



Impact of Corporate Venture Capital on Digital Business Transformation: A Case Study in Germany

Nadine Ladnar^{1,2*}, Daniel Harder³, Ricardo Palomo⁴, Alexander Zureck^{2,5}

¹ CEINDO-CEU Doctoral Program in Economy and Law, Department of Finance, Faculty of Economics and Administration, 28003 Madrid, Spain

² Institute for Strategic Finance, FOM University of Applied Sciences, 45127 Essen, Germany

³ Department of Finance, Faculty of Economics and Administration, Masaryk University, 60177 Brno, Czech Republic

⁴ Department of Business Management, School of Business and Economic Sciences, Universidad CEU San Pablo, 28003 Madrid, Spain

⁵ Faculty of Economics and Administration, Masaryk University, 60177 Brno, Czech Republic

* Correspondence: Nadine Ladnar (nadine.ladnar@fom-net.de)

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Abstract: With the growing need for digital business transformation, corporate venture capital (CVC) investors have been faced with the challenge of how to deal with this trend. Although digital business transformation and CVC are highly relevant, previous studies have investigated them separately instead of their relationships. Therefore, this research aimed to study the impact of CVC on digital business transformation to fill this research gap. Based on an exploratory research design, eleven experts from different industries were interviewed. The following results were found in this study: (1) after the CVC unit collaborated with an Open Innovation (OI) unit, the CVC activities were integrated into the decentralized OI activities, and a dedicated team in the CVC unit was responsible for OI and venture client-based OI activities, thus achieving digital OI; (2) CVC was used to pursue ambidexterity, digital exploration or exploitation; (3) CVC supported digital business transformation at the organizational, social, and technical levels, which provided an answer to the overarching research question of how CVC supported innovation processes. Theoretical implications of this study lied in enhancing the understanding between CVC and digital business transformation, thus extending the understanding of CVC organization and impact. Furthermore, this study provided practical implications and recommendations on organizing CVC and using it to achieve digital business transformation according to strategic objectives.

Keywords: Corporate venture capital; Ambidexterity; Entrepreneurship; Innovation; Digital business transformation

1 Introduction

Digital transformation is of high strategic importance for German companies in various industries to stay competitive. These companies have been looking for process digitalization and automation and business model innovation in order to establish new digital businesses. Therefore, they have been looking for opportunities to lead ambidexterity. Start-ups tend to be more flexible and sometimes faster in trying out new methods and technologies. Companies are aware of not only the potential of the start-ups but also the intersection of CVC between corporate activities and start-up activities. In addition, many companies have established CVC units. However, the collaboration between other departments responsible for digital business transformation and innovation activities and the CVC unit was often unstructured. Moreover, companies are aware of the need of ambidextrous leadership abilities, but they do not know how to lead (digital) exploration and exploitation at the same time. Furthermore, companies have provided information (e.g., on their websites) that they used CVC to enable and support digital business transformation. However, studies of digital business transformation at different levels in the context of CVC are not available. Thus, managers do not have a guideline about how CVC supports digital business transformation. A literature review leading to the research questions of this study was provided as follows:

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Dushnitsky and Lenox [1] described economic and behavioral reasons of CVC investment, and CVC investing companies were more innovative compared with their non-investing competitors, which was repeated and evaluated from different perspectives in other studies. Wadhwa and Kotha [2] described the relationships between the patenting rate (an innovation indicator) and the activities of portfolio firms involved by CVC investors. In addition, Keil et al. [3] studied the contribution of CVC to innovation activities. Sahaym et al. [4] also investigated this topic by exploring the relationships between R&D expenditures and the number of CVC investments within an industry. Maula et al. [5] described CVC as an opportunity, which enabled managers to pay attention to the discontinuity of emerging technologies. Wadhwa et al. [6] found U-shaped relationships between innovation performance and the overall diversity of the portfolio, indicating that the relationships between CVC and innovation were previously focused.

Start-ups often carried out innovation activities based on existing technologies, which was concluded from the studies of Agarwal et al. [7], Agarwal et al. [8], Kim et al. [9] and Klepper and Sleeper [10]. Technology expertise existed, but innovation commercialization expertise did not, which enabled CVC to support start-ups.

In this context, Agarwal et al. [7] focused on the creative destruction of new ventures. Agarwal et al. [8] primarily paid attention to knowledge capabilities affecting spinouts. Anyway, the results were transferred to the CVC context because they described start-up needs and success factors. Kim et al. [9] focused on start-up innovation based on incumbent firms. Klepper and Sleeper [10] described knowledge exploitation from their parents, and also focused on spinouts. Anyway, a transfer to CVC was possible because of relationship similarities.

Dushnitsky [11], Kunz et al. [12] as well as Lee and Kang [13] focused more on the relationships between OI and CVC investment, and described the integration of CVC into OI activities, the role of outside-in innovation, and the monitoring of disruptive innovations, especially in the context of digital transformation. It should be taken into consideration that Kunz et al. [12] focused on legacy media. CVC was integrated into the OI activities of corporate investors, which was used by investors in OI activities from closed innovation processes to outside-in ones. In addition, the CVC integration especially supported investors to identify destructive technological discontinuity, meaning that OI process supported investors to make preparations for their digital transformation. Scuotto et al. [14], Martinez-Conesa et al. [15], Natalicchio et al. [16] as well as Meissner and Carayannis [17] described OI in general without specially focusing on CVC.

The relevance of CVC to OI has been clearly stated in scientific research. Anyway, the question how CVC activities can be structured to achieve OI has not been described in prior research and was answered by the first research question:

Question 1: How can CVC activities be structured to support OI activities?

Kunz et al. [12] showed that CVC activities supported exploration and exploitation, which was confirmed by Wadhwa et al. [6], by adding that the direction depended on the individual directions of investors. With a special focus on exploration, Wadhwa et al. [6] described the opportunity of knowledge creation to pursue offering new products and services. In addition, Dirik [18] focused on exploitation, and described knowledge creation as the center of internal process improvement rather than that of new business creation. Rossi et al. [19] described not only the ambidexterity of the CVC unit in general, including exploration and exploitation, but also the ambidexterity level (ambidextrous, hybrid, or dis-ambidextrous) dependent on the CVC focus (financial or strategic). Vrontis et al. [20], Soto-Acosta et al. [21], Ferraris et al. [22], Ferraris et al. [23] as well as Wassmer et al. [24] described ambidexterity in general without specially focusing on CVC.

Compared with CVC, more studies have been conducted on digital transformation. Fitzgerald et al. [25] described the need for digital transformation, the speed of transformation process, and the reason why digital transformation failed. Matt et al. [26] also focused on the strategic context of digital transformation and stated that digital transformation strategies needed to be aligned with other business strategies, or failure was the consequence. Sebastian et al. [27] described two main digital transformation directions: customer engagement and digitized solutions. Hess et al. [28] described a guideline for managers responsible for digital transformation, including strategic questions and possible answers. Chanas et al. [29] stated that a fixed digital transformation strategy did not exist. Instead, the transformation strategy formulation was emergent.

Karimi and Walter [30] showed the impact of dynamic capabilities on the response performance of digital disruption. Yeow et al. [31] used the dynamic capability approach in the context of digital strategy. Constantinides et al. [32] described this topic with a special focus on digital platforms and infrastructures. Li [33] described the digital transformation in the business model context using a holistic framework. Loebbecke and Picot [34] showed the influence of digitization and big data analytics on business and society.

It made sense to reach a conclusion on digital transformation because there have been many studies on this topic. Reis et al. [35] provided a literature review on digital transformation research before 2018. Vial [36] did further research and made a research agenda. Anyway, there is no research investigating the leadership of CVC digital ambidexterity. This research gap can be filled by answering the second research question:

Question 2: How does CVC realize (digital) ambidexterity leadership?

Maula [37] described the strategic focus and opportunities of CVC investment. As digital transformation was a part of most business strategies, it was also part of the strategic focus in this study. Different CVC types were used according to different objectives. Lantz et al. [38] described these types. Weber and Weber [39] described that CVC relational fit facilitated knowledge transfer and creation, which positively influenced organizational performance in the next step.

Dirik [18] showed the best practice of CVC and mentioned strategic objectives, including digital transformation. Instead of solely mentioning CVC, Mes and Heim [40] described corporate venturing in general and how it supported digitalization. Eckert [41] focused on innovation abilities and how CVC supported these abilities. As a strategy, innovation and digital transformation were connected, and the studies mentioned above were connected as well.

Becker and Kappenthuler [42] stated that CVC focused on monitoring the structural and technological change. Golla [43] mainly described factors influencing the CVC exchange relationships, and how corporate investors benefited from OI by accessing to start-up ecosystems. Napp and Minshall [44] drew a similar conclusion, and described strategic objectives (e.g., innovation) of CVC investment. By stating that CVC supported technological innovation, Lantz et al. [38] described strategic objectives more specifically than other researchers. In addition, Schaller [45] focused more on digital transformation, and described CVC to understand digital business models.

It was concluded that there were many studies of digital transformation in general, but few of them was about CVC in the context of digital transformation. Although this topic was mentioned by some researchers, it was not the key content of their studies. In addition, there has been no overall research on specific CVC factors supporting digital transformation. The third research question was derived from this research gap:

Question 3: How does CVC contribute to digital business transformation?

CVC units were quite transparent in their strategic focus. For example, Deutsche Bahn Digital Ventures [46] invested in mobility, logistics, industrial and clean technology. Robert Bosch Venture Capital [47] focused on artificial intelligence (AI) & deep learning, automation & digitalization, semiconductor & next generation computer, augmented reality (AR), virtual reality (VR), and mobility solutions. BASF [48] invested in new material, agricultural technology, digitalization, decarbonization, circular economy as well as new and disruptive business models. Boehringer Ingelheim Venture Fund [49] invested with a focus on therapeutic and digital health. Merck Ventures [50] invested in healthcare, life sciences, electronics and sustainability. These examples showed that the digital transformation focus was on websites of the CVC units. However, there were no scientific models of organization, ambidexterity leadership, and CVC contribution towards digital transformation.

To answer the three above-mentioned research questions, eleven experts with different jobs in different companies and industries were interviewed in a semi-structured manner. In the following chapter, the data sample and collection method and analysis were described. In the third chapter, the process results were presented in three subchapters according to the three research questions. In the fourth chapter, the results were critically discussed, recommendations for action were provided, and limitations were considered. This study ended with a conclusion in the fifth chapter.

2 Methodology

2.1 Data Sample and Collection

German CVC investors were defined as the data sample of this study, because data sample needed to represent the basic population. Moreover, economic considerations were recommended, meaning that not every German CVC investing company was part of the data sample. The criteria of choosing interviewees were their CVC experience, and their different points of view arising from different jobs in different companies and industries [51–53].

This study compared CVC activities of seven German organizations in the fields of chemical industry, automotive, mobility and banking sectors, politics, and research. The exact company names were not stated because the interviews were made anonymously. The data sample consisted of telephone interviews with eleven experts from March 2020 to April 2020. The expert interviews were made from different professional perspectives in order to meet the information triangulation requirement. The interviewees included investment managers from CVC units, a chief digital officer (CDO), a business development expert, a politician and German Digital Agenda Committee member, and a researcher [54, 55].

The interviews were anonymous so that the interviewees could provide internal corporate information about their companies and the results were more accurate. Therefore, each interviewee signed a privacy policy and informed consent document. The interviews were made in the native German language, and then were recorded, transcribed, and coded by the author of this study. The transcription was simplified, because this study was not a psychological analysis and the results should not be distorted. Interviewees had the chance to review their interview results (transcripts) and adjust their statements. Totally 589 minutes of recorded materials were transcribed on 171 pages [56].

To ensure that all relevant aspects were covered, semi-structured interviews with open-end questions were used, which allowed new insights to be discovered during the interviews. The structure of the interview guideline followed the research questions of this study [57]. The translated interview questions are shown in Table 1.

Table 1. Interview questions

Main Question 1	How do you use CVC as part of your OI process?
Sub-question	What role do discontinuous innovation projects play?
Main Question 2	Do you focus on digital transformation or digital new business?
Sub-question	Can you provide examples from your portfolio?
	What new resources and capabilities have you benefited from?
Main Question 3	What is the impact at the operational level?
Sub-questions	What is the impact on employees/multipliers?
	What is the impact on new business areas?
	What new knowledge has been generated?

2.2 Data Analysis

According to Mayring [53], qualitative content analysis was analyzing fixed communication based on theories and rules in a systematic way. It was recommended to choose a qualitative research approach when little had been known about the research field. Therefore, a qualitative approach was chosen in this study because there have been few scientific studies describing the relationships between CVC and digital transformation [52, 57–59].

The transcribed interviews were coded by the author using MAXQDA according to the principles of grounded theory, which aimed to uncover the key issues and patterns of how CVC contributed to the digital investment transformation. Based on codes and categories described by Selig et al. [60] in the deductive coding phase, the codebook was added by the author in an inductive coding phase. The final codebook consisted of codes from the open and axial coding process and those observed from the digital transformation literature. A frequency analysis approach was used in this study. Interviews represented material samples derived from the research questions. Different categories were built within a category system, with the minimum and maximum numbers of codes defined for each category. The remaining codes were summarized in terms of the digital transformation dimensions, such as digital data, automation, networking, and digital customer access [52, 53, 61–67].

A codebook was used in the selective coding phase. The initial 44 codes from the open and axial coding phase were reduced to 37 ones, which focused on the effects on transformation that arose in the core organizations.

For the first research question, four codes were used as follows:

- Venture client
- Decentralized OI activities
- Collaboration with a dedicated corporate OI team
- An OI team integrated into the CVC unit

For the second question, three codes were used as follows:

- Both (core and new business)/ambidexterity
- Digital transformation of core business/exploitation
- New digital business/exploration

As described above, the remaining codes were split into the following three categories to answer the third question:

- Social level
- Organizational level
- Technological level

A detailed overview on the categories, codes, and frequencies was provided in a table in the next chapter. The research team listened to the feedback from two interviewees and an investment manager to reduce the bias of the results.

3 Empirical Results

3.1 Contribution of CVC to OI

The first research question was how to structure CVC activities to support OI activities. It was found in the interviews that four different CVC organization types supported OI. Table 2 shows these four organization types and the code frequency used for the first research question.

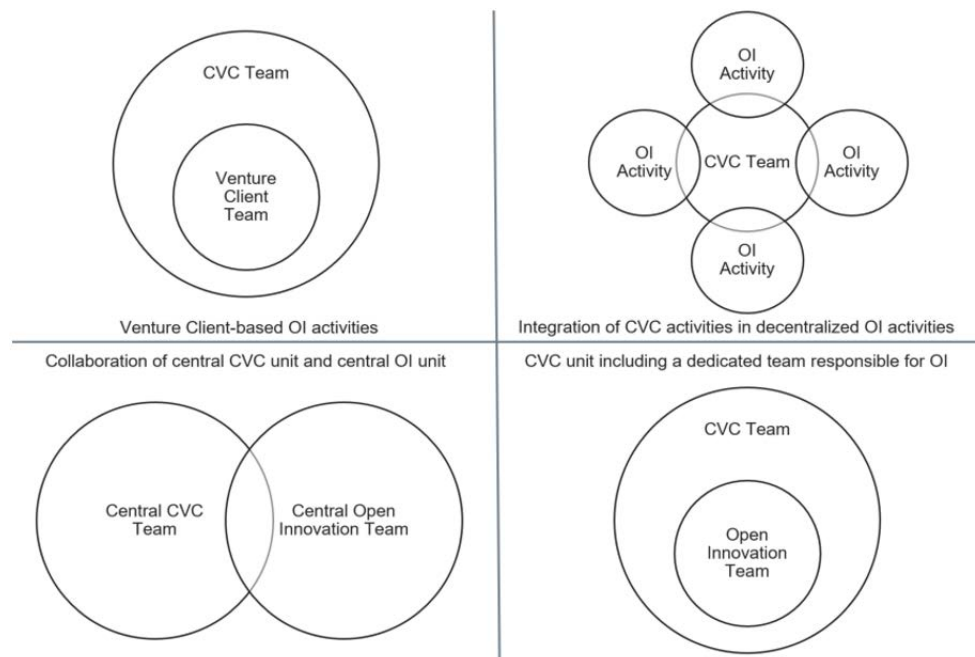
Companies adopted different ways to achieve CVC objectives in the context of OI and collaboration:

- 1) Venture client-based OI activities
- 2) Integration of CVC activities into decentralized OI activities
- 3) Collaboration of the CVC unit with another central OI department
- 4) The CVC unit included a dedicated team responsible for OI

Table 2. OI structure of interview results

Code system	Number of codes
Venture client	8
Decentralized OI activities	5
Collaboration with a dedicated corporate OI team	4
An OI team integrated into the CVC unit	3

(1) A visualization diagram in Figure 1 shows the different organization types to achieve OI. These types were not completely separate from each other. For example, an OI team, which was integrated into the CVC unit, also participated in decentralized corporate OI activities. In particular, the venture client process was carried out in different collaboration forms because it was a specific case of collaboration with the start-up, which was considered as a vendor rather than solely an investee company. The types were described as follows:

**Figure 1.** CVC activity organization to support OI activities

Instead of investing directly in a start-up, OI was achieved through the venture client model in the first organization type. The start-up was considered as a customer. Procurement departments of companies usually had clear regulations for suppliers, and start-ups were not considered to be reliable enough for companies to purchase their products. However, an exception was made in the venture client model, which enabled a company to obtain products instead of shares in the start-up in order to innovate based on it.

CVC activities were integrated into decentralized OI activities in the second organization type, because some companies neither had an OI department nor connected the CVC unit to such a department. In this case, the collaboration was decentralized. The CVC investment manager usually contacted the department related to the start-up product or service, and decided the personnel in charge case by case and how the start-up collaboration was organized to support OI activities.

In the case of a CVC unit collaborating with another central corporate OI unit, both units were considered as the central departments of a company, and regularly exchanged and organized knowledge transfer from the start-up investment towards the company. The central OI team usually collaborated closely with different business lines of the company to transfer knowledge to the core organization.

In the fourth organization type, the CVC unit assigned one or more team members to take charge of OI, thus transferring knowledge from the CVC unit to the core organization. The advantage was that the team was well-informed because it was part of the CVC unit. However, there was a risk of mistrust from the core organization because the CVC unit was often legally detached from it.

3.2 Core Business Transformation and New Digital Business

Current organizational processes needed to be understood to lead the core business well, because the processes were usually based on the core business. However, innovators needed to detach from the core business to develop an open mindset, thus exploring new business models. These different mindsets within one company conflicted without CVC. Interviewees explained the ambidexterity of CVC in investing in start-ups both close to and far away from the core business at the same time.

As shown in Table 3, most interviewees adopted an ambidextrous approach, instead of using CVC for either exploitation or exploration exclusively. Interviewees mentioned the approach thirteen times. Leading ambidexterity was a challenge for managers and leaders, which was solved by achieving exploration and exploitation at the same time using CVC. Therefore, it was possible for a company to transform the core business digitally by improving products, services, or even internal services. In addition, it was possible to establish a completely new digital business, by offering start-up solutions or new products and services derived from start-up technologies and synergies. Although not all managers and leaders did not know the term “ambidexterity”, it has been increasingly focused by scientific literature. On the one hand, the CVC unit was open externally, which did not affect the core business. On the other hand, the unit introduced completely new technologies and business models.

Table 3. Interview result transformation directions

Code system	Number of codes
Both (core and new business)/ambidexterity	13
Digital transformation of core business/exploitation	7
New digital business/exploration	6

As presented in the above table, interviewees mentioned the focus on exploitation seven times, and that on exploration six times. Some mentioned that there was a focus on one direction. Regardless, both directions were followed. Therefore, there were three codes for exploration, exploitation, and ambidexterity, respectively. For the second research question, it was concluded that most investors used CVC to lead ambidexterity. Anyway, CVC was also applied to lead exploitation or exploration.

3.3 CVC Supporting Digital Transformation

Rönick et al. [68] divided digital transformation into three levels, namely, organizational, social, and technical levels, which was further referred to as the Technology-Organizations-People (TOP) model [69, 70], meaning that digital business transformation could not be realized through technology only. Employees, customers, suppliers, and other people in the company needed to be included to realize successful transformation. Furthermore, corporate organization and processes needed to be adjusted. The categories used in this study were derived from this classification. The results are shown in Table 4. In addition to this deductive approach, more codes were needed in the inductive coding phase. For a deeper insight, the tables of inductive codes combined with deductive ones were in the appendix.

Table 4. Interview result transformation levels with code systems and number of codes (N)

Organizational level		Social level		Technical level	
Code system	N	Code system	N	Code system	N
Start-up ecosystem	33	Entrepreneurial employees	29	Automation	30
Innovation platforms	17	Knowledge resources	19	Digital customer access	8
Organizational resources	23	Entrepreneurial multipliers	7	Connectivity	7
Physical resources	7			Digital data	4
Financial resources	2				

At the organizational level, interviewees mentioned start-up ecosystem 33 times, innovation platforms 17 times, organizational resources 23 times, physical resources seven times, and financial resources twice. For example, interviewees said that they were organizing networking events, such as pitch competitions, which supported them to enter the start-up ecosystem to obtain new knowledge and information.

In digital business transformation support at the social level, interviewees mentioned three main factors. They first mentioned entrepreneurial employees 29 times, with a shift in their working behaviours and mindsets. Then they mentioned knowledge resources 19 times and entrepreneurial multipliers seven times. Interviewees stated that their teams shifted towards an open mindset and positively influenced the whole organization, demonstrating that flexibility of start-ups changed the way of thinking of employees.

CVC supported digital business transformation in four aspects at the technical level. Interviewees mentioned automation the most for 30 times, digital customer access eight times, connectivity seven times, and digital data used or generated four times. This level was described as dependent on the investment focus, new technologies or technologies improving existing products and services.

For the third research question, it was found that CVC supported digital business transformation at all three levels and the organizational level had the highest code frequency. It was derived that CVC supported digital business transformation at the organizational level the most, which was followed by the social and then the technical level. This conclusion supported current literature concerning the relevance of these three levels and added the role of CVC supporting the transformation at the three levels.

4 Discussion and Limitations

4.1 Recommendations for Action

Based on the results, Figure 2 provides an overview of the main recommendations for action. If companies did not have a dedicated OI department, the CVC unit collaborated with the department carrying out OI activities on a regular or irregular basis. This decentralized collaboration was special because the OI unit was usually specialized on certain topics, and the CVC unit possibly contacted the expert department in case of related investment opportunities. The expert department may focus on digital transformation. The disadvantage was that the core business department and the start-up should have a connection, meaning that successful CVC and OI activities depended on the right organizational structure. Therefore, the first recommendation for action was that companies should align CVC and OI activities according to their structures, which was targeted at CVC investing companies that pursued OI.

The second recommendation for action was that companies should use CVC to achieve exploration, exploitation, or ambidexterity according to their pursued directions. In particular, it was challenging to lead ambidexterity, which highlighted the advantage of CVC in supporting ambidexterity.

The third recommendation for action was that companies should pursue digital business transformation using CVC at social, organizational, and technical levels. With regard to the results at the organizational level, the highest priority was to obtain new knowledge and information in the start-up ecosystem. In terms of the results at the social level, this knowledge should be transferred into the organization and CVC should help change the mindsets and flexibility of the corporate employees, which was crucial to the transformation process.

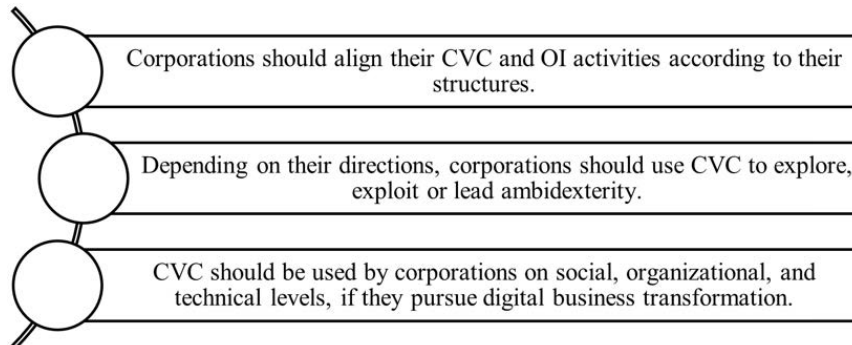


Figure 2. Overview of recommendations for action

4.2 Results in the Context of Existing Literature

4.2.1 OI

Many researchers have described OI without a specific link to CVC, including Bogers et al. [71, 72], Martinez-Conesa et al. [15], Natalicchio et al. [16], Thomas [73], and Vanhaverbeke et al. [74]. However, Radziwon and Bogers [75] stated that there were different ways of organizing OI without relation to CVC, which was confirmed by the research results of this study. In addition, more details were added to describe the possibility of different organization types, especially in the context of CVC:

1. Venture client-based OI activities;
2. Integration of CVC activities into decentralized OI activities;
3. Collaboration of a CVC unit with another central corporate OI unit;
4. The CVC unit included a dedicated team responsible for OI.

This showed that the conclusions of this study added details to the current studies. Companies should choose the most suitable way of integrating OI into CVC activities according to the organizational structures, objectives, and strategies.

Kunz et al. [12] described disruptive innovation in the context of CVC, and focused on the legacy media industry instead of providing general results. Interviewees said that their companies invested in start-ups to participate in disruptive innovation rather than being replaced with the innovation, which helped corporate investors to keep their competitiveness. For example, quantum computing had the potential to become disruptive innovation in the chemical industry. It was concluded that companies should invest in start-ups working on disruptive business models, thus making preparations for and participate in disruptive innovation.

Gimmy et al. [76] provided a basic overview of the venture client model and described that it was based on proof of concepts. However, the model was almost not studied because it was a new model and trend. According to Tischer [77] BMW was an example that successfully implemented this model, based on the information provided by 27 pilots. In addition, BMW supported companies implementing the model. Venture client in general was seen as a substitute for CVC. One of the interviewees said that a venture client team was part of the CVC unit, showing the integration. It was derived that corporate investors used the venture client model solely or together with other activities to connect OI and CVC activities.

To conclude, innovation has been studied, but the studies in the context of CVC are less. Anyway, many researches described and found that OI in the context of CVC was an important topic. Previous literature did not describe the collaboration between the CVC unit and the OI department, and this research gap was filled by this study.

4.2.2 Exploration, exploitation, and ambidexterity

Several researchers described ambidexterity in general without focusing on CVC, including Ardito et al. [78] Mom et al. [79] and Soto-Acosta et al. [80]. In addition, Hill and Birkinshaw [81] as well as Rossi et al. [19] described ambidexterity in the context of CVC, including different CVC orientations with ambidextrous, hybrid, and non-ambidextrous management focus, which was consistent with the results of this study. However, ambidexterity has not been studied in the context of CVC and digital business transformation, and the research gap was filled by this study by asking interviewees if they pursued:

1. Exploring new digital business
2. Exploiting core digital business
3. Ambidexterity in the context of digital transformation

It was found that this depended on the company, but CVC was able to pursue any type. If exploration was chosen, the start-up was not closely connected to the core business. Some companies only invested in start-ups clearly connected to the general core business or even specific business lines. This study showed that most of the CVC investors pursued both exploration and exploitation, i.e., ambidexterity, rather than only one direction.

Titus et al. [82] showed how external CVC was used for exploration. A general overview of exploration was provided instead of benefits by focusing on CVC. In addition, Wadhwa et al. [6] showed that CVC was used to explore new businesses or offer new products and services, which made sense under the condition that exploration was the objective of corporate investors. The most important was knowledge creation through start-up interaction. This study showed how new digital businesses were explored by corporate investors. Exploration examples were mentioned by interviewees. For example, a chemical B2B supplier cooperated with a start-up to get customer access. It was concluded that companies should invest CVC if they pursued to explore new digital business.

Wadhwa et al. [6] stated that exploitation was realized by improving internal processes and monetizing internal capacities through CVC. Wadhwa et al. [6] gave several examples, such as laboratories, production facilities, and operating departments (e.g., accounting and HR departments), which was supported by Dirik [18] who showed that gaining technological know-how through CVC investment and start-up interaction was the basis of product and service improvement and development, economic performance, competitiveness, and survival. Interviewees of this study confirmed these findings. For example, an app was used in production facilities to resolve technical issues. To conclude, companies should invest CVC if they pursued to exploit as part of their digital business transformation activities.

Ferraris et al. [23] showed that exploration and exploitation capabilities were combined simultaneously in ambidextrous strategies. As described above, Rossi et al. [19] explained different types of CVC ambidexterity. According to CVC orientation (financial or strategic) and the entrepreneurial intensity level, the CVC unit was considered as ambidextrous, hybrid, or non-ambidextrous, which was confirmed by interviews of this study. There have been neither current studies investigating how to achieve ambidexterity in the context of digital business transformation, nor examples of companies working on to explore and exploit at the same time. Therefore, this study showed how to use ambidexterity in the context of CVC and digital business transformation. An interviewee said that a CVC unit exploited by investing in a start-up to push the shop floor digitalization. In addition, the same corporate investor invested in quantum computing to explore new digital business. It was derived that companies should use CVC to explore new digital business and exploit at the same time as part of their digital business transformation activities, thus handling ambidexterity.

4.2.3 Social level

Rönick et al. [23] described three levels of Industry 4.0, and these levels were also used to describe digital business transformation:

1. Social level
2. Organizational level
3. Technical level

The classification was based on a socio-technical approach described by Freimuth and Freimuth [83] by referring to the study of Trist and Bamforth [84]. These levels were used in this study, and corresponding codes appeared in the interviews, showing that these levels were applied to CVC supporting digital business transformation.

Social capital was the keyword in the context of CVC at the social level, which was described by Wadhwa et al. [6]. Moreover, Maula et al. [85] showed that CVC added value to social capital by referring to the studies of Nahapiet and Ghoshal [86] Gabbay and Leenders [87] as well as Adler and Kwon [88]. Selig et al. [60] described transformation effects, which were assigned to the social level in this study based on the above scientific literature. Each type of transformation effects was explained in the context of CVC and digital business transformation as follows:

Selig et al. [60] described entrepreneurial community as an opportunity to stay in contact apart from an investment (e.g., after an investment), and referred to accelerator programs describing this aspect. Benson and Ziedonis [89] described entrepreneurial community in a CVC context rather than that related to accelerator programs, showing that it was used to describe the benefits of CVC in digital transformation rather than general organizational transformation. The code of entrepreneurial multipliers was mentioned seven times, which showed that it existed. Selig et al. [60] described entrepreneurial multipliers as a transformational dimension, and defined them as multiplier-effects triggered by the increased number of entrepreneurial employees of a corporate investor. In addition, entrepreneurial role models as well as internal coaches and mentors were mentioned. These have not been found in the present analysis because it was more common for corporate accelerators to develop entrepreneurial role models as well as internal coaches and mentors, compared with CVC.

Selig et al. [60] find the following three transformation effects under the transformational dimension of entrepreneurial employees:

- Creation of an entrepreneurial mindset
- Sensitization of top management
- Creation of entrepreneurial skillset

Some of these effects have been described in present literature in detail, such as an entrepreneurial mindset by Abrell and Karjalainen [90] top management sensitization by Horlacher and Hess [91] and entrepreneurial skillset by Wilson and Silva [92] which were mentioned by the interviewees, showing that they also appeared in the context of CVC and digital business transformation.

For internal corporate venturing, Abrell and Karjalainen [90] described a shift towards an entrepreneurial mindset. For accelerators, Selig et al. [60] described the creation of an entrepreneurial mindset as the change of individual stakeholders and participants. The code appeared eleven times in this study, showing that the mindset of stakeholders changed not only in the context of accelerators and organizational transformation in general, but also in CVC in the context of digital transformation. CVC should be used by companies, if they pursued the creation of an entrepreneurial mindset for their employees to achieve digital business transformation. Anyway, Teppo and Wüstenhagen [93] found a lack of entrepreneurial thinking and mindset was a reason for the failure of CVC deals, which should be taken into consideration.

Horlacher and Hess [91] described that digital business transformation became the key at the top management level with the role of CDO. Garrett and Neubaum [94] described the sensitization of top management through internal venturing rather than external venturing or even CVC. Selig et al. [60] described sensitization of top management as a result of the time of top managers contacting with entrepreneurial roles. For example, top managers played the roles of jury members, sponsors, or mentors. Interviewees of this study described the role of jury members in detail. The code appeared eleven times in total. In addition, the interviewees had regular meetings with top managers, where investment managers or business development employees informed the top managers of the latest trends appearing in the start-up ecosystem, showing that top management sensitization of organizational transformation using accelerator programs and that of digital business transformation using CVC differed slightly. Anyway, they were similar, and the result was the same, i.e. top management sensitization. It was concluded that companies should use CVC if they pursued the sensitization of top managers to achieve digital business transformation.

Instead of providing information on the number of codes, Selig et al. [60] found the creation of entrepreneurial skillset as a further code of entrepreneurial employees, and defined this transformation effect resulting from coaching and mentoring as well as new working methods learned by employees during acceleration programs, such as design thinking and lean start-up methods. This code appeared three times in the interview results, showing that it was weaker than the ones mentioned above. The creation of an entrepreneurial skillset was possible, but the extension was

lower for CVC than accelerator programs. Interviewees mentioned the code of new work, which was mentioned two times. Interpretation of new work was based on whether it was part of entrepreneurial skillset, such as new working methods described by Selig et al. [60]. Another weak code found in this study was the creation of openness, which was mentioned twice. New work and creation of openness were not described by Selig et al. [60] which could be investigated in detail in further study because they were weaker than the other codes. To conclude, companies should use CVC if they pursued the creation of an entrepreneurial skillset for their employees to achieve digital business transformation. Anyway, it should be considered that the results of CVC deals depended on existing entrepreneurial skills. Wilson and Silva [92] and Da et al. [95] described the difference and the different performance.

Wadhwa et al. [6] showed that knowledge creation through CVC added value at the social capital level. To describe the influence of accelerator programs on organizational transformation, Selig et al. [60] described the opportunity of knowledge creation by referring to the studies of Burgelman [96] and Elia et al. [97] and the following three transformation effects were found:

- Creation of methodical know-how
- Creation of customer insights
- Creation of technological know-how

These codes were also found in the interview results, showing that knowledge was transferred in the context of CVC and digital business transformation as well. It was derived that companies should use CVC if they pursued knowledge creation for their employees to achieve digital business transformation.

Elia et al. [97] and Selig et al. [60] described methodical know-how creation dealing with new working methods and styles. Taking design thinking as an example again. This code was mentioned in the interviews five times, showing that creation of methodical know-how through CVC supported digital business transformation. To conclude, corporations should use CVC to create methodical know-how for digital transformation activities.

Customer insights were also confirmed in the interviews. Selig et al. [60] described the creation of new know-how and market trends. Although accelerator programs were described to transform the organization in general, the same code was found in the interviews five times, showing that customer insights were also generated through CVC to achieve digital business transformation. It was derived that corporations should use CVC to create customer insights for digital transformation activities.

Selig et al. [60] described technological know-how as another transformation effect, which focused on new knowledge of technologies and product features that had not been used by a corporate investor before. Whereas Selig et al. [60] described technological know-how creation for corporate accelerators, and Wadhwa et al. [6] described it for CVC. The generation of technological know-how was mentioned nine times by interviewees, showing that it was possible to achieve technological knowledge creation through CVC. Technologies were relevant especially in the context of digital transformation, which was described by interviewees and was also derived from the number of codes. Whereas methodical know-how creation and customer insights were mentioned five times, respectively, and technological know-how creation was mentioned nine times. It was concluded that companies should use CVC to create technological know-how for digital transformation activities.

4.2.4 Organizational level

As mentioned above, organizational, relational, financial and physical resources belonged to the organizational level, which were described one after another in the following. Dirik [18] showed that companies used CVC to stay up-to-date and be prepared for radical change. Based on this, Eckert [41] described rising abilities to change and stay innovative and competitive through corporate venturing. Selig et al. [60] concluded innovation platforms under relational resources, and defined a start-up ecosystem between relational and financial resources. In addition, entrepreneurial multipliers were defined as a transformation dimension between human and relational resources. To simplify this, the start-up ecosystem and innovation platforms were listed under relational resources in this study. Entrepreneurial multipliers were listed under human resources and described above. To conclude, companies should use CVC if they pursued to build relational resources to achieve digital business transformation.

Svahn and Mathiassen [98] described the main advantages of an external innovation ecosystem. Wilson and Silva [92] showed that entrepreneurial ecosystems were developed through venture capital (VC) without a specific focus on CVC, which was similar to the study of Park and Vermeulen [99] where the term start-up ecosystem was used in a general VC context rather than a CVC context. Under a start-up ecosystem, Selig et al. [60] described two transformation effects through accelerator programs, which were access to start-up ecosystem and strategic options. These effects were also found in CVC supporting digital business transformation. Selig et al. [60] described access to the the start-up ecosystem, which offered spin-out opportunities for employees interested in working on their ideas. This was different in the context of CVC as the collaboration structure was different. Therefore, the research focus was collaboration between corporate investors and certain stakeholders, thus describing the access. The interview results showed that it was not only about collaboration between a CVC unit and the start-up and access to a network. Such collaboration and networking opportunities in this direction were mentioned 17 times, showing how large the collaboration effect was. Anyway, interviewees mentioned two more collaboration opportunities.

Internal networking was mentioned ten times, especially OI, which was of high importance. Moreover, networking between corporate investors was described two times. Further research can be conducted to figure out how many CVC investors are connected to each other and how they benefit from this collaboration. One of the interviewees said the following case: if a company analyzed and found that a start-up was not connected to its core business, other corporate investors were informed because this might be related to their focus areas and vice versa. It was derived that companies should use CVC to create access to the start-up ecosystem, internal networking, and networking between corporate investors to achieve digital business transformation.

In 2006, Lubatkin et al. [100] showed that the integration of top management teams into collaboration activities enabled top managers to be aware of strategic options. Lee et al. [101] described different strategic options, such as strategic alliances, joint ventures, licensing agreements, M&A, OI, and collective intelligence. Benson and Ziedonis [89] also described CVC performance results in general with a focus on the influence on M&A activities. These strategic options went along with CVC, substituted it, or followed CVC investments. Selig et al. [60] considered future acquisition investments as examples of strategic options, and the strategic fit played a role in this context, which was confirmed by the interviewees. Strategic options were mentioned six times, showing that they were also supported by CVC. Especially if digital business transformation was pursued and integrated into a corporate investor's strategy, this digital business transformation was supported or rather achieved through CVC. It was concluded that CVC should be used if companies pursued the creation of strategic options to achieve digital business transformation.

Narsalay et al. [102] described four OI modes according to knowledge hiddenness and problem complexity. If both factors were low, it was a traditional IP contract; if the problem complexity was high and knowledge was available, it was OI partnership; if both factors were high, OI communities were used; if the problem complexity was low and knowledge was hidden, OI platforms and contests were used. For the transformation dimension innovation platforms, Selig et al. [60] described two main transformation effects for accelerators: innovation exchange platforms and exposure to new sponsors. The latter was not mentioned in the interviews for this study, however, the former was mentioned twelve times. Selig et al. [60] described these innovation exchange platforms in a way that physical and virtual meetings were possible, such as pitch events and demo days, which were organized by CVC investors, or participated by them to extend their network and get inspired for the innovation development. In addition, three interviewees mentioned the specific importance of new ideas generated through interaction, which were the basis for (digital) innovation of corporate investors. It was concluded that companies should use CVC if they pursued the creation of innovation exchange platforms.

Izquierdo et al. [103] described difficulties of operational renewal and the role of dynamic capabilities to withstand these challenges. For operational renewal, Selig et al. [60] described two main transformation effects: the creation of both operational flexibility and new processes. The code of operational flexibility was mentioned the most in the interviews. Interviewees mentioned that their speed, flexibility, and error culture increased by learning from start-ups. Moreover, start-ups were faster in the context of development and change, because it was easier for them to adjust flexibly according to market requirements. In addition, the creation of new processes was mentioned by the interviewees five times in total. Selig et al. [60] described process adjustments within the core organization of an investor, which was detected by the interviewees. One of the interviewees said that a new process was set up in the company, which achieved digital manufacturing support via mobile devices through CVC, showing that operational renewal was achieved through CVC, especially in the context of digital business transformation. It was concluded that companies should use CVC to create new processes and operational flexibility as part of their digital transformation activities.

Kunz et al. [12] showed exploration and exploitation opportunities created new business opportunities. Selig et al. [60] described new business creation, which consisted of two main transformation effect, by referring to the study of Antoncic and Hisrich [104]. The first transformation effect was the creation of new business in general not directly linked to the investor's core business. The creation of new business was mentioned by interviewees five times, showing that it was created through CVC for digital business transformation in a way similar to that through accelerators for organizational transformation in general. The second transformation effect was the creation of new services or features, which complemented existing products to improve customer satisfaction and experience. The creation of new services or features was mentioned two times. It can be reviewed in further research whether CVC has a strong impact on the creation of new digital services or features, because interviewees mentioned the transformation effect very few times. Anyway, joint development with start-ups was mentioned. For example, a bank offered sponsoring service, which was developed with an investee company, aiming to support the core financial products. It was derived that CVC should be used to achieve digital business transformation in order to create new business, services, and features.

Rossi et al. [105] described the strategic benefits of CVC and financial objectives pursued with CVC investments. However, the study was limited to the US market rather than the German or European market. Selig et al. [60] described the start-up ecosystem as a transformation dimension, partly belonging to financial resources and partly to relational resources. The start-up ecosystem was completely assigned to relational resources to simplify the results

in this study. Moreover, Selig et al. [60] assigned new business creation partly to financial resources and partly to physical resources. New business creation was assigned to physical resources in this study to simplify the results again. Financial resources were used as their own code in the analysis, because no transformation dimension was left for the resource category. Financial benefits were mentioned only by two interviewees, showing that strategic benefits were specially focused, especially in the context of digital business transformation, where financial benefits were less important. Anyway, the interviewees said the following: when there was a shift in strategy, or the start-up did not perform well, the focus on financial benefits, resulting from an exit, increased. It was concluded that companies should use CVC if they pursued the creation of financial resources to achieve digital business transformation. Anyway, the risk should be considered.

4.2.5 Technological level

In 2009, Benson and Ziedonis [89] described a window on technology as an opportunity provided by CVC. Hamm et al. [106] interviewed an industry professional to get an overview of CVC market trends and to describe technology trend monitoring, without providing technology details. A detailed literature analysis showed that there was almost no research on the analysis of CVC supporting digital business transformation at the technical level. Four dimensions of Berger [107] were used at the technical level:

- Automation
- Digital customer access
- Connectivity
- Digital data

By indicating the occurrence of disruptive innovation and the need of staying competitive, Coccia [108] described the need for monitoring potentially disruptive technologies. Acevedo-Berry [109] also studied disruptive technologies by referring to the study of Christensen et al. [110] which underlined the relevance of studying emerging and potential disruptive technologies.

Berger [107] showed that robotics and additive manufacturing promoted automation, and described drones and autonomous vehicles as propositions. Additive manufacturing was mentioned six times by interviewees, showing that this technology was supported by CVC. However, robotics was not mentioned. Besides, interviewees mentioned quantum computing 18 times, showing that this technology was quite important to corporate investors. Quantum computing was described as the focus because it had potential disruptive influence. Especially in the chemical industry, quantum computing calculated for chemical experiments, which could make chemical experiments obsolete. Pioneer experiments were carried out by Google, as described by Rubin and Neill [111]. Moreover, AI was mentioned six times in the interviews, showing the importance of this topic as well. One interviewee mentioned “digital employees” working for their companies in the future. It was concluded that CVC enabled automation to support digital business transformation of the corporate investor. Additive manufacturing, quantum computing, and AI were the most used ones. To conclude, companies should use CVC under the condition that they pursued automation to achieve digital business transformation.

Referring to the study of Krings et al. [112], Dremel et al. [113] showed that digitalization had the strongest impact on sales processes when it included digital customer access. Berger [107] showed that social networks and mobile internet/apps promoted digital customer access, and described e-commerce, infotainment, and fourth-party logistics as propositions. Mobile internet and apps were mentioned six times by interviewees. For example, manufacturing service was obtained using a mobile app. Social networks were mentioned twice. In this context, future research can figure out the impact of CVC on the usage of social networks. It was concluded that CVC enabled digital customer access to support digital business transformation. Mobile internet and apps were the most used ones. It was concluded that companies should use CVC if they pursued digital customer access to achieve digital business transformation.

Based on the study of Lipsmeier et al. [114], Bansmann et al. [115] described different technologies leading to connectivity, such as cloud computing. Berger [107] showed that cloud computing and broadband promoted connectivity, and described smart factories, pure digital products, and remote maintenance as propositions. Cloud computing and broadband were both mentioned twice by the interviewees, which showed that they were weaker than the other ones mentioned. The impact of CVC on them can be analyzed in future study. Blockchain was not described by Berger [107] but was mentioned by interviewees three times, showing that it was weaker than others but was supported through the usage of CVC. Support of CVC for connectivity was weaker, which should not lead to wrong conclusions. As described above, networking was highly important at the organizational and social levels. It was weak at the technological level, which did not mean that connectivity, in general, was not supported. It was concluded that CVC enabled connectivity to support digital business transformation, with stronger influence at the organizational and social levels than at the technological level. It was concluded that companies should use CVC if they pursued connectivity to achieve digital business transformation.

Berger [107] showed that wearable, big data, and Internet of Things (IoT) promoted digital data, and described data-based routing, demand forecasts, and predictive maintenance as propositions. Zragat [116] analyzed the impact

of big data on corporate financial reports without relation to CVC. Reddy et al. [117] described the security of structured and semi-structured big data outsourced to the cloud, and built relationships between the connectivity and the digital data dimensions to explain this. Interviewees did not mention wearables, but mentioned big data and IoT twice, showing comparably weak support of the two. However, digital data was analyzed in a wider context. For example, one interviewee mentioned that data was collected or used as an intermediate step for new business models. Influence of CVC on enabling digital data to support digital business transformation can be analyzed in further study. To conclude, companies should use CVC if they pursued the creation or usage of digital data to achieve digital business transformation.

The analysis of focus areas on the websites of CVC investors provided further insights. Deutsche Bahn Digital Ventures [46] described investments in mobility, logistics, industrial and clean technology, showing a focus on Berger's [107] dimension "connectivity". Robert Bosch Venture Capital [47] described investments in AI & deep learning, automation & digitalization, semiconductor & next generation computer, AR, VR, and mobility solutions, showing a focus on Berger's [107] dimensions "digital data" and "automation". BASF [48] described investments in agricultural technology, digitalization, decarbonization, circular economy as well as new and disruptive business models, showing a focus on all of Berger's [107] dimensions, because they were part of the Industry 4.0. Boehringer Ingelheim Venture Fund [49] described investments in therapeutic and digital health, showing a focus on Berger's [107] dimension "digital customer access". Merck Ventures [50] described investments in healthcare, life sciences, electronics and sustainability. Healthcare and life sciences were data-intensive in studies concerning these topics, showing a focus on Berger's [107] dimension "digital data". Apart from the interview results, it was found that CVC supported different dimensions and its technological focus was provided on the CVC units' websites. It was concluded that companies should use CVC if they pursued social, organizational, or technical opportunities to achieve digital business transformation.

Many researchers have studied digital transformation, especially from the last few years. Most of the studies focused on innovation and the role of digital transformation, and described in detail why digital transformation was important and how to make it a part of or go along with corporate strategy. Studies of digital transformation in the context of CVC were not so many, which mentioned that CVC was used for digital transformation. Anyway, there has been little research on how this was carried out. There has been no holistic description of how CVC supports digital transformation and in which dimensions this happens, which was another research gap filled by this study.

It was found that CVC supported digital transformation at three levels:

- Social level
- Organizational level
- Technological level

It was derived that the findings of this study supported existing literature, which showed that CVC supported digital transformation. This study had more findings, such as the way of organizing, the levels, and the exact changes in the organization. It was derived from the above findings that CVC should be used by companies if they pursued digital business transformation.

4.3 Limitations

The qualitative approach was applied in this study based on German and English scientific literature from 1894 to 2020. Literature available in other languages was not reviewed.

Researchers gave different definitions for CVC. Some definitions included internal CVC, and some only included external CVC. Some researchers considered that CVC units invested in funds. Some like Waite [118] thought CVC units were only engaged in direct investment. Asel et al. [119] defined internal CVC as direct CVC investment and external CVC as investment through an external VC fund. However, some researchers considered that external investment also included direct investment.

Although CVC was described as an emerging topic by several researchers, the study of CVC was general and not detailed, especially in the context of digital business transformation. It was found that CVC had an impact on digital business transformation, but there were no details.

As described by Li [33] the understanding of emerging trends in business model innovations was poor, such as digital transformation of business models, though it was such an actual topic.

Interviewees represented German organizations in different industries, namely, chemical industry, automotive, mobility and banking sectors, politics, and research. Therefore, the applicability of the results was limited, especially for CVC units in other industries. The applicability of the developed model should be tested using a quantitative research approach. The approach was applied for evidence, because the sample size was large.

The interview results showed differences in the number of codes mentioned, which led to two challenges. The first was evaluation of this number and drawing a direct conclusion concerning the importance of a code. However, a code was described several times because of a long conversation or actuality rather than its importance. Another challenge was dealing with codes not mentioned often. For examples, some codes were mentioned only twice.

This study showed the positive impact of CVC on digital business transformation, because the research questions were formulated positively. Therefore, the answers of interviewees were positive as well. However, this could lead to a bias, because CVC supporting digital business transformation was described in a positive way, without describing things concerning resources, challenges or opportunity costs of the investments.

Finally, CVC and digital business transformation were described without considering other factors, such as factors influencing digital business transformation positively or negatively.

5 Conclusion and Outlook

The previous analysis offered insight into open internal innovation process of CVC to digital business transformation, which showed that there were different ways to achieve this opening depending on the CVC investor's focus. In further research, quantitative or qualitative research methods can be used to analyse other regions and derive general results. Moreover, different levels of digital business transformation can be analyzed in detail to provide more information about the specific support of CVC at these levels. As the focus of this study was the German CVC market, an investigation of other CVC markets and the comparison with the results of this study can be valuable. In this study, experts from different industries were interviewed to get an overall insight of the impact of CVC on the digital business transformation. An analysis of differences between industries can add further details and results.

The main findings of the study were related to the three research questions. First, OI was pursued through venture client, by organizing CVC to decentralized OI activities, through collaboration with a dedicated corporate OI team, and an OI team integrated into the CVC unit. It was recommended for companies to align the CVC structure to their corporate structures using one of the four approaches. Second, CVC was applied to lead exploration, exploitation, or ambidexterity, which were the three objectives of the second research question. It was recommended for companies to decide which of the three approaches was relevant according to their corporate strategy, build conciseness for it and invest in start-ups, thus strengthening the core business (exploitation), exploring new business (exploration), or achieving both (ambidexterity). Third, CVC supported digital business transformation at the organizational, social, and technical levels. An awareness of these three dimensions should be the key for transferring added value through CVC into the organization.

When referring to these findings, it should be taken into consideration the limitations caused by sample size and data collection methods, as well as the generalizability of the findings.

Data Availability

The qualitative data supporting our research results are under privacy or ethical restrictions. The data are available from Ladnar, Nadine for researchers, who meet the criteria for accessing confidential data.

Conflicts of Interest

The authors declare no conflict of interest.

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Appendix

Appendix Table 1. Interview result transformational levels - organizational level

Code system	Number of codes
Relational resources	
Start-up ecosystem	
Access to start-up ecosystem	17
Internal networking	10
Strategic options	6
Innovation platforms	
Creation of innovation exchange platforms	12
Creation of new ideas	3
Creation of networking opportunities between corporates	2
Organizational resources	
Operational renewal	
Creation of operational flexibility	18
Creation of new processes	5
Physical resources	
New Business Creation	
Creation of new business	5
Creation of new features/services	2
Financial resources	2

Appendix Table 2. Interview result transformational levels - social level

Code system	Number of codes
Human resources	
Entrepreneurial employees	
Creation of an entrepreneurial mindset	11
Sensitization of top management	11
Creation of entrepreneurial skillset	3
New Work	2
Creation of Openness	2
Entrepreneurial multipliers	
Creation of an entrepreneurial community	7
Knowledge resources	
Know-how creation	
Creation of technological know-how	9
Creation of methodological know-how	5
Creation of customer insights	5

Appendix Table 3. Interview result transformational levels - technological level

Code system	Number of codes
Automation	
Quantum computing	18
Additive manufacturing	7
AI	6
Digital customer access	
Mobile internet/apps	6
Social networks	2
Connectivity	
Blockchain	3
Broadband	2
Cloud computing	2
Digital data	
IoT	2
Big data	2