute to a better understanding of value creation and how these different types of value can be achieved through the various CE programs. By showing the relationships between CE programs and outputs, it becomes clearer how the different types of values associated with CE can be achieved on a more operational level. This resolves the lack of understanding about how the CE programs differ regarding their value creation (see Hill & Georgoulas, 2016). By presenting this relationship between the different CE program types and outputs, future studies can build on it when focusing on comparing CE programs. From a managerial perspective, a more detailed understanding of the differences in the value creation allows a better (more suited) selection of CE programs by the management of an organization (see Section 8.5).

D: Exploration and exploitation through CE programs

CE is often associated with the exploration of new knowledge and technologies. However, different outputs that were identified in this study (e.g., increased efficiency and improved flexibility and speed) imply that CE also covers exploitation activities, which typically result in the optimization of the core business. Therefore, the results from Subsections 7.2.2 and 7.2.4 form the basis for better understanding which CE program types are rather exploitation-oriented and which ones are more oriented towards exploration. In particular, types of the external CE program group that focus on startup engagement show exploitative outputs (Selig & Baltes, 2020). These results indicate that even though CE programs are generally more associated with exploration and the core organization is typically linked with exploitation, this distinction cannot be generalized.

It is essential to understand that if some CE programs focus more on exploitation whereas others more on exploration, they require different types of management (see Benner & Tushman, 2003). Furthermore, the management of expectations regarding the results should be different either (see, e.g., Gupta et al., 2006; March, 1991). For example, when insourcing already existing solutions from startups to solve problems in the core organization, the results should become visible after a shorter period of time than if the CE program focuses on building new businesses from scratch.

E: Relevance of organizational context

Our results show that it is important to investigate the context of the CE program. The context consists of (a) the company-internal environment (the company where the CE program is embedded) and (b) the company-external environment (the market the company is acting in). Even though the context elements were not the main focus of our study, the results indicate that they have a moderating impact on the occurrence of the outputs created by a CE program as well as on the selection of the CE program.

These findings are in line with the configuration theory that was applied as a theoretical perspective in our study. It states that for understanding the performance of an organization in achieving a certain objective, the organization must show an internal and an external fit (see Subsection 2.2.3). Our results suggest that this also applies to investigating CE programs and illustrate with a few examples how the context can have an influence on CE programs.

F: Differences between CE and R&D

The study shows that, among other outputs, CE programs are used to explore new technologies and develop new products. This is a type of activity that is done in the classical R&D departments of a company. However, the two activities (of CE programs and R&D departments) differ in that CE programs do not focus on developing new technology or product only but also on the business around them. For this purpose, the participants in a CE program (particularly for internal CE program types) are organized like a new venture consisting of technology and market experts. In contrast, R&D departments focus mainly on the technological aspect reflected in the circumstance that they employ technical experts only. In addition to the broader focus of CE programs (developing new businesses), CE programs also differ from classical R&D departments as they address various types of innovation (process innovation, service innovation, product innovation, and business model innovation). On the other hand, R&D departments mainly focus on product innovation and related technologies.

8.4.2 Generalizability of the results

From a qualitative perspective, the results are based on a relatively large data set of 54 cases. The cases cover twelve different industry classes (see Subsection 3.2.1) and four different countries (Germany, Austria, Switzerland, and the United States of America). Therefore, we expect the results to be generalizable to companies and organizations outside the DACH region. This is supported by the fact that the analysis of the company-external context as a possible influencing factor on the relationship between CE program types and outputs has shown no significant differences depending on the location of the CE program or the core organization.

The main limitation in terms of generalizability of the results focuses on the maturity of the organizations. As mentioned in Section 8.3, our study focused on established companies with an average age of 108 years. These are currently facing the challenge of the digital transformation of their organization. This challenge does not seem to apply to companies that are much younger and whose business model is based on digital technologies. Therefore, it remains questionable whether the results are applicable to these companies, which can be considered digital natives.

In today's volatile markets, every company faces the need for changes in their organization, which may be caused by different reasons such as sustainability or increasing competitiveness. Consequently, we believe that the results for the CE program types are applicable regardless of the maturity level of the company, while the results for the outputs might be slightly different for younger companies (fewer outputs), as their need for transformation is likely to be lower. This can be observed, for example, in the case of Alphabet Inc. (parent organization of Google), which runs multiple CE programs like a strategic investor (Google Ventures) or a venture builder ("Google" X). These activities aim to diversify the businesses of Alphabet but not to transform the core organization, which is different from most activities of the established companies of our study.

8.4.3 Adding to methodology

Besides the theoretical contributions that improve the understanding of the heterogeneity of CE programs, our study shows a contribution regarding the research method that was applied. Analyzing organizational designs is a relevant topic in many fields. The systematic approach that was used in this study to explore the different types of CE programs is suited to be replicated in other fields of research, such as studies on startups or the management of research and development activities.

The approach will be briefly summarized below.

Step 1 – Design elements: Identifying relevant design elements using a grounded theory approach to describe an organizational unit. For this purpose, the data (in our case, the interviews and process descriptions) are examined for all concepts that describe the organization's structure, process, and strategy. Depending on the existing knowledge base, the elements derived from the data can be combined and aligned with elements used in previous studies. The aim is to identify all design elements that can be used to describe and to distinguish the organizational units (purely descriptive design elements are not used).

Step 2 – Morphological box: Creating a morphological box based on these design elements. This box, which consists of two dimensions and should be structured as follows. The first dimension (vertical) is reflecting the different design elements, e.g., the focus of the organization, the governance mode, the roles of employees, etc. The second dimension (horizontal) covers the manifestation that belongs to each design element, e.g., sales, marketing, engineering, etc., for the design element "roles of employees". For each case, such a morphological box will be created that reflects its specific organizational design.

Step 3 – Identifying configurations: Having created a morphological box for each case, they will be compared to identify the ones with a similar organizational design. These similar cases will be grouped together and analyzed for the design elements that show the same (or similar) manifestations among the cases in the group. This step leads to the identification of a subset of design elements and their manifestations which are characteristic for each of the groups. If a case does not fit to the characteristic set of design elements, the case is removed from the group. This procedure is applied until all cases are assigned to a group. For each group, a characteristic set of design elements is identified. The groups and their design elements represent the respective organizational configurations (in our case, the nine CE program types, see Section 5.1 & Section 5.2).

Step 4 – Understanding the value creation: As a next step, the configurations (CE program types) are investigated regarding their value creation (in our case, the outputs that are created by CE programs). Linking the identified CE program types and the outputs allows a more detailed understanding of the value creation and how the configurations (CE program types) are different regarding the value they are creating.

This approach is combining (a) grounded theory approach to derive relevant design elements with (b) morphological analysis as a framework to systematically analyzing and distinguishing organizational designs. The relevant design elements can be derived either from the data and/ or from existing studies, which makes the approach can be flexibly applicable in a variety of contexts. The approach can be used to create taxonomies of organizational designs (independent from the level of analysis) to investigate and understand the practical phenomenon.

8.5 Practical contributions

In this section, the practical contributions of our study will be described. Our results provide three concrete recommendations for established companies that want to use CE programs. After each recommendation, questions (indicated by bullets) will be summarized that should be considered by the management to ensure a more effective use of CE programs.

The practical contributions focus on: (A) clear understanding of the objective, (B) adjusting CE programs to the company's need, and (C) measuring the performance of CE programs.

A: Clear understanding of the objective

In Chapter 6, we have presented a harmonized set of outputs that shows that CE programs can be used for various outputs. Before starting the implementation of a CE program, it must be clear what types of outputs are desired. This forms the basis for defining a clear objective (consisting of one or multiple intended outputs).

Starting with a clear definition of the objective is the ideal way to implement a CE program. Nevertheless, we recognize that the use of CE programs is not common knowledge for established companies. As a result, implementing a CE program is often seen as an experiment itself. This experimentation can be seen as a driver for creativity and is one reason for the emergence of novel CE program types. However, at the same time, companies must be aware that after a certain period of time, the CE program must leave the stage of experimentation and find a stable state (configuration) in order to create value for the core organization.

Several cases within our data set did have no objectives at all or only unclear objectives (Lang et al., 2021). When having no clear understanding of the concrete objective, there is a high chance that wrong expectations exist (mostly in the core organization). In these cases, the results created by the CE program are not perceived as valuable. To avoid this problem and to achieve good expectation management, the 27 outputs from Chapter 6 can be used as a basis for precise goal setting. However, it must be acknowledged that the objectives are more than a combination of the different outputs that were identified in our study. For example, the objective is typically not only "to create new businesses" but also covers a more strategic component, e.g., the area the businesses should be targeting.

After defining the objective, it must be evaluated which types of CE programs are generally suited to achieve the outputs related to the objective. In Chapter 7, we have analyzed the relationship between CE programs and the outputs. These findings can serve as a basis for selecting a suited CE program type.

In practice, the selection of the organizational design was often made before the objective was clear. It must be understood that having selected a certain CE program type limits the possible objectives that can be pursued. Therefore, the management must be aware of these dependencies and manage stakeholder expectations.

- What is the aim I want to pursue with this CE program?
- Do the intended outputs fit together, or must a trade-off be considered?
- Can the outputs be created by one CE program, or are multiple CE programs required?
- Can the intended outputs be achieved by other means instead of using CE programs?

B: Adjusting CE programs to the company's need

The nine CE program types presented in Sections 5.1 and 5.2 show that a certain set of design elements is characteristic for each type. Therefore, it is important to consider the relationship and interdependencies between these design elements when designing and implementing a CE program. For example, when creating an innovation adjacent to the core business, the preferred exit path should not be the transfer to the core organization since it can be expected that the structures and competencies do not fit.

The results presented in Chapter 5 can serve as the basis for designing a CE program as they show the typical design elements for the respective type. However, they do not serve as a blueprint that can be copied since every CE program has different options depending on the context in which they are implemented.

- How well do the characteristics of the design elements fit to the objective?
- When implementing certain design elements differently from the characteristics of the respective CE program type, how will they influence the other design elements?
- Considering the trade-off: How well is the CE program suited to achieve its objective vs. how well does the CE program fit to the core organization?
- If the CE program is designed to fit to the core organization, does it still suit to achieve the intended objective?

C: Measuring the performance of CE programs

A third practical contribution might be based on the different outputs that were identified. It is crucial to use performance indicators that are suited for measuring the performance of a CE program, which are aligned with the respective outputs. Depending on the CE program type, different outputs can be created that are ranging from new products over new technologies to new ways of working. This variety of outputs demands a diverse but accurate measurement that goes beyond (a) the pure focus on financial indicators such as turnover or costs savings and (b) rather descriptive indicators such as the number of innovation ideas supported by the CE program.

For example, one case in our data set hat multiple objectives ranging from supporting the cultural change, over creating new products, to increase efficiency. Even though there were multiple objectives assigned to the CE program, the performance was measured only based on the costs that were saved by the digitalization activities. The measurement of cost savings, however, was not suited to evaluate the performance of the other objectives and shows a clear mismatch between the objectives and performance measurement.

Although, the set of outputs can be used as a basis to develop performance indicators for CE programs that reflect the actual value creation. Accurate performance indicators would allow an effective management as well as a better management of expectations in the core business. Many of the outputs are related to other areas of a company, such as human resources, research and development, or corporate development. Hence, the management does not necessarily have to develop new indicators but maybe combine and adjust the performance measurement and the controlling that is already applied in other areas of the company.

- What are the main objective and the time horizon expected to see the first results?
- If multiple outputs are expected, do we have a priority regarding the results?
- Do the performance indicators cover all outputs that are intended to be created?

8.6 Future research

This section focuses on the recommendations for future research avenues. Our results have contributed to a better understanding of the heterogeneity of CE programs, in particular about their organizational designs and value creation. At the same time, these new insights have led to many new questions that did arise during our research.

The recommendations for future research are grouped into two areas. In Subsection 8.6.1, we focus on recommendations that did arise out of practical challenges in the management of CE programs we have observed. Subsection 8.6.2 presents recommendations that are building on the theoretical contributions of our study.

8.6.1 Recommendations based on their practical relevance

Even though many companies are operating CE programs, we are still at the beginning of understanding how they can be managed effectively and how CE can become a crucial part of an organization. During our study, many questions did arise regarding how the management can be improved and how CE activities could become more successful. Based on these questions, five avenues for future research will be presented.

A: Transfer of innovation ideas

Many studies focus on the design, the management, or the performance of CE activities themselves. However, CE activities do not serve their own purpose, but they are carried out to create added value for the core organization. Inevitably, the innovation ideas supported by a CE program reach a point where they experience a type of transfer to the core organization.

Often, this transfer has been mentioned as a challenge or even as the reason why innovation ideas fail. Two classes of examples are: (1) some innovation ideas were not mature enough to survive the processes and standards in the core organization, and (2) capabilities in the core organization were missing to operate and scale the innovation ideas appropriately. The transfer challenge is not only the case for CE programs but more general for all types of radical innovations that must be integrated into the core organization (see Gassmann et al., 2012).

Future research on CE programs may address the transfer of innovation ideas by investigating (a) the reasons why the transfer of innovation ideas is challenging, (b) the mechanisms that can be applied to reduce the negative impact on the innovation ideas, and (c) why these mechanisms differ for the various CE program types. We believe that a better understanding of this “end-to-end” process” of CE programs could improve the success rate of innovation ideas resulting out of their activities.

B: CE programs and the type of innovation

A second recommendation for future research focuses on the types of innovation. Often, CE programs are initiated to work on rather discontinuous types of innovation. However, there are different levels (or strengths) of discontinuity and different effects an innovation can have on the core business. For example, is it cannibalizing the current core business or is it contributing to the diversification?

It would be interesting to understand whether certain types of CE programs are better suited for certain types of innovations. The results of our study have shown that the CE program types show differences regarding their innovation focus exists. However, it was not investigated whether they are also better in doing so.

For investigating this question, two things would be relevant. On the one hand, a better understanding of discontinuous innovations itself seems to be required, as the degree of discontinuity (radicality) seems not to be well understood yet. On the other hand, it would then be interesting to understand which CE program types are suited for the more discontinuous innovation and if this might be explained by their structure.

Deepening the knowledge on this topic would be highly relevant for established companies, as it seems that in particular, the types of innovation with a high degree of radicality or even a disruptive impact on their business are a huge challenge for them (see, e.g., Baltes & Freyth, 2017), e.g., Kodak and the introduction of digital cameras (see Lucas & Goh, 2009) or Nokia with the switch from mobile phones to smartphones (see Laamanen et al., 2016).

C: Goal setting of CE programs

The goal setting process for CE programs has been identified as one field which is still in its infancy. In general, the following three issues regarding the target setting of CE programs have been unveiled during the research process.

1) *No objectives*: The CE program had no objectives at all or objectives that were defined on their own, but not aligned with the management in the core organization.
2) *Unclear objectives*: The objectives were defined vaguely or ambiguous, which led to a certain level of unclarity about the concrete objective of the CE program.
3) *Multiple objectives*: The CE program had a broad range of different objectives, which led to a variety of (sometimes conflicting) activities and an unclear focus.

In order to understand the effective management of CE programs and to evaluate their performance, the goal-setting process of CE programs must be better investigated. It can be assumed that the target setting differs from the core organization since CE is often accompanied by a higher level of uncertainty.

Furthermore, CE programs do not only create new products or optimize the core business, but they can also support the organizational transformation and the development of new capabilities. To cover this variety, it is important to investigate the target setting of CE programs. This would also be a precondition for investigating the performance and success of CE programs.

D: Performance measurement

A major part of the studies using purely financial indicators for measuring the performance of CE (see Bierwerth et al., 2015). As shown by our results in Chapter 6, the value creation of CE programs shows a high level of heterogeneity covering different outputs, such as the creation of new business or products, cultural transformation, as well as insights about current trends and developments. These different outputs are, however, not covered when using purely financial indicators only.

Based on the seven output categories and 27 outputs identified in our study, future research may address the question of how companies can improve the measurement of the value of CE programs and develop instruments that can be applied in research and practice.

E: Differences regarding the innovation focus

Generally, CE programs do show a general focus on either (a) leveraging internal innovation potential or on (b) using external sources of innovation. Even though the results of our study show that both categories can lead to similar outputs, it is yet not well understood how they may differ in the long-term (outcomes).

Answering this question seems to be relevant since general differences between internal and external CE programs can be expected. Whereas internal CE activities lead to the rather direct creation of new capabilities for the company, external ones often show a rather transactional character, e.g., by creation a customer-supplier relationship.

Hence, from a managerial perspective, it would be interesting to understand if and how CE programs are different regarding their long-term impact (outcome). This type of investigation would require a more longitudinal research approach that does not only focus on the outputs that are created but also on evaluating their impact. For this purpose, a multiple case study design seems to be suited for further deepening the understanding of the value creation of CE programs.

8.6.2 Recommendations based on the theoretical contributions

In this subsection, we will present three additional avenues for future research that are based on the theoretical contributions of our work and topics that did arise during the research process. They are: (A) the internal fit of CE programs, (B) the external fit of CE programs, and (C) the relevance of time.

A: Internal fit of CE programs

This study follows a configuration theory perspective as the theoretical framework. Due to the lack of understanding about both the organizational design and the value creation of CE programs, the primary focus of our work was to understand them in more detail. This detailed understanding of CE program types and outputs is required for applying configuration theory on the program-level of CE.

The results mainly contribute to the understanding of the internal fit of CE programs by (a) providing definition for nine CE program types, (b) presenting design elements that can be used to distinguish the CE programs, (c) giving an overview of the value creation (outputs) of CE programs and (d) identifying relationships between CE program types and the outputs.

In particular, the identified relationships between CE program types and the outputs serve as a first indicator of the internal fit. By comparing the objective of a CE program and the outputs that are likely to be achieved, it can be evaluated how well they fit together. However, this perspective does not focus on the performance in achieving the outputs. Based on these results, it is recommended to further investigate the internal fit of CE programs.

For this purpose, it seems to be required to develop constructs that can be applied in a quantitative study, since measuring and comparing the performance seems to be rather difficult in a qualitative approach. This could build the basis for evaluating the internal fit of CE programs and to identify the ones that are suited best to achieve certain outputs. The design elements from Chapter 4 can be used as a starting point for developing constructs to measure and analyze the different organizational designs in quantitative studies.

B: External fit of CE programs

The external fit focuses on the question of how well the organization fits with its environmental context. The context for CE programs is divided into (a) the company-internal context, reflected by the characteristics of the core organization, and (b) the company-external context, which is described by the market environment the company is acting in.

The results indicate that the context has an influence on the occurrence of the outputs and on the selection of CE programs themselves. However, since understanding the context was not the primary objective of our study, a detailed understanding of the contextual elements is still lacking. Future research could focus on investigating the context in at least three aspects. First, what factors are describing the context of CE programs? Second, which context factors have an influence on the performance? Third, what type of influence can be observed?

This would contribute to an improved use of CE programs in established companies since the selection of a suited CE program is not only based on the objective the company wants to achieve but also based on the situation of the company, which is reflected by the company-internal and company-external context.

C: Relevance of time

Configuration theory assumes that the organizational designs of a configuration are relatively stable over time, alternating episodically with periods of change that occur to meet shifting requirements (see Meyer et al., 1993). Mirroring this to the field of CE, it can be assumed that (a) relatively stable configurations of CE programs can be observed and (b) that these configurations reach a point where they experience changes in their organizational design.

Our results have shown that different configurations of CE programs could be observed in different contexts (type of companies and age of the CE programs), which supports the assumption that rather stable configurations exist.

However, previous studies have shown that CE programs can reach a point where a re-design of their structure takes place to improve the fit to the company's current needs (see Gutmann et al., 2020). Changes in the organizational design were also observed in our study, which suggests that investigating the role and relevance of time in the research on CE programs could be a future avenue on which studies might focus.

For the organizational design, questions might arise if there are natural evolutions from one CE program type to another one or if some CE programs have a rather temporary nature whereas other CE programs are more longevity. These questions are linked with a life cycle for CE programs that exist, which was mentioned in previous studies (see, e.g., Ma, 2020; Burgelman & Välikangas, 2005).

A second time relevant aspect focuses on the temporary nature of certain outputs. Due to the current challenges that arise with the ongoing digital transformation, many companies have implemented CE activities to support their organizational change. However, it can be assumed that at one point, the core organization has created the required digital capabilities and does not require an additional entity, like a CE program, to drive digital projects. If this assumption holds true, some outputs seem to have a temporary nature, whereas others are always relevant. Hence, it looks promising for future studies to consider the relevance of time and what conclusions can be drawn from it.

Final remarks on research avenues

To conclude on the avenues for future research, it can be stated that this study provides a basis for studies that focus on the investigation of CE programs and their value creation. Now that we understand the heterogeneity of (a) organizational designs and (b) value creation of CE programs, this will allow future research to focus on the complex relationships between them. In addition, the nine CE program types and the 27 outputs form the basis of applying quantitative studies, which seem to be better suited for an understanding of the performance of CE programs and to generate new insights into the influence of contextual factors.

8.7 Concluding on the research

The aim of this study was to gain a deeper understanding of CE programs and how they can be used by established companies to support the creation of discontinuous innovation and drive organizational transformation. By answering the PS and the three RQs (see Section 8.1

and Section 8.2), we have shown how our results contribute to a better understanding of the heterogeneity of CE programs.

As shown in Section 1.2, it is crucial for established companies to implement different types of innovations simultaneously. In this regard, the implementation of more discontinuous innovations is particularly challenging for established companies. The results of our study show that CE programs can be used to create different types of innovation and that the type of innovation varies depending on the CE program type. While some CE program types, e.g., the startup facilitator, are suitable for implementing process innovations (see Subsection 7.4.7), other CE program types, e.g., the intrapreneurial excubator, are more suitable for creating innovations that lead to the creation of new businesses (see Subsection 7.4.6). A clear understanding of how the nine CE program types can be used to create specific types of innovations and how they support the organizational transformation of a company can be used to complement a company's overall innovation and transformation activities.

In summary, CE programs provide a wide range of different types of value to established companies. Their effective use can contribute to a company's dynamic capabilities and strengthen its competitiveness in a volatile environment such as we have in our world today.

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Appendices

In this part of the thesis, the following six appendices are covered.

Appendix 1: Guideline semi-structured interviews

Appendix 2: Overview additional data

Appendix 3: List of definitions of terms used to describe research quality

Appendix 4: Overview prior studies using multiple design elements to describe CE programs

Appendix 5: Description of the 138 element characteristics belonging to the design elements

Appendix 6: Morphological box for the venture builder

Appendix 1: Guideline semi-structured interviews

Key theme	Sample questions semi-structured interviews
Personal Background	• What is your educational background? • What is your career track until your current job at the CE program? • Can you describe your current role at the program? • What motivates you to work in an entrepreneurial context within an established company?
CE program's Background	• When was the CE program initiated? • What was the motivation of the company to start the CE program? • Who was the main driver for starting the program? • How many people are working in the program and what are their roles? • Did you have major adjustments in the structure or the strategy of the CE program?
Objective & performance measurement	• What are the objectives of the CE program? • How is the performance of the CE program measured? • Do you have concrete KPIs? • How are you controlled/steered by the management? • Do you have special routines to interact with the corporate management?
Organization of the CE program	• Where are you located in the companies' organigram? • Are you organized as an own legal entity? • What were the reasons to organize the program like it is? • Do you have different processes or rules than the core organization? • Which processes and rules are different, and why? • Are there additional CE programs or innovation units that are organized differently to the core organization?
Mode of operation	• What are the tasks/activities to run the CE program? • Can you explain the process of the program and the stages? • How many projects are being supported by the CE program? • Can you give me a rough number of the innovation funnel? (How many projects are at the beginning, how many "survive" all stages of the process?) • What type of support is offered to the innovation ideas within the program? • With which departments or units does the CE program primarily interact? • Do you work closely with other CE programs? • How does the collaboration look like and are there any synergies?
Value creation and impact	• How many new businesses or products have been developed by the program? • Did the activities of the CE program lead to changes in processes, structures, etc. within the core organization? (Spill-over effects from the CE program) • Are there any additional effects the CE program has on the core organization that were initially not intended? • What is a successful project in your understanding? And how is the success rate of the CE program? • What factors were critical for being successful? • How would you rate the success of the CE program from your perspective (ranging from 1-10)?

The interview-guideline presented in the table below covers examples of questions to illustrate the topics discussed with the interviewees. Since the interviews were semi-structured, we did not always follow the order presented in the table but the interviewees' answers and topics to ensure that new themes could still be observed.

In addition, the questions were adjusted on the interviewee's choice of words to minimize the influence on the answers. Meaning, if they used a specific word to describe something, e.g., "*we were seen as an alien within our organization",* we used to word "alien" to follow up. When new topics did arise, we did a follow up to understand them in full detail. These follow-up questions are not covered in the table.

Appendix 2: Overview additional data

Case	Company	Interviews	Follow-up messages	Homepage / Social Media	Publications / Presentations	Scientific Publications	Internal Documents
1	A	1	x	x	x		
2	B	1					x
3	B	1	x	x			x
4	C	1	x		x		
5	D	1	x				
6	D	1					
7	D	1		x			
8	D	1		x	x		
9	D	1	x		x		
10	E	1		x			
11	F	1		x	x		
12	F	1	x		x		
13	G	1	x		x		
14	G	2	x	x	x		
15	G	1		x	x		
16	G	1		x	x		
17	H	2*		x			
18	H	1		x			
19	H	1		x	x		
20	I	1		x			
21	J	2*	x	x	x		
22	J	1	x	x	x	x	
23	K	2*	x	x	x		
24	L	1		x			
25	M	1		x			
26	N	1	x				
27	O	1					
28	O	2*		x			
29	P	1		x			x
30	Q	2*					

Case	Company	Interviews	Follow-up messages	Homepage / Social Media	Publications / Presentations	Scientific Publications	Internal Documents
31	R	1					
32	S	1	x	x	x		
33	S	1	x	x			
34	T	1	x	x		x	
35	T	1		x			
36	U	2*		x			
37	V	1	x	x			x
38	W	1		x			
39	X	1		x	x		x
40	Y	1			x		
41	Z	2		x			
42	Z	1	x		x	x	
43	AA	2		x			x
44	AA	1		x			
45	AB	2*					
46	AC	1		x	x		
47	AC	1		x		x	
48	AD	1		x		x	
49	AE	1	x		x		
50	AF	1		x			
51	AG	2*		x	x		
52	AH	2		x			
53	AI	2	x		x		
54	AJ	1		x	x		

* follow-up interview with the same interviewee

Appendix 3: List of definitions of terms used to describe research quality

In Subsection 3.3.3, the different actions undertaken to ensure a high level of quality during the study were described. To maintain clarity, the eight terms marked in italics (in Subsection 3.3.3) have not been defined within the text. Below, the eight definitions are provided.

Definition I *Validity* is defined as the suitability of a measurement instrument to examine the results that are intended to be measured.

Definition II *Reliability* defines the consistency and stability of the results, meaning how likely it is that the results will be similar or the same when the study is repeated.

Definition III *Credibility* defines the level of confidence in how trustable the results can be by others, meaning how plausible are the results and their interpretations.

Definition IV *Transferability* defines how well the study results can be transferred or applied to another context.

Definition V *Dependability* defines the extent to which results are stable over time and concerning the context in which the data were collected.

Definition VI *Confirmability* is defined as the degree to which the results of a study are based on the data rather than the researcher's perspective and biases.

Definition VII *Reflexivity* defines a researcher's awareness and self-reflection regarding the influence and role they have in the research being conducted.

Definition IIX *Trustworthiness* is the degree to which others can trust the results and is acknowledged as an overarching quality criterion in qualitative research.

Appendix 4: Overview prior studies using multiple design elements to describe CE programs

Focus of the study	Design elements	Reference
Distinguishing accelerator from other startup support units like incubators or business angels	- Duration - Cohorts (batch logic) - Business Model - Selection - Venture stage - Education - Mentorship - Venture location	(Cohen, 2013)
Identifying design elements that are commonly used to categorize CE programs and offer a more detailed categorization	- Locus of opportunity - Prioritization of objectives - Ambidexterity - Link to the corporate firm - Level of investment intermediation - Equity involvement - Direction of innovation flow	(Gutmann, 2018)
Options of different structural configurations for corporate incubators by analyzing different design opportunities	- Location - Equipment - Strategic focus (innovation) - Governance model - Intervention phase - Source of ideas - Legal form - Access to firm's resources - Preferred exit path - Project funding - Funding duration/extend	(Schuh et al., 2017)
Comparison of different types for startup engagement/ collaboration that established companies can pursue	- Main goals - Scale (# of startups) - Integration with core business - Closeness to core business - Completeness of startup support - Value capturing - Organizational anchoring - Time horizon of involvement - Exclusivity (access to innovation) - Admission of new startups	(Weiblen & Chesbrough, 2015)

Focus of the study	Design elements	Reference
Comparing external corporate accelerators and startup supplier programs, providing a first definition about this rather new phenomenon (startup supplier program)	- Program objective - Value proposition to startup - Startup type (maturity) - Project focus (result) - Application procedure - Duration - Organizational setup - Number of startups - Main contact - End of program - Financial resources - Educational resources - Type of network access - Product-related resources	(Kurpjuweit & Wagner, 2020)
Distinguishing different modes how external corporate accelerators can be designed	- # of involved companies - Management structure - Location - Focus (internal/external) - Maturity - Equity or funding - Flexibility program structure	(Moschner et al., 2019)
In-depth case study about external corporate accelerator to understand different characteristics, presenting four types of accelerators	- Primary objective - Locus of opportunity - Strategic logic - Industry focus - Equity involvement - Venture stage - External partner - Connection to parent - Leadership experience	(Kanbach & Stubner, 2016)
A typology for corporate venturing based on three dimensions to resolve terminological issues	- Competence development - Level of intermediation - Focus of activities	(Reimsbach & Hauschild, 2012)

Focus of the study	Design elements	Reference
Comparison of globally leading CVC unit – aiming at understanding the evolution and objectives of these units	- Scope - Objectives - Guiding principles - Structure - Reporting line - KPI	(Battistini et al., 2013)
The typology that describes four different "business models" to execute CVC activities and related characteristics	- Focus - Source of ideas - Degree of autonomy - Required skills - Funding - Performance measures - Incentives	(Campbell et al., 2003)
Theoretically grounded typology that presents eight different corporate venturing logics	- Dominant VC logic - Strategic orientation - Strategic relatedness - Operational relatedness - Business model	(Biniari et al., 2015)
Identifying and comparing different modes of external corporate accelerators	- Type of corporate nurturing - Way to identify ventures - Strategic posture - Investment time horizon - Type of corporate acceleration	(Shankar & Shepherd, 2019)
Comparison of three CE programs using an organizational ambidexterity perspective	- Approach - Initial purpose - Ambidexterity strategy - Innovation focus - Probe-and-learn process - Co-creation - Top management role - Integration with business units - Evaluation process - Use of standardized approaches - Implementation strategy	(Alänge & Steiber, 2018)

Appendix 5: Description of the 138 element characteristics belonging to the design elements

Below, the 138 element characteristics that belong to the 26 design elements will be described briefly. A definition of the design elements (highlighted in bold) can be found in Section 4.2. The first column in the table represents the element characteristics, and the second column describing the element characteristics. The design elements to which the element characteristics are belonging are presented in a single column above the respective element characteristics.

Orientation	
Strategic	Focus is mainly set on strategic value for the core organization
Financial	Focus is mainly set on financial value for the core organization
Balanced	Focus covers both strategic and financial value
Strategic logic	
Exploration	Creation of new knowledge that goes beyond core business
Exploitation	Optimization of existing knowledge in the core business
Innovation type	
Process	Innovation focusing on improving processes
Service	Innovation focusing on introducing new services to the customer
Product	Innovation focusing on the creation of new products
Business model	Innovation focusing on renewing the business model
Business relatedness	
Improve core business	Activities aim at improving the current core business
Complement core business	Activities aim at supplementing products from core business
Adjacent to core business	Activities aim at creating products related to the core business
Cannibalize core business	Activities aim at replacing the products of the core business
Independent new business	Activities aim at creating new, independent businesses
Innovation flow	
Inside-in	Innovation is created within the company and remains there
Inside-out	Innovation is created within the company and is spun off
Outside-in	Innovation is created outside the company and is insourced
Innovation demand	
Push by intrapreneur	Intrapreneurs drive the innovation by applying to the CE program
Pull by core organization	The core organization orders innovations
Moderated pull	The CE program and core business jointly drive the innovations
Push by top management	The top management pushes innovations into the CE program

Push by CE program	The CE program itself drives innovations
Application process	
Open to apply	Everyone can apply to the CE program with their ideas
Call for application	Organized call for application with a specific innovation topic
Internal ideation	The CE program itself develops innovation ideas
Screening for opportunities	The CE program is externally screening for relevant innovations
Decided by hierarchy	The core organization selects participants in the CE program
By order	The core organization must formally order innovation ideas
Starting point	
Ongoing	Continuous participation in the CE program possible
Batches	Fixed start and endpoints for participating in the CE program
One time only	CE activity is organized only one time
Duration	
Fixed (time)	Duration of participation has a fixed period of time
Fixed (content)	Duration of participation depends on the innovation's progress
Flexible (no pre-defined end)	CE program has no pre-defined duration for supporting innovations
Multiple phases	CE program has multiple phases with different durations
Number of phases	
1 phase (ideation)	Developing potentially relevant innovation ideas
2 phases (validation)	Ideation & validation of the problem-solution-fit
3 phases (build)	Ideation, validation & creation of innovation with a product-market-fit
4 phases (operate)	Ideation, validation, creation & operation of businesses by CE program
Program end (idea maturity)	
Proof of concept	A proof of concept for innovation ideas is delivered
Technical prototype	A technical prototype of the innovation idea is created
Business concept	A business concept for the innovation idea is developed
Minimum viable product	A minimum viable product is developed and has first customers
Operating business	An operating business is established
Venture exit	An exit (or IPO) of a venture is achieved
Open end	There is no pre-defined end of the program

Preferred exit path	
Transfer to business unit	Innovation is transferred to a business unit in core organization
Become a business unit	Innovation becomes an own business unit
Operating business themself	The CE program itself operates innovation
Spin-off (strategic/financial)	Innovation is spun-off into a new corporate venture
Licensing	Innovation is licensed to other companies
Portfolio company	The startup becomes a portfolio company of the venture fund
Exit of the venture	Initial public offering or acquisition of the portfolio company
Governance mode	
Within hierarchy	The CE program is organized as an entity within the core organization
Central office	The CE program is organized as a central office
Own business unit	The CE program is organized as an own business unit
Own legal entity	The CE program is spun-off into an own legal entity
Location	
Virtual	The CE program is a virtual program without physical locations
Decentral	The CE program has spaces on the different sites of the company
On site	The CE program is located in the area of the main office
Separated nearby	The CE program is separated but close to the main office
Innovation hotspot	The CE program has a location in an innovation hotspot
Multiple locations	The CE program has multiple, rather stand-alone locations globally
Platform openness	
Open	The CE program is a platform where multiple companies can join
Closed	The CE program is closed for other companies
Funding source (in-program)	
CE program	The budget of the CE program funds the innovation ideas
Joint funding	Joint funding through core organization and CE program
Division in core organization	Parts of the core organization fund the innovation ideas
Strategic innovation budget	A strategic innovation budget funds the innovation ideas
Funding source (post-program)	
CE program	The budget of the CE program funds the innovation ideas
Joint funding	Joint funding through core organization and CE program
Division in core organization	Parts of the core organization fund the innovation ideas
Strategic innovation budget	A strategic innovation budget funds the innovation ideas
External investor	An external investor funds the innovation ideas
Power promoter	

CEO	Chief executive officer
CTO	Chief technological officer
CDO	Chief digitalization officer
COO	Chief operating officer
CHRO	Chief human resources officer
CFO	Chief financial officer
Head of strategy	Leader of the strategy department
Head of R&D / innovation	Leader of the R&D or innovation department
Advisory board	Advisory board consisting of multiple higher managers
Business unit lead	Leader of a business unit from the core organization
Key activities	
Scouting innovation	Scouting for startups or internal innovation ideas
Facilitating cooperation	Managing cooperation between startup and core organization
Investing in startups	Organizing the investment process for a particular startup
Ideating new ideas	Creating new innovation ideas
Incubating innovation	Supporting innovation ideas with resources and know-how
Assisting idea development	Supporting the development of innovations with human resources
Executing idea development	Implementing an innovation idea through the CE program
Consulting core business	Using innovation know-how to support the core business
Educating employees	Training entrepreneurial/innovation methods and skills
Innovation formats	
Multiple CE programs	Multiple CE programs are combined in one organizational unit
Multiple innovation formats	CE program is running additional innovation formats
HR-related activities	CE program is running HR-related activities
Just the CE program	Just the CE program, no additional types of activities
CE program-as-a-service	CE program is offering their activities as a service for core business
External consulting	CE program is offering its expertise as external consulting
Main contact	
All departments	Participants of the CE program have contact with all departments
R&D and innovation	Participants are mainly in contact with R&D/innovation departments
Sales and marketing	Participants are mainly in contact with sales/marketing departments
Strategy department	Participants are mainly in contact with the strategy department
Mainly CE program itself	Participants are mainly in contact with the CE program itself

Type of funding	
No funding	The innovation idea receives no financial support
Pocket money	A small budget to support the idea validation or proof of concept
Project funding	Innovation idea is funded during the program phase
Option to invest	Financial support is linked with the option to invest
Equity investment	Financial investment in exchange for shares of the venture
Key value proposition	
Time to work on innovation	Employees can work on their innovation ideas
Network access	Access to the network of the company
Domain expertise	Access to the specialized expertise of the company's domain
Training	Education and training of entrepreneurial skills & methods
Funding	Access to financial resources to support the innovation development
Operational expertise	Access to know-how for operating in a certain business
Program participants	
Startup (external)	External startups are working with the company on an innovation
Employee core business (ECB)	Employees of the core business are working on innovation ideas
Employees CE program (ECEP)	Employees of the CE program are working on innovation ideas
ECB + freelancer	Freelancers support employees of the core business
Startup + ECB	Startup and employees of core business work together on innovation
Startup + ECEP	Startup and employees of the CE program work together
ECB + ECEP	Employees of core business and the CE program work together
Startup + ECB + ECEP	Startup, employees of the core business & CE program work together
Key functions	
Innovation scout	A person who is scouting internal ideas or external startups
Internal facilitator	A person who is facilitating startup cooperation projects
Investment manager	A person who is running the investment process in a startup
Technology specialist	A person who has deep technological expertise used
Innovation coach	A person with solid methodological expertise to coach participants
Business developer	A person who is responsible for identifying business opportunities
Project manager	A person who is responsible for managing innovation projects
Program lead	A person who is in charge of the CE program
Marketing manager	A person who is operating all marketing activities of the CE program

Idea maturity	
Explore/ideate (seed stage)	Innovation is in the stage of being explored or ideated
Validate (seed stage)	Innovation idea has been validated
Business building (early stage)	The business around the innovation is defined and in development
Business launch (early stage)	The business has been launched and has initial customers
Growth business (later stage)	The business is in the phase of scaling
Mature business (later stage)	The business has reached a level of maturity

Appendix 6: Morphological box for the venture builder

Due to size limits, the morphological box is split into two parts. Below, Part I can be found.

Design dimension	***Design category***	***Design element***	***Element characteristics***						
Strategy	Purpose	Orientation	Strategic	Balanced	Financial				
		Strategic logic	Exploration	Exploitation					
	Scope	Innovation type	Process	Service	Product	Business model			
		Business relatedness	Improve core business	Complement core business	Adjacent to core business	Cannibalize core business	Independent new business		
		Innovation flow	Inside-in	Inside-out	Outside-in				
		Innovation demand	Push by intrapreneur	Pull by core organization	Moderated pull	Push by top management	Push by CE program		
Structure	Process	Application process	Open to apply	Call for application	Internal ideation	Screening for opportunities	Decided by hierarchy	By order	
		Starting point	Ongoing	Batches	One time only				
		Duration	Fixed (time)	Fixed (content)	Flexible (no pre-defined end)	Multiple phases			
		Number of phases	1 phase (ideation)	2 phases (validation)	3 phases (build)	4 phases (operate)			
		Program end (idea maturity)	Proof of concept	Technical prototype	Business concept	Minimum viable product	Operating business	Venture exit	Open end
		Preferred exit path	Transfer to business unit	Become a business unit	Operating business themself	Spin-off (strategic/financial)	Licensing	Portfolio company	Exit of the venture
	Governance	Governance mode	Within hierarchy	Central office	Own business unit	Own legal entity			
		Location	Virtual	Decentral	On site	Separated nearby	Innovation hotspot	Multiple locations	
		Platform openness	Open	Closed					

Part II of the morphological box

Design dimension	Design category	Design element	Element characteristics									
Structure	Governance	Funding source (in-program)	CE program	Joint funding	Division in core organization	Strategic innovation budget						
		Funding source (post-program)	CE program	Joint funding	Division in core organization	Strategic innovation budget	External investor					
		Power promoter	CEO	CTO	CDO	COO	CHRO	CFO	Head of strategy	Head of R&D / innovation	Advisory board	Business unit lead
	Operations	Key activities	Scouting innovation	Facilitating cooperation	Investing in startups	Ideating new ideas	Incubating innovation	Assisting idea development	Executing idea development	Consulting core business	Educating employees	
		Innovation formats	Multiple CE programs	Multiple innovation formats	HR-related activities	Just the CE program	CE program as-a-service	External consulting				
	Idea support	Main contact	All departments	R&D and innovation	Sales and marketing	Strategy department	Mainly CE program itself					
		Type of funding	No funding	Pocket money	Project funding	Option to invest	Equity investment					
		Key value proposition	Time to work on innovation	Network access	Domain expertise	Training	Funding	Operational expertise				
	People	Program participants	Startup (external)	Employees core business (ECB)	Employees CE program (ECEP)	ECB + freelancer	Startup + ECB	Startup + ECEP	ECB + ECEP	ECB + ECEP + startup		
		Key functions	Innovation scout	Internal facilitator	Investment manager	Technology specialist	Innovation coach	Business developer	Project manager	Program lead	Marketing manager	
		Idea maturity	Explore / ideate (seed stage)	Validate (seed stage)	Business building (early stage)	Business launch (early stage)	Growth business (later stage)	Mature business (later stage)				

Frequency of occurrence: 100% | 67% | 33%

Summary

Entrepreneurial activities within established companies are known as *Corporate Entrepreneurship.* They are an exciting phenomenon that recently received a great deal of awareness from researchers and practitioners. Corporate Entrepreneurship (CE) can be understood as a set of managerial tools for (1) adapting the company to changing market environments, (2) creating discontinuous innovations, and (3) supporting organizational transformation. Surely, today's world is characterized by profound changes that are driven by developments such as globalization, digital transformation, and movement towards greater sustainability. To cope with these changes, companies continuously need to adapt and stimulate changes in their environment. *CE programs* are formalized entrepreneurial activities to support internal corporate ventures or work with external startups. They can support companies in mastering these changes by a wide range of outputs. The heterogeneous value creation also makes CE programs a valuable tool to support the *organizational transformation* of established companies. At the same time, the heterogeneity of CE programs reflected in different outputs and organizational designs appears to be a challenge for effective use and goal-directed management.

To address all current challenges combined, Chapter 1 formulates the following problem statement: *How can established companies effectively use CE programs to support their organizational transformation?* For answering the problem statement, the three research questions (RQs) are formulated. Here we provide a wrap-up of the RQs in three steps. *First*, the different types of organizational design of CE programs are defined and distinguished using design elements (derived from the literature and our data). *Second*, the variety of outputs that CE programs create is explored and categorized according to their type, resulting in a harmonized set of 27 outputs. *Third*, the different CE program types and outputs are examined for relationships between them. The application of these three steps leads to an improved understanding of the heterogeneity of CE programs in terms of (1) their differences in organizational design, (2) their value creation, and (3) the relationship between the CE program types and the different outputs.

In Chapter 2, the concept of CE and its three sub-categories of (a) *corporate venturing,* (b) *strategic entrepreneurship*, and (c) *corporate nurturing* are defined and described to establish

a common understanding of the topic. In addition, different theoretical perspectives (namely dynamic capabilities, contingency theory, and configuration theory) are reviewed to identify the most appropriate theoretical perspective for answering our problem statement and the three research questions. Finally, the c*onfiguration theory* is selected as the framework most suitable for conducting our research.

Chapter 3 describes the research method and data set. The study follows a purely qualitative research design that builds on grounded theory principles to reveal new insights that enhance the understanding of the heterogeneity of CE programs. The decision to use a purely qualitative research design is based on the fact that neither a complete list of CE program types exists nor a corresponding list of outputs created by CE programs. To remedy this lack as much as possible, an overview of the data set is provided by describing the data from (a) the company perspective, which focuses on the characteristics of the companies operating the CE programs, and (b) the CE program perspective, which focuses on the characteristics and background information of the CE programs themselves.

Chapter 4 provides the basis for answering RQ1, which reads as follows: *What are the different types of CE programs?* Here, we first start with a literature review on the existing organizational designs of CE programs to identify design elements that form the basis for their investigation. The literature review provides an initial set of design elements used in previous studies to describe and compare different CE program types. Next, this initial set of design elements is complemented with additional design elements derived from the empirical analysis of 54 cases. Finally, a set of design elements that is *suitable for defining and distinguishing CE programs* is presented. The harmonized set of design elements forms the basis for a systematic analysis for which the *general morphological method* is used.

In Chapter 5, an answer to RQ1 is given. For this purpose, the data set is investigated to identify different types of CE programs using the systematic approach and the design elements from Chapter 4. In total, *nine CE program types* and *three types of radical innovation units* (related to CE but no real CE programs) are *identified, described, and defined*. In addition, the design elements are used to identify characteristic differences in the organizational designs of the CE programs. The results show that all *nine CE program types can be clearly defined and distinguished*. The findings enhance the current understanding of the organizational designs. We are now able to make a systematic ordering of established CE program types, the ones that recently emerged in practice are also included. At the same time, some still existing concepts commonly used in CE, such as incubation and acceleration, are identified as rather general concepts. They no longer count as specific types of organizational designs.

Chapter 6 provides an answer to RQ2, which reads: *What types of outputs are created by CE programs?* There, 54 cases are investigated regarding their strategic value creation. As a result, *seven output categories* are identified, with a total of *27 outputs* representing the full range of *strategic value* created through the use of CE programs. We observe that some of the identified outputs are effectively created by most CE program types. Indeed, there is a contrast with others that are less common. Hence, we see clear differences in the value created by the different CE program types. Overall, the value creation of CE programs shows a strong focus on (1) supporting organizational transformation and (2) creating new businesses. This makes CE programs a valuable tool for the management of established companies.

In Chapter 7, the relationships between the CE program types and the various outputs are investigated. Here, RQ3 is addressed: *Can causal relationships between CE programs and their outputs be identified?* The frequency of occurrence of specific outputs in relation to the various CE program types is used to describe their relationship. If a relationship occurs in more than 50% of the cases, it is declared to be a *strong* relationship. The likelihood of creating this output (using the respective CE program type) is relatively high. The results show that there are *clear differences in the value creation* of the different CE program types. Our results show that similarities and differences in value creation are (partly) explained by the organizational design and the characteristics of the various CE program types. Hence, the results provide a clear understanding of the relationship between the CE program types and the outputs. However, further research is needed to understand the *causality* between them. In that sense, our findings indicate that the role of the context (company internal and external) will be crucial for understanding their precise relationships. It is shown that the context influences the relationship between CE program types and their outputs.

Chapter 8 summarizes the answers to the three RQs and the problem statement. The results provide an improved understanding of the heterogeneity of CE programs regarding (a) their organizational design, (b) their value creation, and (c) the relationship between the organizational designs and the value creation. The management of established companies can build on this knowledge to effectively use CE programs to support their organizational transformation and strengthen their competitiveness. The improved understanding of the heterogeneity of CE programs and the identification of relationships between CE program types and outputs answer our problem statement. So the question: *How can established companies effectively use CE programs to support their organizational transformation*? is answered for now. In addition, we note that (a) the harmonized set of outputs, (b) the derived design elements, and (c) the systematic approach for investigating the organizational design of CE programs provide a solid basis for future studies. Hence, we close the thesis with (1) stressing the limitations of the study, (2) providing the theoretical and practical contributions, and (3) indicating the implications for future research avenues.

Samenvatting

Ondernemersactiviteiten binnen gevestigde bedrijven staan bekend als *Corporate Entrepreneurship*. Het is een opwindend fenomeen dat recent veel aandacht verkreeg van onderzoekers en praktijkmensen. *Corporate Entrepreneurship* (CE) kan worden opgevat als een reeks managementinstrumenten voor (1) het aanpassen van de onderneming aan veranderende marktomgevingen, (2) het creëren van discontinue innovaties, en (3) het ondersteunen van organisatorische transformatie. De wereld van vandaag wordt immers gekenmerkt door diepgaande veranderingen die worden aangedreven door ontwikkelingen, zoals globalisering, digitale transformatie, en de beweging naar meer duurzaamheid. Om met deze veranderingen om te gaan, moeten bedrijven zich voortdurend aanpassen en veranderingen in hun omgeving stimuleren. CE-programma's zijn geformaliseerde ondernemersactiviteiten om interne bedrijfsondernemingen te ondersteunen of met externe start-ups samen te werken. Zij kunnen ondernemingen ondersteunen bij het beheersen van deze veranderingen door middel van een breed scala aan outputs. Door de heterogene waarde-creatie zijn CE-programma's ook een waardevol instrument om de organisatorische transformatie van gevestigde ondernemingen te ondersteunen. Tegelijkertijd blijkt de heterogeniteit van CE-programma's, die tot uiting komt in verschillende outputs en organisatorische ontwerpen, een uitdaging te zijn voor effectief gebruik en doelgericht management.

Met het doel alle huidige uitdagingen tezamen aan te pakken, formuleert Hoofdstuk 1 de volgende probleemstelling: *Hoe kunnen gevestigde bedrijven effectief gebruik maken van CE programma's om hun organisatorische transformatie te ondersteunen?* Voor de beantwoording van de probleemstelling worden drie onderzoeksvragen (OVs) geformuleerd. Hier geven we relevante achtergrondkennis in drie stappen. Ten eerste worden de verschillende types van organisatieontwerp van CE-programma's gedefinieerd en onderscheiden aan de hand van ontwerpelementen (afgeleid uit de literatuur en onze data). Ten tweede wordt de verscheidenheid aan outputs die CE-programma's creëren onderzocht en gecategoriseerd volgens type, resulterend in een geharmoniseerde set van 27 outputs. Ten derde worden de verschillende typen CE-programma's en outputs onderzocht op hun onderlinge relaties. De toepassing van deze drie stappen leidt tot een beter begrip van de heterogeniteit van CE-programma's in termen van (1) hun verschillen in organisatorische

opzet, (2) hun waarde-creatie, en (3) de relatie tussen de soorten CE-programma's en de verschillende outputs.

In hoofdstuk 2 worden het begrip CE en de drie subcategorieën (a) *corporate venturing*, (b) strategisch ondernemerschap, en (c*) corporate nurturing* gedefinieerd en beschreven om tot een gemeenschappelijk begrip van het onderwerp te komen. Daarnaast worden verschillende theoretische perspectieven (namelijk dynamische capaciteiten, contingentietheorie, en configuratietheorie) onderzocht om het meest geschikte theoretische perspectief te identificeren voor het beantwoorden van onze probleemstelling en de drie onderzoeksvragen. Uiteindelijk is de configuratietheorie geselecteerd als het meest geschikte raamwerk voor het uitvoeren van ons onderzoek.

Hoofdstuk 3 beschrijft de onderzoeksmethode en de dataset. De studie volgt een puur kwalitatieve onderzoeksopzet die voortbouwt op *grounded theory* principes om nieuwe inzichten te verwerven die het begrip van de heterogeniteit van CE-programma's vergroten. De keuze voor een puur kwalitatieve onderzoeksopzet is gebaseerd op het feit dat er geen volledige lijst van typen CE-programma's bestaat, noch een corresponderende lijst van outputs die door CE-programma's worden gecreëerd. Om dit gebrek zoveel mogelijk te ondervangen, wordt een overzicht gegeven van de dataset door de gegevens te beschrijven vanuit (a) het ondernemingsperspectief, dat zich richt op de kenmerken van de ondernemingen die de CE-programma's uitvoeren, en (b) het perspectief van het CE-programma, dat zich richt op de kenmerken en achtergrondinformatie van de CE-programma's zelf.

Hoofdstuk 4 vormt de basis voor de beantwoording van OV 1, die als volgt luidt: *Wat zijn de verschillende typen CE-programma's?* We beginnen met een literatuuronderzoek naar de organisatorische ontwerpen van CE-programma's om ontwerpelementen te identificeren die de basis vormen voor het onderzoek. De literatuurstudie levert een eerste set van ontwerp-elementen op die in eerdere studies zijn gebruikt om verschillende types CE-programma's te beschrijven en te vergelijken. Vervolgens wordt deze initiële set van ontwerpelementen aangevuld met bijkomende ontwerpelementen afgeleid uit de empirische analyse van 54 cases. Tenslotte wordt een set van ontwerp-elementen gepresenteerd die geschikt is om CE-programma's te definiëren en te onderscheiden. De geharmoniseerde set van ontwerpelementen vormt de basis voor een systematische analyse waarvoor de algemene morfologische methode wordt gebruikt.

In hoofdstuk 5 wordt een antwoord gegeven op OV 1. Hiertoe wordt de dataset onderzocht om verschillende typen CE-programma's te identificeren met behulp van de systematische aanpak en de ontwerpelementen uit hoofdstuk 4. In totaal worden negen typen CE-programma's en drie typen radicale innovatie-eenheden (gerelateerd aan CE, maar geen echte CE-programma's) geïdentificeerd, beschreven en gedefinieerd. Daarnaast worden de ontwerpelementen gebruikt om karakteristieke verschillen in de organisatorische ontwerpen van de CE-programma's te identificeren. De resultaten laten zien dat alle negen typen CE-programma's duidelijk kunnen worden gedefinieerd en onderscheiden. De bevindingen vergroten het huidige begrip van de organisatieontwerpen. We zijn nu in staat om een systematische ordening aan te brengen in de gevestigde CE-programmatypes, waarbij ook de types die recent in de praktijk zijn opgekomen zijn meegenomen. Tegelijkertijd worden enkele nog steeds bestaande concepten die veel in CE worden gebruikt, zoals *incubatie* en *acceleratie*, geïdentificeerd als tamelijk algemene concepten. Zij gelden niet langer als specifieke types van organisatieontwerpen.

Hoofdstuk 6 geeft een antwoord op OV 2, die luidt: *Welke soorten outputs worden gecreëerd door CE-programma's?* Daar worden 54 cases onderzocht op hun strategische waarde-creatie. Het resultaat is dat zeven outputcategorieën worden geïdentificeerd, met een totaal van 27 outputs die het volledige scala van strategische waarde-creatie door het gebruik van CE-programma’s vertegenwoordigen. We stellen vast dat sommige van de geïdentificeerde outputs effectief worden gecreëerd door de meeste CE-programmatypes. Er is inderdaad een contrast met andere outputs die minder vaak voorkomen. We zien dan ook duidelijke verschillen in de waarde die door de verschillende soorten CE-programma's wordt gecreëerd. In het algemeen blijkt uit de waarde-creatie van CE-programma's dat zij sterk gericht zijn op (1) ondersteuning van organisatorische transformatie en (2) het creëren van nieuwe bedrijven. Dit maakt CE-programma's tot een waardevol instrument voor het management van gevestigde ondernemingen.

In hoofdstuk 7 worden de relaties tussen de CE programmatypes en de verschillende outputs onderzocht. Hier wordt OV 3 geadresseerd: *Kunnen causale relaties tussen CE programma's en hun outputs worden geïdentificeerd?* De frequentie van voorkomen van specifieke outputs in relatie tot de verschillende typen CE-programma's wordt gebruikt om hun relatie te beschrijven. Als een verband in meer dan 50% van de gevallen voorkomt, wordt het als een *sterk* verband bestempeld. De kans dat deze output tot stand komt (met behulp van het desbetreffende CE-programmatype) is relatief groot. De resultaten laten zien dat er duidelijke verschillen zijn in de waarde-creatie van de verschillende CE-programmatypes. Onze resultaten laten zien dat overeenkomsten en verschillen in waarde-creatie (deels) worden verklaard door de organisatieopzet en de kenmerken van de verschillende CE programmatypen. De resultaten geven dus een duidelijk inzicht in de relatie tussen de CE programmatypes en de outputs. Er is echter nog verder onderzoek nodig om de causaliteit tussen beide te begrijpen. In die zin geven onze bevindingen aan dat de rol van de context (intern en extern bedrijf) van cruciaal belang zal zijn om hun precieze relaties te begrijpen. Gebleken is dat de context van invloed is op de relatie tussen soorten CE-programma's en hun resultaten.

Hoofdstuk 8 geeft een samenvatting van de antwoorden op de drie OVs en de probleemstelling. De resultaten geven een beter inzicht in de heterogeniteit van CE programma's met betrekking tot (a) hun organisatorische ontwerp, (b) hun waarde-creatie, en (c) de relatie tussen de organisatorische ontwerpen en de waarde-creatie. Het management van gevestigde ondernemingen kan op deze kennis voortbouwen om CE-programma's effectief te gebruiken om hun organisatorische transformatie te ondersteunen en hun concurrentievermogen te versterken. Het verbeterde begrip van de heterogeniteit van CE programma's en de identificatie van relaties tussen CE programmatypes en outputs beantwoorden onze probleemstelling. Derhalve is de vraag: *Hoe kunnen gevestigde bedrijven effectief CE-programma's gebruiken om hun organisatorische transformatie te ondersteunen?* voor dit moment beantwoord. Hierbij merken we op dat (a) de geharmoniseerde set van outputs, (b) de afgeleide ontwerpelementen, en (c) de systematische aanpak voor het onderzoeken van het organisatorisch ontwerp van CE-programma's een solide basis vormen voor toekomstige studies. We sluiten het onderzoek af met (1) het leggen van enige nadruk op de beperkingen van het onderzoek, (2) het geven van de theoretische en praktische bijdragen, en (3) het aangeven van de implicaties voor toekomstige onderzoeksmogelijkheden.

Curriculum Vitae

Christoph Johannes Selig was born on January 6, 1989, in Rottweil, Germany. After completing his apprenticeship as an industrial clerk, he started his studies at the University of Applied Sciences in Konstanz. He holds a Bachelor in Engineering and Management in Electro and Information Technology (B.Eng) and a Master in Industrial Engineering and Management (M.Eng).

In 2015, he started working as a research assistant at the IST Institute (Institut für Strategische Innovation und Technologie Management in Konstanz, Germany), focusing on innovation management, digital transformation, and corporate entrepreneurship. In 2016, he was admitted to the Ph.D. program of the Faculty of Science at the Leiden Institute of Advanced Computer Science.

Next to the research, he was responsible for building up the local startup initiative Kilometer1 at the University of Applied Sciences in Konstanz, which is now an established organization at the university. In 2018, he joined the founding team of Unisphere GmbH, a deep-tech startup that develops technologies to automate the flight operations of unmanned aircraft. Since 2021 he is working full-time in the management team of Unisphere, responsible for the commercial activities.

Acknowledgments

On my way as a researcher, I have received diverse support from many persons, without whom my research and my personal development would not have come so far. In the following, I would like to express my gratitude to them. Starting with my supervising team, consisting of my first promotor Jaap van den Herik, my second promotor Guido Baltes and my co-promotor Roland Ortt, who guided and supported me with their complementary skills.

I am extremely grateful to Jaap van den Herik for the intense support in the final phase of the thesis and for the incredibly instructive time that has considerably improved my way of writing and structuring my knowledge. A special thank is owed to Guido Baltes for giving me the trust, freedom, and opportunity to set up the research on Corporate Entrepreneurship at the IST Institute with him, and for the many intense conversations and experiences that have led to the profound insights into managing CE programs and beyond. Furthermore, I express my gratitude to Roland Ortt for his support in formulating my thoughts and ideas and for the many intensive discussions that enabled me to better structure the findings, which eventually resulted in this dissertation.

Another second part of my Ph.D. career was the international graduate school NITIM (Networks, Information Technology, and Innovation Management), which gave me the opportunity to network and exchange ideas with researchers and other Ph.D. candidates across Europe and beyond. Here I would like to thank in particular Roland Ortt, Stefan Klein, Guido Baltes, Mauricio Camargo, Laurent Dupont, Claudia Bücker, Kristin Paetzold, Christina Weber, and all the other faculty members for their engagement which allowed me to have this wonderful opportunity of a European-wide graduate school.

During my time at the IST Institute, I had the opportunity to work with great colleagues with whom I could not only conduct research together, build up the Startup Initiative Kilometer1 of the University of Applied Sciences Konstanz, and manage various industry projects, but above all had an unforgettable time. The very exciting but also challenging time would have been hardly conceivable and in no way nearly enjoyable without them. Many thanks to Christina Ungerer, Tim Gasser, Christina Lang, Nicolai Heinzelmann, and Rebecca Off, and all others from the Kilometer1 and IST Institute community who were part of this journey.

During the six years of my research, I was fortunate to meet many exciting people. In particular, I would like to mention Christoph Stettina and Tobias Gutmann, with whom I was able to further develop my ideas through a variety of discussions and also had the pleasure of working on joint publications.

A special thanks to my partner Ramona, who supported me in the last phase of my dissertation with her love and kindness during this stressful time. I would also like to thank all my old and new friends who have accompanied me during this time and enriched my life. Last but not least, I would like to thank my family, who supported me from the very beginning as the first member of the family to follow an academic path. They were always behind me and made it possible to pursue my interests and career in this way.

List of Publications

2021

van der Meer, R.; Selig, C. J.; Stettina C. J. (2021, June). Innovation Labs - a Taxonomy of four different Types. In: Proceedings, 2021 IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC). Virtual conference. Cardiff, United Kingdom, 6/21/2021 - 6/23/2021. Piscataway, NJ: IEEE, pp. 1–9.

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21. Krisztian Balog (UvA) *People Search in the Enterprise*
22. Henk Koning (UU) *Communication of IT-Architecture*
23. Stefan Visscher (UU) *Bayesian network models for the management of ventilator-associated pneumonia*
24. Zharko Aleksovski (VU) *Using background knowledge in ontology matching*
25. Geert Jonker (UU) *Efficient and Equitable Exchange in Air Traffic Management Plan Repair using Spender-signed Currency*
26. Marijn Huijbregts (UT) *Segmentation, Diarization and Speech Transcription: Surprise Data Unraveled*
27. Hubert Vogten (OU) *Design and Implementation Strategies for IMS Learning Design*
28. Ildiko Flesch (RUN) *On the Use of Independence Relations in Bayesian Networks*

29. Dennis Reidsma (UT) *Annotations and Subjective Machines - Of Annotators, Embodied Agents, Users, and Other Humans*
30. Wouter van Atteveldt (VU) *Semantic Network Analysis: Techniques for Extracting, Representing and Querying Media Content*
31. Loes Braun (UM) *Pro-Active Medical Information Retrieval*
32. Trung H. Bui (UT) *Toward Affective Dialogue Management using Partially Observable Markov Decision Processes*
33. Frank Terpstra (UvA) *Scientific Workflow Design; theoretical and practical issues*
34. Jeroen de Knijf (UU) *Studies in Frequent Tree Mining*
35. Ben Torben Nielsen (UvT) *Dendritic morphologies: function shapes structure*

2009

1. Rasa Jurgelenaite (RUN) *Symmetric Causal Independence Models*
2. Willem Robert van Hage (VU) *Evaluating Ontology-Alignment Techniques*
3. Hans Stol (UvT) *A Framework for Evidence-based Policy Making Using IT*
4. Josephine Nabukenya (RUN) *Improving the Quality of Organisational Policy Making using Collaboration Engineering*
5. Sietse Overbeek (RUN) *Bridging Supply and Demand for Knowledge Intensive Tasks - Based on Knowledge, Cognition, and Quality*
6. Muhammad Subianto (UU) *Understanding Classification*
7. Ronald Poppe (UT) *Discriminative Vision-Based Recovery and Recognition of Human Motion*
8. Volker Nannen (VU) *Evolutionary Agent-Based Policy Analysis in Dynamic Environments*
9. Benjamin Kanagwa (RUN) *Design, Discovery and Construction of Service-oriented Systems*
10. Jan Wielemaker (UvA) *Logic programming for knowledge-intensive interactive applications*
11. Alexander Boer (UvA) *Legal Theory, Sources of Law & the Semantic Web*
12. Peter Massuthe (TU/e, Humboldt-Universitaet zu Berlin) *Operating Guidelines for Services*
13. Steven de Jong (UM) Fairness in Multi-Agent Systems
14. Maksym Korotkiy (VU) *From ontology-enabled services to service-enabled ontologies (making ontologies work in e-science with ONTO-SOA)*
15. Rinke Hoekstra (UvA) *Ontology Representation - Design Patterns and Ontologies that Make Sense*
16. Fritz Reul (UvT) *New Architectures in Computer Chess*
17. Laurens van der Maaten (UvT) *Feature Extraction from Visual Data*
18. Fabian Groffen (CWI) *Armada, An Evolving Database System*
19. Valentin Robu (CWI) *Modeling Preferences, Strategic Reasoning and Collaboration in Agent-Mediated Electronic Markets*

20. Bob van der Vecht (UU) *Adjustable Autonomy: Controling Influences on Decision Making*
21. Stijn Vanderlooy (UM) *Ranking and Reliable Classification*
22. Pavel Serdyukov (UT) *Search For Expertise: Going beyond direct evidence*
23. Peter Hofgesang (VU) *Modelling Web Usage in a Changing Environment*
24. Annerieke Heuvelink (VU) *Cognitive Models for Training Simulations*
25. Alex van Ballegooij (CWI) *"RAM: Array Database Management through Relational Mapping"*
26. Fernando Koch (UU) *An Agent-Based Model for the Development of Intelligent Mobile Services*
27. Christian Glahn (OU) *Contextual Support of social Engagement and Reflection on the Web*
28. Sander Evers (UT) *Sensor Data Management with Probabilistic Models*
29. Stanislav Pokraev (UT) *Model-Driven Semantic Integration of Service-Oriented Applications*
30. Marcin Zukowski (CWI) *Balancing vectorized query execution with bandwidth-optimized storage*
31. Sofiya Katrenko (UvA) *A Closer Look at Learning Relations from Text*
32. Rik Farenhorst (VU) and Remco de Boer (VU) *Architectural Knowledge Management: Supporting Architects and Auditors*
33. Khiet Truong (UT) *How Does Real Affect Affect Affect Recognition In Speech?*
34. Inge van de Weerd (UU) *Advancing in Software Product Management: An Incremental Method Engineering Approach*
35. Wouter Koelewijn (UL) *Privacy en Politiegegevens; Over geautomatiseerde normatieve informatie-uitwisseling*
36. Marco Kalz (OU) *Placement Support for Learners in Learning Networks*
37. Hendrik Drachsler (OU) *Navigation Support for Learners in Informal Learning Networks*
38. Riina Vuorikari (OU) *Tags and self-organisation: a metadata ecology for learning resources in a multilingual context*
39. Christian Stahl (TU/e, Humboldt-Universitaet zu Berlin) *Service Substitution -- A Behavioral Approach Based on Petri Nets*
40. Stephan Raaijmakers (UvT) *Multinomial Language Learning: Investigations into the Geometry of Language*
41. Igor Berezhnyy (UvT) *Digital Analysis of Paintings*
42. Toine Bogers (UvT) *Recommender Systems for Social Bookmarking*
43. Virginia Nunes Leal Franqueira (UT) *Finding Multi-step Attacks in Computer Networks using Heuristic Search and Mobile Ambients*
44. Roberto Santana Tapia (UT) *Assessing Business-IT Alignment in Networked Organizations*
45. Jilles Vreeken (UU) *Making Pattern Mining Useful*

46. Loredana Afanasiev (UvA) *Querying XML: Benchmarks and Recursion*

2010

1. Matthijs van Leeuwen (UU) *Patterns that Matter*
2. Ingo Wassink (UT) *Work flows in Life Science*
3. Joost Geurts (CWI) *A Document Engineering Model and Processing Framework for Multimedia documents*
4. Olga Kulyk (UT) *Do You Know What I Know? Situational Awareness of Co-located Teams in Multidisplay Environments*
5. Claudia Hauff (UT) *Predicting the Effectiveness of Queries and Retrieval Systems*
6. Sander Bakkes (UvT) *Rapid Adaptation of Video Game AI*
7. Wim Fikkert (UT) *Gesture interaction at a Distance*
8. Krzysztof Siewicz (UL) *Towards an Improved Regulatory Framework of Free Software. Protecting user freedoms in a world of software communities and eGovernments*
9. Hugo Kielman (UL) *A Politiele gegevensverwerking en Privacy, Naar een effectieve waarborging*
10. Rebecca Ong (UL) *Mobile Communication and Protection of Children*
11. Adriaan Ter Mors (TUD) *The world according to MARP: Multi-Agent Route Planning*
12. Susan van den Braak (UU) *Sensemaking software for crime analysis*
13. Gianluigi Folino (RUN) *High Performance Data Mining using Bio-inspired techniques*
14. Sander van Splunter (VU) *Automated Web Service Reconfiguration*
15. Lianne Bodenstaff (UT) *Managing Dependency Relations in Inter-Organizational Models*
16. Sicco Verwer (TUD) *Efficient Identification of Timed Automata, theory and practice*
17. Spyros Kotoulas (VU) *Scalable Discovery of Networked Resources: Algorithms, Infrastructure, Applications*
18. Charlotte Gerritsen (VU) *Caught in the Act: Investigating Crime by Agent-Based Simulation*
19. Henriette Cramer (UvA) *People's Responses to Autonomous and Adaptive Systems*
20. Ivo Swartjes (UT) *Whose Story Is It Anyway? How Improv Informs Agency and Authorship of Emergent Narrative*
21. Harold van Heerde (UT) *Privacy-aware data management by means of data degradation*
22. Michiel Hildebrand (CWI) *End-user Support for Access to\\ Heterogeneous Linked Data*
23. Bas Steunebrink (UU) *The Logical Structure of Emotions*
24. Dmytro Tykhonov (TUD) *Designing Generic and Efficient Negotiation Strategies*
25. Zulfiqar Ali Memon (VU) *Modelling Human-Awareness for Ambient Agents: A Human Mindreading Perspective*

26. Ying Zhang (CWI) *XRPC: Efficient Distributed Query Processing on Heterogeneous XQuery Engines*
27. Marten Voulon (UL) *Automatisch contracteren*
28. Arne Koopman (UU) *Characteristic Relational Patterns*
29. Stratos Idreos(CWI) *Database Cracking: Towards Auto-tuning Database Kernels*
30. Marieke van Erp (UvT) *Accessing Natural History - Discoveries in data cleaning, structuring, and retrieval*
31. Victor de Boer (UvA) *Ontology Enrichment from Heterogeneous Sources on the Web*
32. Marcel Hiel (UvT) *An Adaptive Service Oriented Architecture: Automatically solving Interoperability Problems*
33. Robin Aly (UT) *Modeling Representation Uncertainty in Concept-Based Multimedia Retrieval*
34. Teduh Dirgahayu (UT) *Interaction Design in Service Compositions*
35. Dolf Trieschnigg (UT) *Proof of Concept: Concept-based Biomedical Information Retrieval*
36. Jose Janssen (OU) *Paving the Way for Lifelong Learning; Facilitating competence development through a learning path specification*
37. Niels Lohmann (TU/e) *Correctness of services and their composition*
38. Dirk Fahland (TU/e) *From Scenarios to components*
39. Ghazanfar Farooq Siddiqui (VU) *Integrative modeling of emotions in virtual agents*
40. Mark van Assem (VU) *Converting and Integrating Vocabularies for the Semantic Web*
41. Guillaume Chaslot (UM) *Monte-Carlo Tree Search*
42. Sybren de Kinderen (VU) *Needs-driven service bundling in a multi-supplier setting - the computational e3-service approach*
43. Peter van Kranenburg (UU) *A Computational Approach to Content-Based Retrieval of Folk Song Melodies*
44. Pieter Bellekens (TU/e) *An Approach towards Context-sensitive and User-adapted Access to Heterogeneous Data Sources, Illustrated in the Television Domain*
45. Vasilios Andrikopoulos (UvT) *A theory and model for the evolution of software services*
46. Vincent Pijpers (VU) *e3alignment: Exploring Inter-Organizational Business-ICT Alignment*
47. Chen Li (UT) *Mining Process Model Variants: Challenges, Techniques, Examples*
48. Withdrawn
49. Jahn-Takeshi Saito (UM) *Solving difficult game positions*
50. Bouke Huurnink (UvA) *Search in Audiovisual Broadcast Archives*
51. Alia Khairia Amin (CWI) *Understanding and supporting information seeking tasks in multiple sources*

52. Peter-Paul van Maanen (VU) *Adaptive Support for Human-Computer Teams: Exploring the Use of Cognitive Models of Trust and Attention*
53. Edgar Meij (UvA) *Combining Concepts and Language Models for Information Access*

2011

1. Botond Cseke (RUN) *Variational Algorithms for Bayesian Inference in Latent Gaussian Models*
2. Nick Tinnemeier (UU) *Organizing Agent Organizations. Syntax and Operational Semantics of an Organization-Oriented Programming Language*
3. Jan Martijn van der Werf (TU/e) *Compositional Design and Verification of Component-Based Information Systems*
4. Hado van Hasselt (UU) *Insights in Reinforcement Learning; Formal analysis and empirical evaluation of temporal-difference learning algorithms*
5. Base van der Raadt (VU) *Enterprise Architecture Coming of Age - Increasing the Performance of an Emerging Discipline*
6. Yiwen Wang (TU/e) *Semantically-Enhanced Recommendations in Cultural Heritage*
7. Yujia Cao (UT) *Multimodal Information Presentation for High Load Human Computer Interaction*
8. Nieske Vergunst (UU) *BDI-based Generation of Robust Task-Oriented Dialogues*
9. Tim de Jong (OU) *Contextualised Mobile Media for Learning*
10. Bart Bogaert (UvT) *Cloud Content Contention*
11. Dhaval Vyas (UT) *Designing for Awareness: An Experience-focused HCI Perspective*
12. Carmen Bratosin (TU/e) *Grid Architecture for Distributed Process Mining*
13. Xiaoyu Mao (UvT) *Airport under Control. Multiagent Scheduling for Airport Ground Handling*
14. Milan Lovric (EUR) *Behavioral Finance and Agent-Based Artificial Markets*
15. Marijn Koolen (UvA) *The Meaning of Structure: the Value of Link Evidence for Information Retrieval*
16. Maarten Schadd (UM) *Selective Search in Games of Different Complexity*
17. Jiyin He (UvA) *Exploring Topic Structure: Coherence, Diversity and Relatedness*
18. Mark Ponsen (UM) *Strategic Decision-Making in complex games*
19. Ellen Rusman (OU) *The Mind's Eye on Personal Profiles*
20. Qing Gu (VU) *Guiding service-oriented software engineering - A view-based approach*
21. Linda Terlouw (TUD) *Modularization and Specification of Service-Oriented Systems*
22. Junte Zhang (UvA) *System Evaluation of Archival Description and Access*
23. Wouter Weerkamp (UvA) *Finding People and their Utterances in Social Media*
24. Herwin van Welbergen (UT) *Behavior Generation for Interpersonal Coordination with Virtual Humans On Specifying, Scheduling and Realizing Multimodal Virtual Human Behavior*

25. Syed Waqar ul Qounain Jaffry (VU) *Analysis and Validation of Models for Trust Dynamics*
26. Matthijs Aart Pontier (VU) *Virtual Agents for Human Communication - Emotion Regulation and Involvement-Distance Trade-Offs in Embodied Conversational Agents and Robots*
27. Aniel Bhulai (VU) *Dynamic website optimization through autonomous management of design patterns*
28. Rianne Kaptein (UvA) *Effective Focused Retrieval by Exploiting Query Context and Document Structure*
29. Faisal Kamiran (TU/e) *Discrimination-aware Classification*
30. Egon van den Broek (UT) *Affective Signal Processing (ASP): Unraveling the mystery of emotions*
31. Ludo Waltman (EUR) *Computational and Game-Theoretic Approaches for Modeling Bounded Rationality*
32. Nees-Jan van Eck (EUR) *Methodological Advances in Bibliometric Mapping of Science*
33. Tom van der Weide (UU) *Arguing to Motivate Decisions*
34. Paolo Turrini (UU) *Strategic Reasoning in Interdependence: Logical and Game-theoretical Investigations*
35. Maaike Harbers (UU) *Explaining Agent Behavior in Virtual Training*
36. Erik van der Spek (UU) *Experiments in serious game design: a cognitive approach*
37. Adriana Burlutiu (RUN) *Machine Learning for Pairwise Data, Applications for Preference Learning and Supervised Network Inference*
38. Nyree Lemmens (UM) *Bee-inspired Distributed Optimization*
39. Joost Westra (UU) *Organizing Adaptation using Agents in Serious Games*
40. Viktor Clerc (VU) *Architectural Knowledge Management in Global Software Development*
41. Luan Ibraimi (UT) *Cryptographically Enforced Distributed Data Access Control*
42. Michal Sindlar (UU) *Explaining Behavior through Mental State Attribution*
43. Henk van der Schuur (UU) *Process Improvement through Software Operation Knowledge*
44. Boris Reuderink (UT) *Robust Brain-Computer Interfaces*
45. Herman Stehouwer (UvT) *Statistical Language Models for Alternative Sequence Selection*
46. Beibei Hu (TUD) *Towards Contextualized Information Delivery: A Rule-based Architecture for the Domain of Mobile Police Work*
47. Azizi Bin Ab Aziz (VU) *Exploring Computational Models for Intelligent Support of Persons with Depression*
48. Mark Ter Maat (UT) *Response Selection and Turn-taking for a Sensitive Artificial Listening Agent*

49. Andreea Niculescu (UT) *Conversational interfaces for task-oriented spoken dialogues: design aspects influencing interaction quality*

2012

1. Terry Kakeeto (UvT) *Relationship Marketing for SMEs in Uganda*
2. Muhammad Umair (VU) *Adaptivity, emotion, and Rationality in Human and Ambient Agent Models*
3. Adam Vanya (VU) *Supporting Architecture Evolution by Mining Software Repositories*
4. Jurriaan Souer (UU) *Development of Content Management System-based Web Applications*
5. Marijn Plomp (UU) *Maturing Interorganisational Information Systems*
6. Wolfgang Reinhardt (OU) *Awareness Support for Knowledge Workers in Research Networks*
7. Rianne van Lambalgen (VU) *When the Going Gets Tough: Exploring Agent-based Models of Human Performance under Demanding Conditions*
8. Gerben de Vries (UvA) *Kernel Methods for Vessel Trajectories*
9. Ricardo Neisse (UT) *Trust and Privacy Management Support for Context-Aware Service Platforms*
10. David Smits (TU/e) *Towards a Generic Distributed Adaptive Hypermedia Environment*
11. J.C.B. Rantham Prabhakara (TU/e) *Process Mining in the Large: Preprocessing, Discovery, and Diagnostics*
12. Kees van der Sluijs (TU/e) *Model Driven Design and Data Integration in Semantic Web Information Systems*
13. Suleman Shahid (UvT) *Fun and Face: Exploring non-verbal expressions of emotion during playful interactions*
14. Evgeny Knutov (TU/e) *Generic Adaptation Framework for Unifying Adaptive Web-based Systems*
15. Natalie van der Wal (VU) *Social Agents. Agent-Based Modelling of Integrated Internal and Social Dynamics of Cognitive and Affective Processes.*
16. Fiemke Both (VU) *Helping people by understanding them - Ambient Agents supporting task execution and depression treatment*
17. Amal Elgammal (UvT) *Towards a Comprehensive Framework for Business Process Compliance*
18. Eltjo Poort (VU) *Improving Solution Architecting Practices*
19. Helen Schonenberg (TU/e) *What's Next? Operational Support for Business Process Execution*
20. Ali Bahramisharif (RUN) *Covert Visual Spatial Attention, a Robust Paradigm for Brain-Computer Interfacing*
21. Roberto Cornacchia (TUD) *Querying Sparse Matrices for Information Retrieval*
22. Thijs Vis (UvT) *Intelligence, politie en veiligheidsdienst: verenigbare grootheden?*

23. Christian Muehl (UT) *Toward Affective Brain-Computer Interfaces: Exploring the Neurophysiology of Affect during Human Media Interaction*
24. Laurens van der Werff (UT) *Evaluation of Noisy Transcripts for Spoken Document Retrieval*
25. Silja Eckartz (UT) *Managing the Business Case Development in Inter-Organizational IT Projects: A Methodology and its Application*
26. Emile de Maat (UvA) *Making Sense of Legal Text*
27. Hayrettin Gurkok (UT) *Mind the Sheep! User Experience Evaluation & Brain-Computer Interface Games*
28. Nancy Pascall (UvT) *Engendering Technology Empowering Women*
29. Almer Tigelaar (UT) *Peer-to-Peer Information Retrieval*
30. Alina Pommeranz (TUD) *Designing Human-Centered Systems for Reflective Decision Making*
31. Emily Bagarukayo (RUN) *A Learning by Construction Approach for Higher Order Cognitive Skills Improvement, Building Capacity and Infrastructure*
32. Wietske Visser (TUD) *Qualitative multi-criteria preference representation and reasoning*
33. Rory Sie (OU) *Coalitions in Cooperation Networks (COCOON)*
34. Pavol Jancura (RUN) *Evolutionary analysis in PPI networks and applications*
35. Evert Haasdijk (VU) *Never Too Old To Learn -- On-line Evolution of Controllers in Swarm- and Modular Robotics*
36. Denis Ssebugwawo (RUN) *Analysis and Evaluation of Collaborative Modeling Processes*
37. Agnes Nakakawa (RUN) *A Collaboration Process for Enterprise Architecture Creation*
38. Selmar Smit (VU) *Parameter Tuning and Scientific Testing in Evolutionary Algorithms*
39. Hassan Fatemi (UT) *Risk-aware design of value and coordination networks*
40. Agus Gunawan (UvT) *Information Access for SMEs in Indonesia*
41. Sebastian Kelle (OU) *Game Design Patterns for Learning*
42. Dominique Verpoorten (OU) *Reflection Amplifiers in self-regulated Learning*
43. Withdrawn
44. Anna Tordai (VU) *On Combining Alignment Techniques*
45. Benedikt Kratz (UvT) *A Model and Language for Business-aware Transactions*
46. Simon Carter (UvA) *Exploration and Exploitation of Multilingual Data for Statistical Machine Translation*

47. Manos Tsagkias (UvA) *Mining Social Media: Tracking Content and Predicting Behavior*

48. Jorn Bakker (TU/e) *Handling Abrupt Changes in Evolving Time-series Data*

49. Michael Kaisers (UM) *Learning against Learning - Evolutionary dynamics of reinforcement learning algorithms in strategic interactions*

50. Steven van Kervel (TUD) *Ontologogy driven Enterprise Information Systems Engineering*

51. Jeroen de Jong (TUD) *Heuristics in Dynamic Sceduling; a practical framework with a case study in elevator dispatching*

2013

1. Viorel Milea (EUR) *News Analytics for Financial Decision Support*
2. Erietta Liarou (CWI) *MonetDB/DataCell: Leveraging the Column-store Database Technology for Efficient and Scalable Stream Processing*
3. Szymon Klarman (VU) *Reasoning with Contexts in Description Logics*
4. Chetan Yadati (TUD) *Coordinating autonomous planning and scheduling*
5. Dulce Pumareja (UT) *Groupware Requirements Evolutions Patterns*
6. Romulo Goncalves (CWI) *The Data Cyclotron: Juggling Data and Queries for a Data Warehouse Audience*
7. Giel van Lankveld (UvT) *Quantifying Individual Player Differences*
8. Robbert-Jan Merk (VU) *Making enemies: cognitive modeling for opponent agents in fighter pilot simulators*
9. Fabio Gori (RUN) *Metagenomic Data Analysis: Computational Methods and Applications*
10. Jeewanie Jayasinghe Arachchige (UvT) *A Unified Modeling Framework for Service Design*
11. Evangelos Pournaras (TUD) *Multi-level Reconfigurable Self-organization in Overlay Services*
12. Marian Razavian (VU) *Knowledge-driven Migration to Services*
13. Mohammad Safiri (UT) *Service Tailoring: User-centric creation of integrated IT-based homecare services to support independent living of elderly*
14. Jafar Tanha (UvA) *Ensemble Approaches to Semi-Supervised Learning Learning*
15. Daniel Hennes (UM) *Multiagent Learning - Dynamic Games and Applications*
16. Eric Kok (UU) *Exploring the practical benefits of argumentation in multi-agent deliberation*
17. Koen Kok (VU) *The PowerMatcher: Smart Coordination for the Smart Electricity Grid*
18. Jeroen Janssens (UvT) *Outlier Selection and One-Class Classification*
19. Renze Steenhuizen (TUD) *Coordinated Multi-Agent Planning and Scheduling*
20. Katja Hofmann (UvA) *Fast and Reliable Online Learning to Rank for Information Retrieval*
21. Sander Wubben (UvT) *Text-to-text generation by monolingual machine translation*
22. Tom Claassen (RUN) *Causal Discovery and Logic*

23. Patricio de Alencar Silva (UvT) *Value Activity Monitoring*
24. Haitham Bou Ammar (UM) *Automated Transfer in Reinforcement Learning*
25. Agnieszka Anna Latoszek-Berendsen (UM) *Intention-based Decision Support. A new way of representing and implementing clinical guidelines in a Decision Support System*
26. Alireza Zarghami (UT) *Architectural Support for Dynamic Homecare Service Provisioning*
27. Mohammad Huq (UT) *Inference-based Framework Managing Data Provenance*
28. Frans van der Sluis (UT) *When Complexity becomes Interesting: An Inquiry into the Information eXperience*
29. Iwan de Kok (UT) *Listening Heads*
30. Joyce Nakatumba (TU/e) *Resource-Aware Business Process Management: Analysis and Support*
31. Dinh Khoa Nguyen (UvT) *Blueprint Model and Language for Engineering Cloud Applications*
32. Kamakshi Rajagopal (OU) *Networking For Learning; The role of Networking in a Lifelong Learner's Professional Development*
33. Qi Gao (TUD) *User Modeling and Personalization in the Microblogging Sphere*
34. Kien Tjin-Kam-Jet (UT) *Distributed Deep Web Search*
35. Abdallah El Ali (UvA) *Minimal Mobile Human Computer Interaction*
36. Than Lam Hoang (TU/e) *Pattern Mining in Data Streams*
37. Dirk Börner (OU) *Ambient Learning Displays*
38. Eelco den Heijer (VU) *Autonomous Evolutionary Art*
39. Joop de Jong (TUD) *A Method for Enterprise Ontology based Design of Enterprise Information Systems*
40. Pim Nijssen (UM) *Monte-Carlo Tree Search for Multi-Player Games*
41. Jochem Liem (UvA) *Supporting the Conceptual Modelling of Dynamic Systems: A Knowledge Engineering Perspective on Qualitative Reasoning*
42. Léon Planken (TUD) *Algorithms for Simple Temporal Reasoning*
43. Marc Bron (UvA) *Exploration and Contextualization through Interaction and Concepts*

2014

1. Nicola Barile (UU) *Studies in Learning Monotone Models from Data*
2. Fiona Tuliyano (RUN) *Combining System Dynamics with a Domain Modeling Method*
3. Sergio Raul Duarte Torres (UT) *Information Retrieval for Children: Search Behavior and Solutions*
4. Hanna Jochmann-Mannak (UT) *Websites for children: search strategies and interface design - Three studies on children's search performance and evaluation*

5. Jurriaan van Reijsen (UU) *Knowledge Perspectives on Advancing Dynamic Capability*
6. Damian Tamburri (VU) *Supporting Networked Software Development*
7. Arya Adriansyah (TU/e) *Aligning Observed and Modeled Behavior*
8. Samur Araujo (TUD) *Data Integration over Distributed and Heterogeneous Data Endpoints*
9. Philip Jackson (UvT) *Toward Human-Level Artificial Intelligence: Representation and Computation of Meaning in Natural Language*
10. Ivan Salvador Razo Zapata (VU) *Service Value Networks*
11. Janneke van der Zwaan (TUD) *An Empathic Virtual Buddy for Social Support*
12. Willem van Willigen (VU) *Look Ma, No Hands: Aspects of Autonomous Vehicle Control*
13. Arlette van Wissen (VU) *Agent-Based Support for Behavior Change: Models and Applications in Health and Safety Domains*
14. Yangyang Shi (TUD) *Language Models With Meta-information*
15. Natalya Mogles (VU) *Agent-Based Analysis and Support of Human Functioning in Complex Socio-Technical Systems: Applications in Safety and Healthcare*
16. Krystyna Milian (VU) *Supporting trial recruitment and design by automatically interpreting eligibility criteria*
17. Kathrin Dentler (VU) *Computing healthcare quality indicators automatically: Secondary Use of Patient Data and Semantic Interoperability*
18. Mattijs Ghijsen (UvA) *Methods and Models for the Design and Study of Dynamic Agent Organizations*
19. Vinicius Ramos (TU/e) *Adaptive Hypermedia Courses: Qualitative and Quantitative Evaluation and Tool Support*
20. Mena Habib (UT) *Named Entity Extraction and Disambiguation for Informal Text: The Missing Link*
21. Kassidy Clark (TUD) *Negotiation and Monitoring in Open Environments*
22. Marieke Peeters (UU) *Personalized Educational Games - Developing agent-supported scenario-based training*
23. Eleftherios Sidirourgos (UvA/CWI) *Space Efficient Indexes for the Big Data* Era
24. Davide Ceolin (VU) *Trusting Semi-structured Web Data*
25. Martijn Lappenschaar (RUN) *New network models for the analysis of disease interaction*
26. Tim Baarslag (TUD) *What to Bid and When to Stop*
27. Rui Jorge Almeida (EUR) *Conditional Density Models Integrating Fuzzy and Probabilistic Representations of Uncertainty*
28. Anna Chmielowiec (VU) *Decentralized k-Clique Matching*
29. Jaap Kabbedijk (UU) *Variability in Multi-Tenant Enterprise Software*

30. Peter de Cock (UvT) *Anticipating Criminal Behaviour*
31. Leo van Moergestel (UU) *Agent Technology in Agile Multiparallel Manufacturing and Product* Support
32. Naser Ayat (UvA) *On Entity Resolution in Probabilistic Data*
33. Tesfa Tegegne (RUN) *Service Discovery in eHealth*
34. Christina Manteli (VU) *The Effect of Governance in Global Software Development: Analyzing Transactive Memory Systems*.
35. Joost van Ooijen (UU) *Cognitive Agents in Virtual Worlds: A Middleware Design Approach*
36. Joos Buijs (TU/e) *Flexible Evolutionary Algorithms for Mining Structured Process Models*
37. Maral Dadvar (UT) *Experts and Machines United Against Cyberbullying*
38. Danny Plass-Oude Bos (UT) *Making brain-computer interfaces better: improving usability through post-processing*
39. Jasmina Maric (UvT) *Web Communities, Immigration, and Social Capital*
40. Walter Omona (RUN) *A Framework for Knowledge Management Using ICT in Higher Education*
41. Frederic Hogenboom (EUR) Automated Detection of Financial Events in News Text
42. Carsten Eijckhof (CWI/TUD) *Contextual Multidimensional Relevance Models*
43. Kevin Vlaanderen (UU) *Supporting Process Improvement using Method Increments*
44. Paulien Meesters (UvT) *Intelligent Blauw. Met als ondertitel: Intelligence-gestuurde politiezorg in gebiedsgebonden eenheden*
45. Birgit Schmitz (OU) *Mobile Games for Learning: A Pattern-Based Approach*
46. Ke Tao (TUD) *Social Web Data Analytics: Relevance, Redundancy, Diversity*
47. Shangsong Liang (UvA) *Fusion and Diversification in Information Retrieval*

2015

1. Niels Netten (UvA) *Machine Learning for Relevance of Information in Crisis Response*
2. Faiza Bukhsh (UvT) *Smart auditing: Innovative Compliance Checking in Customs Controls*
3. Twan van Laarhoven (RUN) *Machine learning for network data*
4. Howard Spoelstra (OU) *Collaborations in Open Learning Environments*
5. Christoph Bösch (UT) *Cryptographically Enforced Search Pattern Hiding*
6. Farideh Heidari (TUD) *Business Process Quality Computation - Computing Non-Functional Requirements to Improve Business Processes*
7. Maria-Hendrike Peetz (UvA) *Time-Aware Online Reputation Analysis*
8. Jie Jiang (TUD) *Organizational Compliance: An agent-based model for designing and evaluating organizational interactions*

9. Randy Klaassen (UT) *HCI Perspectives on Behavior Change Support Systems*
10. Henry Hermans (OU) *OpenU: design of an integrated system to support lifelong learning*
11. Yongming Luo (TU/e) *Designing algorithms for big graph datasets: A study of computing bisimulation and joins*
12. Julie M. Birkholz (VU) *Modi Operandi of Social Network Dynamics: The Effect of Context on Scientific Collaboration Networks*
13. Giuseppe Procaccianti (VU) *Energy-Efficient Software*
14. Bart van Straalen (UT) *A cognitive approach to modeling bad news conversations*
15. Klaas Andries de Graaf (VU) *Ontology-based Software Architecture Documentation*
16. Changyun Wei (UT) *Cognitive Coordination for Cooperative Multi-Robot Teamwork*
17. André van Cleeff (UT) *Physical and Digital Security Mechanisms: Properties, Combinations and Trade-offs*
18. Holger Pirk (CWI) *Waste Not, Want Not! - Managing Relational Data in Asymmetric Memories*
19. Bernardo Tabuenca (OU) *Ubiquitous Technology for Lifelong Learners*
20. Loïs Vanhée (UU) *Using Culture and Values to Support Flexible Coordination*
21. Sibren Fetter (OU) *Using Peer-Support to Expand and Stabilize Online Learning*
22. Zhemin Zhu (UT) *Co-occurrence Rate Networks*
23. Luit Gazendam (VU) *Cataloguer Support in Cultural Heritage*
24. Richard Berendsen (UvA) *Finding People, Papers, and Posts: Vertical Search Algorithms and Evaluation*
25. Steven Woudenberg (UU) *Bayesian Tools for Early Disease Detection*
26. Alexander Hogenboom (EUR) *Sentiment Analysis of Text Guided by Semantics and Structure*
27. Sándor Héman (CWI) *Updating compressed colomn stores*
28. Janet Bagorogoza (UvT) *KNOWLEDGE MANAGEMENT AND HIGH PERFORMANCE; The Uganda Financial Institutions Model for HPO*
29. Hendrik Baier (UM) *Monte-Carlo Tree Search Enhancements for One-Player and Two-Player Domains*
30. Kiavash Bahreini (OU) Real-time Multimodal Emotion Recognition in E-Learning
31. Yakup Koç (TUD) *On the robustness of Power* Grids
32. Jerome Gard (UL) *Corporate Venture Management in SMEs*
33. Frederik Schadd (TUD) *Ontology Mapping with Auxiliary Resources*
34. Victor de Graaf (UT) *Gesocial Recommender Systems*
35. Jungxao Xu (TUD) *Affective Body Language of Humanoid Robots: Perception and Effects in Human Robot Interaction*

2016

1. Syed Saiden Abbas (RUN) *Recognition of Shapes by Humans and Machines*
2. Michiel Christiaan Meulendijk (UU) *Optimizing medication reviews through decision support: prescribing a better pill to swallow*
3. Maya Sappelli (RUN) *Knowledge Work in Context: User Centered Knowledge Worker Support*
4. Laurens Rietveld (VU) *Publishing and Consuming Linked Data*
5. Evgeny Sherkhonov (UvA) *Expanded Acyclic Queries: Containment and an Application in Explaining Missing Answers*
6. Michel Wilson (TUD) *Robust scheduling in an uncertain environment*
7. Jeroen de Man (VU) *Measuring and modeling negative emotions for virtual training*
8. Matje van de Camp (UvT) *A Link to the Past: Constructing Historical Social Networks from Unstructured Data*
9. Archana Nottamkandath (VU) *Trusting Crowdsourced Information on Cultural Artefacts*
10. George Karafotias (VU) *Parameter Control for Evolutionary Algorithms*
11. Anne Schuth (UvA) *Search Engines that Learn from Their Users*
12. Max Knobbout (UU) *Logics for Modelling and Verifying Normative Multi-Agent Systems*
13. Nana Baah Gyan (VU) *The Web, Speech Technologies and Rural Development in West Africa - An ICT4D Approach*
14. Ravi Khadka (UU) *Revisiting Legacy Software System Modernization*
15. Steffen Michels (RUN) *Hybrid Probabilistic Logics - Theoretical Aspects, Algorithms and Experiments*
16. Guangliang Li (UvA) *Socially Intelligent Autonomous Agents that Learn from Human Reward*
17. Berend Weel (VU) *Towards Embodied Evolution of Robot Organisms*
18. Albert Meroño Peñuela (VU) *Refining Statistical Data on the Web*
19. Julia Efremova (TU/e) *Mining Social Structures from Genealogical Data*
20. Daan Odijk (UvA) *Context & Semantics in News & Web Search*
21. Alejandro Moreno Celleri (UT) *From Traditional to Interactive Playspaces: Automatic Analysis of Player Behavior in the Interactive Tag Playground*
22. Grace Lewis (VU) *Software Architecture Strategies for Cyber-Foraging Systems*
23. Fei Cai (UvA) *Query Auto Completion in Information Retrieval*
24. Brend Wanders (UT) *Repurposing and Probabilistic Integration of Data; An Iterative and data model independent approach*
25. Julia Kiseleva (TU/e) *Using Contextual Information to Understand Searching and Browsing Behavior*

26. Dilhan Thilakarathne (VU) *In or Out of Control: Exploring Computational Models to Study the Role of Human Awareness and Control in Behavioural Choices, with Applications in Aviation and Energy Management Domains*
27. Wen Li (TUD) *Understanding Geo-spatial Information on Social Media*
28. Mingxin Zhang (TUD) *Large-scale Agent-based Social Simulation - A study on epidemic prediction and control*
29. Nicolas Höning (TUD) *Peak reduction in decentralised electricity systems -Markets and prices for flexible planning*
30. Ruud Mattheij (UvT) *The Eyes Have It*
31. Mohammad Khelghati (UT) *Deep web content monitoring*
32. Eelco Vriezekolk (UT) *Assessing Telecommunication Service Availability Risks for Crisis Organisations*
33. Peter Bloem (UvA) *Single Sample Statistics, exercises in learning from just one example*
34. Dennis Schunselaar (TU/e) *Configurable Process Trees: Elicitation, Analysis, and Enactment*
35. Zhaochun Ren (UvA) *Monitoring Social Media: Summarization, Classification and Recommendation*
36. Daphne Karreman (UT) *Beyond R2D2: The design of nonverbal interaction behavior optimized for robot-specific morphologies*
37. Giovanni Sileno (UvA) *Aligning Law and Action - a conceptual and computational inquiry*
38. Andrea Minuto (UT) *MATERIALS THAT MATTER - Smart Materials meet Art & Interaction Design*
39. Merijn Bruijnes (UT) *Believable Suspect Agents; Response and Interpersonal Style Selection for an Artificial Suspect*
40. Christian Detweiler (TUD) *Accounting for Values in Design*
41. Thomas King (TUD) *Governing Governance: A Formal Framework for Analysing Institutional Design and Enactment Governance*
42. Spyros Martzoukos (UvA) *Combinatorial and Compositional Aspects of Bilingual Aligned Corpora*
43. Saskia Koldijk (RUN) *Context-Aware Support for Stress Self-Management: From Theory to Practice*
44. Thibault Sellam (UvA) Automatic Assistants for Database Exploration
45. Bram van de Laar (UT) *Experiencing Brain-Computer Interface Control*
46. Jorge Gallego Perez (UT) *Robots to Make you Happy*
47. Christina Weber (UL) *Real-time foresight - Preparedness for dynamic innovation networks*
48. Tanja Buttler (TUD) *Collecting Lessons Learned*

49. Gleb Polevoy (TUD) *Participation and Interaction in Projects. A Game-Theoretic Analysis*
50. Yan Wang (UvT) *The Bridge of Dreams: Towards a Method for Operational Performance Alignment in IT-enabled Service Supply Chains*

2017

1. Jan-Jaap Oerlemans (UL) *Investigating Cybercrime*
2. Sjoerd Timmer (UU) *Designing and Understanding Forensic Bayesian Networks using Argumentation*
3. Daniël Harold Telgen (UU) *Grid Manufacturing; A Cyber-Physical Approach with Autonomous Products and Reconfigurable Manufacturing Machines*
4. Mrunal Gawade (CWI) *Multi-Core Parallelism In A Column-Store*
5. Mahdieh Shadi (UvA) *Collaboration Behavior*
6. Damir Vandic (EUR) *Intelligent Information Systems for Web Product Search*
7. Roel Bertens (UU) *Insight in Information: from Abstract to Anomaly*
8. Rob Konijn (VU) *Detecting Interesting Differences:Data Mining in Health Insurance Data using Outlier Detection and Subgroup Discovery*
9. Dong Nguyen (UT) *Text as Social and Cultural Data: A Computational Perspective on Variation in Text*
10. Robby van Delden (UT) (Steering) *Interactive Play Behavior*
11. Florian Kunneman (RUN) *Modelling patterns of time and emotion in Twitter #anticipointment*
12. Sander Leemans (TU/e) *Robust Process Mining with Guarantees*
13. Gijs Huisman (UT) *Social Touch Technology - Extending the reach of social touch through haptic technology*
14. Shoshannah Tekofsky (UvT) *You Are Who You Play You Are: Modelling Player Traits from Video Game Behavior*
15. Peter Berck, Radboud University (RUN) *Memory-Based Text Correction*
16. Aleksandr Chuklin (UvA) *Understanding and Modeling Users of Modern Search Engines*
17. Daniel Dimov (UL) *Crowdsourced Online Dispute Resolution*
18. Ridho Reinanda (UvA) *Entity Associations for Search*
19. Jeroen Vuurens (TUD) *Proximity of Terms, Texts and Semantic Vectors in Information Retrieval*
20. Mohammadbashir Sedighi (TUD) *Fostering Engagement in Knowledge Sharing: The Role of Perceived Benefits, Costs and Visibility*
21. Jeroen Linssen (UT) *Meta Matters in Interactive Storytelling and Serious Gaming (A Play on Worlds)*

22. Sara Magliacane (VU) *Logics for causal inference under uncertainty*
23. David Graus (UvA) *Entities of Interest--- Discovery in Digital Traces*
24. Chang Wang (TUD) *Use of Affordances for Efficient Robot Learning*
25. Veruska Zamborlini (VU) *Knowledge Representation for Clinical Guidelines, with applications to Multimorbidity Analysis and Literature Search*
26. Merel Jung (UT) *Socially intelligent robots that understand and respond to human touch*
27. Michiel Joosse (UT) *Investigating Positioning and Gaze Behaviors of Social Robots: People's Preferences, Perceptions and Behaviors*
28. John Klein (VU) *Architecture Practices for Complex Contexts*
29. Adel Alhuraibi (UvT) *From IT-BusinessStrategic Alignment to Performance: A Moderated Mediation Model of Social Innovation, and Enterprise Governance of IT*
30. Wilma Latuny (UvT) *The Power of Facial Expressions*
31. Ben Ruijl (UL) *Advances in computational methods for QFT calculations*
32. Thaer Samar (RUN) *Access to and Retrievability of Content in Web Archives*
33. Brigit van Loggem (OU) *Towards a Design Rationale for Software Documentation: A Model of Computer-Mediated Activity*
34. Maren Scheffel (OU) *The Evaluation Framework for Learning Analytics*
35. Martine de Vos (VU) *Interpreting natural science spreadsheets*
36. Yuanhao Guo (UL) *Shape Analysis for Phenotype Characterisation from High-throughput Imaging*
37. Alejandro Montes Garcia (TU/e) *WiBAF: A Within Browser Adaptation Framework that Enables Control over Privacy*
38. Alex Kayal (TUD) *Normative Social Applications*
39. Sara Ahmadi (RUN) *Exploiting properties of the human auditory system and compressive sensing methods to increase noise robustness in ASR*
40. Altaf Hussain Abro (VU) *Steer your Mind: Computational Exploration of Human Control in Relation to Emotions, Desires and Social Support For applications in human-aware support systems"*
41. Adnan Manzoor (VU) *Minding a Healthy Lifestyle: An Exploration of Mental Processes and a Smart Environment to Provide Support for a Healthy Lifestyle*
42. Elena Sokolova (RUN) *Causal discovery from mixed and missing data with applications on ADHD datasets*
43. Maaike de Boer (RUN) *Semantic Mapping in Video Retrieval*
44. Garm Lucassen (UU) *Understanding User Stories - Computational Linguistics in Agile Requirements Engineering*

45. Bas Testerink (UU) *Decentralized Runtime Norm Enforcement*
46. Jan Schneider (OU) *Sensor-based Learning Support*
47. Yie Yang (TUD) *Crowd Knowledge Creation Acceleration*
48. Angel Suarez (OU) *Collaborative inquiry-based learning*

2018

1. Han van der Aa (VU) *Comparing and Aligning Process Representations*
2. Felix Mannhardt (TU/e) *Multi-perspective Process Mining*
3. Steven Bosems (UT) *Causal Models For Well-Being: Knowledge Modeling, Model-Driven Development of Context-Aware Applications, and Behavior Prediction*
4. Jordan Janeiro (TUD) *Flexible Coordination Support for Diagnosis Teams in Data-Centric Engineering Tasks*
5. Hugo Huurdeman (UvA) *Supporting the Complex Dynamics of the Information Seeking Process*
6. Dan Ionita (UT) *Model-Driven Information Security Risk Assessment of Socio-Technical Systems*
7. Jieting Luo (UU) *A formal account of opportunism in multi-agent systems*
8. Rick Smetsers (RUN) *Advances in Model Learning for Software Systems*
9. Xu Xie (TUD) *Data Assimilation in Discrete Event Simulations*
10. Julienka Mollee (VU) *Moving forward: supporting physical activity behavior change through intelligent technology*
11. Mahdi Sargolzaei (UvA) *Enabling Framework for Service-oriented Collaborative Networks*
12. Xixi Lu (TU/e) *Using behavioral context in process mining*
13. Seyed Amin Tabatabaei (VU) *Using behavioral context in process mining: Exploring the added value of computational models for increasing the use of renewable energy in the residential sector*
14. Bart Joosten (UvT) *Detecting Social Signals with Spatiotemporal Gabor Filters*
15. Naser Davarzani (UM) *Biomarker discovery in heart failure*
16. Jaebok Kim (UT) *Automatic recognition of engagement and emotion in a group of* children
17. Jianpeng Zhang (TU/e) *On Graph Sample Clustering*
18. Henriette Nakad (UL) *De Notaris en Private Rechtspraak*
19. Minh Duc Pham (VU) *Emergent relational schemas for RDF*
20. Manxia Liu (RUN) *Time and Bayesian Networks*
21. Aad Slootmaker (OU) *EMERGO: a generic platform for authoring and playing scenario-based serious games*

22. Eric Fernandes de Mello Araújo (VU) *Contagious: Modeling the Spread of Behaviours, Perceptions and Emotions in Social Networks*
23. Kim Schouten (EUR) *Semantics-driven Aspect-Based Sentiment Analysis*
24. Jered Vroon (UT) *Responsive Social Positioning Behaviour for Semi-Autonomous Telepresence Robots*
25. Riste Gligorov (VU) *Serious Games in Audio-Visual Collections*
26. Roelof de Vries (UT) *Theory-Based And Tailor-Made: Motivational Messages for Behavior Change Technology*
27. Maikel Leemans (TU/e) *Hierarchical Process Mining for Scalable Software Analysis*
28. Christian Willemse (UT) *Social Touch Technologies: How they feel and how they make you feel*
29. Yu Gu (UvT) *Emotion Recognition from Mandarin Speech*
30. Wouter Beek (VU) *The “K” in "semantic web" stands for “knowledge”: scaling semantics to the web*

2019

1. Rob van Eijk (UL) *Web privacy measurement in real-time bidding systems. A graph-based approach to RTB system classification*
2. Emmanuelle Beauxis- Aussalet (CWI, UU) *Statistics and Visualizations for Assessing Class Size Uncertainty*
3. Eduardo Gonzalez Lopez de Murillas (TU/e) *Process Mining on Databases: Extracting Event Data from Real Life Data Sources*
4. Ridho Rahmadi (RUN) *Finding stable causal structures from clinical data*
5. Sebastiaan van Zelst (TU/e) *Process Mining with Streaming Data*
6. Chris Dijkshoorn (VU) *Nichesourcing for Improving Access to Linked Cultural Heritage Datasets*
7. Soude Fazeli (TUD) *Recommender Systems in Social Learning Platforms*
8. Frits de Nijs (TUD) *Resource-constrained Multi-agent Markov Decision Processes*
9. Fahimeh Alizadeh Moghaddam (UvA) *Self-adaptation for energy efficiency in software systems*
10. Qing Chuan Ye (EUR) *Multi-objective Optimization Methods for Allocation and Prediction*
11. Yue Zhao (TUD) *Learning Analytics Technology to Understand Learner Behavioral Engagement in MOOCs*
12. Jacqueline Heinerman (VU) *Better Together*
13. Guanliang Chen (TUD) *MOOC Analytics: Learner Modeling and Content Generation*

14. Daniel Davis (TUD) *Large-Scale Learning Analytics: Modeling Learner Behavior & Improving Learning Outcomes in Massive Open Online Courses*
15. Erwin Walraven (TUD) *Planning under Uncertainty in Constrained and Partially Observable Environments*
16. Guangming Li (TU/e) *Process Mining based on Object-Centric Behavioral Constraint (OCBC) Models*
17. Ali Hurriyetoglu (RUN) *Extracting actionable information from microtexts*
18. Gerard Wagenaar (UU) *Artefacts in Agile Team Communication*
19. Vincent Koeman (TUD) *Tools for Developing Cognitive Agents*
20. Chide Groenouwe (UU) *Fostering technically augmented human collective intelligence*
21. Cong Liu (TU/e) *Software Data Analytics: Architectural Model Discovery and Design Pattern Detec*tion
22. Martin van den Berg (VU) *Improving IT Decisions with Enterprise Architecture*
23. Qin Liu (TUD) *Intelligent Control Systems: Learning, Interpreting, Verification*
24. Anca Dumitrache (VU) *Truth in Disagreement- Crowdsourcing Labeled Data for Natural Language Processing*
25. Emiel van Miltenburg (UvT) *Pragmatic factors in (automatic) image description*
26. Prince Singh (UT) *An Integration Platform for Synchromodal Transport*
27. Alessandra Antonaci (OU) *The Gamification Design Process applied to (Massive) Open Online Courses*
28. Esther Kuindersma (UL) *Cleared for take-off: Game-based learning to prepare airline pilots for critical situations*
29. Daniel Formolo (VU) *Using virtual agents for simulation and training of social skills in safety-critical circumstances*
30. Vahid Yazdanpanah (UT) *Multiagent Industrial Symbiosis Systems*
31. Milan Jelisavcic (VU) *Alive and Kicking: Baby Steps in Robotics*
32. Chiara Sironi (UM) *Monte-Carlo Tree Search for Artificial General Intelligence in Games*
33. Anil Yaman (TU/e) *Evolution of Biologically Inspired Learning in Artificial Neural Networks*
34. Negar Ahmadi (TU/e) *EEG Microstate and Functional Brain Network Features for Classification of Epilepsy and PNES*
35. Lisa Facey-Shaw (OU) *Gamification with digital badges in learning programming*
36. Kevin Ackermans (OU) *Designing Video-Enhanced Rubrics to Master Complex Skills*
37. Jian Fang (TUD) *Database Acceleration on FPGAs*
38. Akos Kadar (OU) *Learning visually grounded and multilingual representations*

2020

1. Armon Toubman (UL) *Calculated Moves: Generating Air Combat Behaviour*
2. Marcos de Paula Bueno (UL) *Unraveling Temporal Processes using Probabilistic Graphical Models*
3. Mostafa Deghani (UvA) *Learning with Imperfect Supervision for Language Understanding*
4. Maarten van Gompel (RUN) *Context as Linguistic Bridges*
5. Yulong Pei (TU/e) *On local and global structure mining*
6. Preethu Rose Anish (UT) *Stimulation Architectural Thinking during Requirements Elicitation - An Approach and Tool Support*
7. Wim van der Vegt (OU) *Towards a software architecture for reusable game components*
8. Ali Mirsoleimani (UL) *Structured Parallel Programming for Monte Carlo Tree Search*
9. Myriam Traub (UU) *Measuring Tool Bias & Improving Data Quality for Digital Humanities Research*
10. Alifah Syamsiyah (TU/e) *In-database Preprocessing for Process Mining*
11. Sepideh Mesbah (TUD) *Semantic-Enhanced Training Data AugmentationMethods for Long-Tail Entity Recognition Models*
12. Ward van Breda (VU) *Predictive Modeling in E-Mental Health: Exploring Applicability in Personalised Depression Treatment*
13. Marco Virgolin (CWI) *Design and Application of Gene-pool Optimal Mixing Evolutionary Algorithms for Genetic Programming*
14. Mark Raasveldt (CWI/UL) *Integrating Analytics with Relational Databases*
15. Konstantinos Georgiadis (OU) *Smart CAT: Machine Learning for Configurable Assessments in Serious Games*
16. Ilona Wilmont (RUN) *Cognitive Aspects of Conceptual Modelling*
17. Daniele Di Mitri (OU) *The Multimodal Tutor: Adaptive Feedback from Multimodal Experiences*
18. Georgios Methenitis (TUD) *Agent Interactions & Mechanisms in Markets with Uncertainties: Electricity Markets in Renewable Energy Systems*
19. Guido van Capelleveen (UT) *Industrial Symbiosis Recommender Systems*
20. Albert Hankel (VU) *Embedding Green ICT Maturity in Organisations*
21. Karine da Silva Miras de Araujo (VU) *Where is the robot?: Life as it could be*
22. Maryam Masoud Khamis (RUN) *Understanding complex systems implementation through a modeling approach: the case of e-government in Zanzibar*
23. Rianne Conijn (UT) *The Keys to Writing: A writing analytics approach to studying writing processes using keystroke logging*

24. Lenin da Nobrega Medeiros (VU/RUN) *How are you feeling, human? Towards emotionally supportive chatbots*
25. Xin Du (TU/e) *The Uncertainty in Exceptional Model Mining*
26. Krzysztof Leszek Sadowski (UU) *GAMBIT: Genetic Algorithm for Model-Based mixed-Integer opTimization*
27. Ekaterina Muravyeva (TUD) *Personal data and informed consent in an educational context*
28. Bibeg Limbu (TUD) *Multimodal interaction for deliberate practice: Training complex skills with augmented reality*
29. Ioan Gabriel Bucur (RUN) *Being Bayesian about Causal Inference*
30. Bob Zadok Blok (UL) *Creatief, Creatieve, Creatiefst*
31. Gongjin Lan (VU) *Learning better -- From Baby to Better*
32. Jason Rhuggenaath (TU/e) *Revenue management in online markets: pricing and online advertising*
33. Rick Gilsing (TU/e) *Supporting service-dominant business model evaluation in the context of business model innovation*
34. Anna Bon (MU) *Intervention or Collaboration? Redesigning Information and Communication Technologies for Development*
35. Siamak Farshidi (UU) *Multi-Criteria Decision-Making in Software Production*

2021

1. Francisco Xavier Dos Santos Fonseca (TUD) *Location-based Games for Social Interaction in Public Space*
2. Rijk Mercuur (TUD) *Simulating Human Routines: Integrating Social Practice Theory in Agent-Based Models*
3. Seyyed Hadi Hashemi (UvA) *Modeling Users Interacting with Smart Devices*
4. Ioana Jivet (OU) *The Dashboard That Loved Me: Designing adaptive learning analytics for self-regulated learning*
5. Davide Dell'Anna (UU) *Data-Driven Supervision of Autonomous Systems*
6. Daniel Davison (UT) *"Hey robot, what do you think?" How children learn with a social robot*
7. Armel Lefebvre (UU) *Research data management for open science*
8. Nardie Fanchamps (OU) *The Influence of Sense-Reason-Act Programming on Computational Thinking*
9. Cristina Zaga (UT) *The Design of Robothings. Non-Anthropomorphic and Non-Verbal Robots to Promote Children's Collaboration Through Play*
10. Quinten Meertens (UvA) *Misclassification Bias in Statistical Learning*

11. Anne van Rossum (UL) *Nonparametric Bayesian Methods in Robotic Vision*
12. Lei Pi (UL) *External Knowledge Absorption in Chinese SMEs*
13. Bob R. Schadenberg (UT) *Robots for Autistic Children: Understanding and Facilitating Predictability for Engagement in Learning*
14. Negin Samaeemofrad (UL) *Business Incubators: The Impact of Their Support*
15. Onat Ege Adali (TU/e) *Transformation of Value Propositions into Resource Re-Configurations through the Business Services Paradigm*
16. Esam A. H. Ghaleb (MU) *BIMODAL EMOTION RECOGNITION FROM AUDIO-VISUAL CUES*
17. Dario Dotti (UM) *Human Behavior Understanding from motion and bodily cues using deep neural networks*
18. Remi Wieten (UU) *Bridging the Gap Between Informal Sense-Making Tools and Formal Systems - Facilitating the Construction of Bayesian Networks and Argumentation Frameworks*
19. Roberto Verdecchia (VU) *Architectural Technical Debt: Identification and Management*
20. Masoud Mansoury (TU/e) *Understanding and Mitigating Multi-Sided Exposure Bias in Recommender Systems*
21. Pedro Thiago Timbó Holanda (CWI) *Progressive Indexes*
22. Sihang Qiu (TUD) *Conversational Crowdsourcing*
23. Hugo Manuel Proença (LIACS) *Robust rules for prediction and description*
24. Kaijie Zhu (TUE) *On Efficient Temporal Subgraph Query Processing*
25. Eoin Martino Grua (VUA) *The Future of E-Health is Mobile: Combining AI and Self-Adaptation to Create Adaptive E-Health Mobile Applications*
26. Benno Kruit (CWI & VU) *Reading the Grid: Extending Knowledge Bases from Human-readable Tables*
27. Jelte van Waterschoot (UT) *Personalized and Personal Conversations: Designing Agents Who Want to Know You*
28. Christoph Selig (UL) *Understanding the Heterogeneity of Corporate Entrepreneurship Programs*