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A Review and Research Agenda

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REVIEW PAPER

Understanding corporate entrepreneurship in the digital age: a review and research agenda

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Abstract

In a digital world increasingly characterized by new business opportunities and challenges driven by the proliferation of pervasive digital technologies, companies are more than ever called to act entrepreneurially. This scenario has raised important questions at the intersection of corporate entrepreneurship (CE) and digital technologies, as we currently lack a comprehensive understanding on the implications of digital technologies in CE strategy, related antecedents, processes, and outcomes. To fill this gap, our study takes stock of the extant literature on CE in the digital age. Through a review of 54 studies, we craft an integrative framework of CE in the digital age, articulated across six building blocks. Building on the proposed framework, we elaborate a research agenda for future research.

Keywords Corporate entrepreneurship · Digital technologies · Systematic literature review · Digital transformation

JEL Classification M1 · M10 · M19 · M20

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1 Introduction

The purpose of this article is to provide an overview of the state of research and outline a future research agenda on corporate entrepreneurship (CE) in the digital age—intended as CE process actions and outcomes influenced or shaped by the pervasive role played by digital technologies (Simsek et al. 2020; Menz et al. 2021; Murtinu et al. 2021). Digital technologies are widely considered as one of the most powerful enablers in entrepreneurship, highly influencing entrepreneurial processes, outcomes, and agency (Nambisan 2017; Von Briel et al. 2018). Starting from Nambisan's seminal work (2017), scholars have discussed the crucial role of digital technologies in enabling entrepreneurial pursuits at different levels of analysis, with specific reference to new ventures (Cavallo et al. 2019; Kraus et al. 2019; Morkunas et al. 2019; Lin and Maruping 2022). However, in a digital world that is increasingly dynamic, interconnected, and uncertain, corporations are urged to act entrepreneurially as an antidote to inertia and business stagnation (Corbett et al. 2013; Arvidsson and Mønsted 2018; Covin et al. 2020). Moreover, from a managerial perspective, trying to promote entrepreneurship in a corporate context without taking into consideration the pervasive influence of digital technologies on corporate entrepreneurial processes and outcomes may result a vain exercise.

This important phenomenon has attracted growing scholarly attention[1] to address the implications of digital technologies for "entrepreneurship in a corporate context"—i.e., corporate entrepreneurship (CE) (Reibenspiess et al. 2022; Petzsche et al. 2023). CE is traditionally conceived as all the entrepreneurial activities in incumbent firms aimed at creating and adding new business or at developing and fostering innovation in order to achieve competitive advantage (Burgelman 1983; Phan et al. 2009; Corbett et al. 2013). However, recent CE research has questioned whether scholars need to reconsider, extend, or reframe the current extant CE's conceptualization, related processes, and outcomes in the light of an era characterized by highly powerful digital technologies—i.e., the digital age (Vassilakopoulou and Grisot 2020; Ghosh et al. 2021). Recent reviews on CE have investigated other aspects than digitalization (see Pirhadi and Feyzbakhsh 2021 for a review on CE and internationalization) or provide an overall perspective on the literature in this field (see, for instance, Urbano et al. 2022), without recognizing the centrality of digital technologies in the CE debate. As highlighted by recent works (see Simsek et al. 2020; Menz et al. 2021; Murtinu et al. 2021), several questions have been raised concerning whether and how digital technologies are changing the nature of CE. Therefore, we deem that the topic deserves to be systematically examined.

[1] A refined search in the SciVerse Scopus database yielded 378 articles at the crossroads of corporate entrepreneurship and digital technologies, appearing in academic journals or conference proceedings. Among these, 272 articles (72%) were recently published, specifically in 2018 or later. For further information, refer to Sect. 2 for details on the search strategy and contributions identification.

In the light of these considerations, this article addresses the following question: How are digital technologies shaping the extant body knowledge of CE? To answer this question, we performed a systematic search (Tranfield et al. 2003), which resulted in 54 academic journal articles and conference proceedings. Since our study represents the first review on CE and digital technologies, we deem the systematic approach (Tranfield et al. 2003) as the most appropriate to enable a comprehensive mapping of the extant body of knowledge on this emerging subject, as well as to ensure verification of content analyzed or replication of the analysis. The 54 articles constituting our final sample were hence reviewed to take into consideration quantitative elements characterizing the extant literature (e.g., number of publications per year, publication types, percentage of publications per journal, industry and geographical distribution), as well as qualitative elements, which could lead to the identification of a future research agenda (Rauch 2020; Bacq et al. 2021; Kraus et al. 2023). This approach seeks to meaningfully synthesize existing works, laying a foundational framework that is inherently beneficial for future research (Davidsson and Gruenhagen 2021; Kraus et al. 2022a). We synthesize the results using the "input–process–output" logic (Fernhaber and Zou 2022; Urbano et al. 2022).

Based on our analysis of the literature, we present an overarching integrative framework describing CE in the digital age as a phenomenon where digital technologies trigger and enable corporate entrepreneurial action.

This study contributes to the literature in two main ways. First, we examine the extant conceptualizations and perspectives on CE in the digital age. As a result, we propose a comprehensive view that reflects what is, to date, CE in the digital age. Fundamentally, we provide evidence and arguments on the emergent nature of what could become a distinct research field and yet is not at present. Second, we propose a framework that may help to critically analyze the current status of knowledge of CE in the digital age as well as to properly identify new avenues that warrant further research.

2 Method

As the main purpose of this study is to take stock and organize the body of knowledge concerning CE in the digital age, we conducted a literature review based on a systematic search as the first attempt to focus on research at the intersection of CE and digital technologies in incumbent organizations. As defined by Petticrew and Roberts (2008, p. 2), "reviews are a method of mapping out areas of uncertainty, and identifying where little or no relevant research has been done, but where new studies are needed." The recently emerging research at the intersection of CE and digital technologies is still fragmented and undertheorized, thus representing an opportunity for an effort to systematize these research contributions, so that a systematic literature review "is not the end of the road, but the beginning of new journeys" (Massaro et al. 2016, p. 793). Thus, we followed the procedures of a systematic search to give structure and guide future research on CE in the digital age

(Kraus et al. 2020, 2022b; Bacq et al. 2021; Sauer and Seuring 2023). Accordingly, the study adopted Tranfield et al.'s (2003) recommendation as a guiding framework for conducting a literature review in the management and business field, employing a multi-step process (Di Stefano et al. 2010; Ghezzi et al. 2018; Cavallo et al. 2019; Kimjeon and Davidsson 2021). Following we explain searching, screening, and extraction/synthesis stages.

2.1 Search and identification

The review commenced with a search on the SciVerse Scopus online database to identify scholarly articles at the convergence of corporate entrepreneurship and digital technologies. Given that Scopus offers a more comprehensive and less selective approach compared to databases like Web of Science, it implies a broader exploration of international publications, making it potentially more attuned to the topic under investigation (Ghezzi et al. 2018; Gusenbauer and Haddaway 2020; Paul and Criado 2020). Furthermore, the Scopus database is frequently employed as a primary reference for systematically searching in literature reviews (Spender et al. 2017; Roshanghalb et al. 2018; Cavallo et al. 2019; Busch 2022).

In the first step, the study's research question was stated in line with the aforementioned goal. Our review aimed to take stock of existing literature at the intersection of CE and digital technologies while charting new research pathways for the future of research on CE in the digital age. To enhance the chances of thoroughly exploring existing research on CE in the digital age, The query was intentionally broad, aligning with commonly used and recognized terms in the literature to describe entrepreneurship within corporations, ensuring a comprehensive search (e.g., Castriotta et al. 2021; Glinyanova et al. 2021; Urbano et al. 2022), namely, "corporate entrepreneurship" (Burgelman 1983), "corporate venturing" (MacMillan et al. 1986), "intrapreneurship" (Pinchot 1985), "entrepreneurial employee activity" (Stam 2013), "internal entrepreneurship" (Jones and Butler 1992), "internal venturing" (Stopford and Baden-Fuller 1994), "strategic renewal" (Zahra 1993), "organizational renewal" (Kuratko 2007), and "strategic entrepreneurship" (Morris et al. 2010). In order to search for papers dealing with CE in the digital age, we employed all of these terms (corporate entrepreneur*, intrapreneur*, internal entrepreneur*, strategic entrepreneur*, corporate ventur*, strategic renewal, entrepreneurial employee, internal ventur*, organizational renewal) in the titles, abstracts, keywords, and texts of the articles, crossing each of these terms with the comprehensive term "digital" (see Table 3 in the Appendix). While digital technologies manifest themselves through numerous and ever-growing technological streams (e.g., artificial intelligence, big data, cloud computing, blockchain), we opted to consider the broader term "digital" to possibly include a wider range of studies: this approach is shared by similar previous reviews of fields at the intersection with digital technologies (for instance, see Kraus et al. 2019 for a review on digital entrepreneurship). As a result of this search strategy, 743 studies were identified for screening.

In the second step, criteria for inclusion or exclusion of articles from our sample were established. First, given the dynamic and expanding literature on corporate entrepreneurship in the digital age, we chose to review papers published in both academic journals and conference proceedings, mirroring the approach commonly used in literature reviews addressing emerging topics (Adams et al. 2016; Saunders et al. 2016; Ghezzi et al. 2018; Silva et al. 2021). as our aim was to concentrate on articles on CE in the digital age with managerial implications, while retaining a broad scope, our search was confined to the subject areas of "Business, Management and Accounting", "Social Sciences", "Economics, Econometrics and Finance" and "Decision Sciences"—hence excluding corporate entrepreneurship studies from fields and disciplines outside the social sciences (e.g., Engineering, Computer science, or Medicine). Third, to keep our broad scope, no time limitation was implemented, and we considered all the articles published in Scopus up to the date of collection (i.e., September 2022). Finally, only studies published in English were selected, since there were no justifications to include other languages besides the academic lingua franca English and to avoid language bias (Kraus et al. 2022b). In accordance with the aforementioned inclusion and exclusion criteria, 295 studies were removed, resulting in a sample of 448 articles. Overlapping results (70) were also eliminated, thus obtaining 378 articles from this identification phase.

2.2 Screening

Studies identified through the query were analyzed to select those in scope for this work. Thus, the authors performed a two-step process of screening, first, based on abstract reading, and then, for those articles which passed abstract screening, based on a full paper reading. Documents included in the study had to relate to CE in the digital age and they had to be relevant, as inferred from their abstract (step 1) or by examining the full paper (step 2). More specifically, the following second level criteria determined whether studies were included: (i) articles discussing CE and digital, and (ii) articles discussing digital technologies in CE (see Table 4 in the Appendix for the complete list of inclusion/exclusion criteria). Accordingly, we excluded articles not in line with the research question and articles discussing digital technologies in CE in a superficial way. To mitigate bias and minimize the possibility of excluding pertinent previous studies or incorporating studies outside the intended scope, two co-authors independently conducted screening for each contribution. In the case of opposite judgment for a specific study, the third and fourth co-authors reviewed the contribution to decide whether to include or exclude it.

During the initial screening phase, we assessed abstracts, which typically encompass the publication's theme, objectives, methodological approach, and summarized results. At this juncture, we only excluded studies that were deemed entirely irrelevant, deferring the final decision to the next stage, contingent upon a full-text reading. The first screening, screening, relying on abstract analysis, narrowed down the included contributions from 378 to 134. During this phase, the exclusion criterion pertaining to the focus and relevance of digital technologies in the corporate entrepreneurship context was applied. Nevertheless, it's worth noting

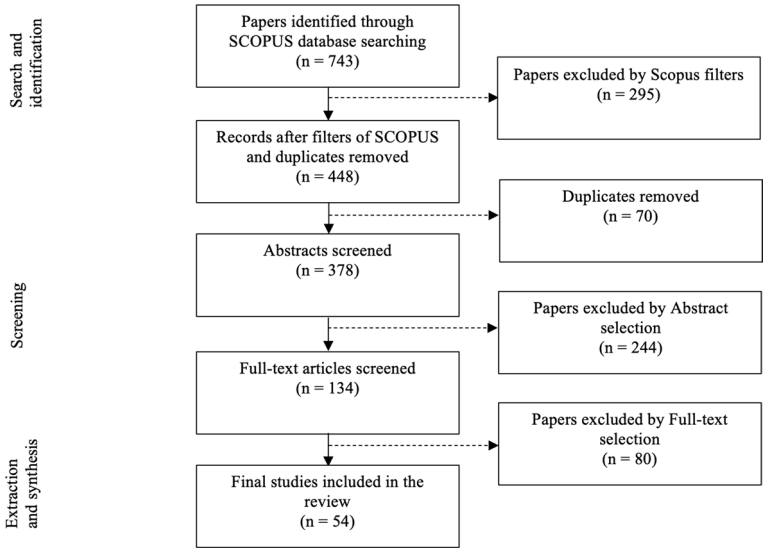

Fig. 1 Prisma flow diagram

that abstracts may not offer a comprehensive insight into the content of the research work.

The remaining 134 records underwent thorough examination through complete paper readings. Following this phase, an additional 80 studies were excluded upon validating the exclusion criteria during the full readings. Articles were omitted for two primary reasons. First, we omitted articles discussing digital technologies outside the scope of CE. Second, articles were excluded if they only superficially mentioned digital technologies in the context of CE without a substantial examination of these topics. Following these screening rounds, 54 contributions were chosen and incorporated into this literature review (refer to Table 5 in the Appendix for the complete list of selected studies). The outcomes at various stages have been summarized in a PRISMA flow diagram (Liberati et al. 2009; Hutton et al. 2015), detailing the screening process and enumerating the number of papers excluded at each step (see Fig. 1).

2.3 Extraction and synthesis

The final set of 54 documents underwent a comprehensive analysis employing a three-tiered approach or third-level criteria (Higgins and Green 2008). This approach comprised three distinct sections: (i) a "demographic" section detailing article information, including descriptive data (e.g., title, year, keywords, author/s, journal, Scopus citations); (ii) a "theoretical" section focusing on definitions, models, and theories of corporate entrepreneurship in the digital context; and (iii) a section aggregating all pertinent details about the type of study (e.g., article type,

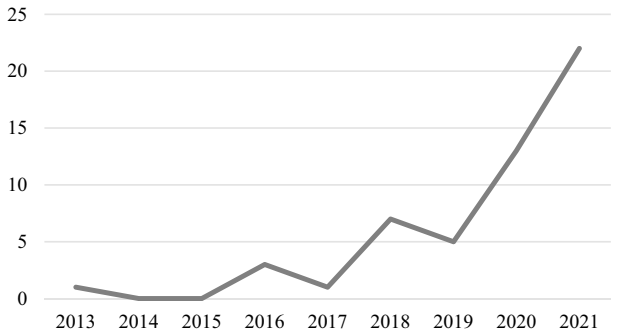

Fig. 2 Representation of publications per year in the analyzed sources

research methodology, related theoretical streams, and the study's main findings) to characterize the nature of studies in the existing literature. Employing a qualitative content analysis approach, we engage in intuitive interpretation and conceptual development (Welch et al. 2020; Fernhaber and Zou 2022). In alignment with prior CE reviews (Ireland et al. 2009; Kolev et al. 2019; Urbano et al. 2022), we employ McGrath's (1964) "input–process–output" logic to analyze the selected studies. This framework facilitates systematic content analysis and provides an organizing structure for evaluating the state of the literature on CE in the digital age. The "input" category addresses articles focusing on the use of digital technologies in CE, the "process" category encompasses articles exploring how digital technologies shape CE, and the final "output" category involves articles investigating outcomes related to the use of digital technologies in CE. Synthesizing results, we develop an integrative framework for comprehending CE in the digital age.

3 Descriptive analysis

Following the guidance of Tranfield et al. (2003) as endorsed in various systematic reviews (Ghezzi et al. 2018; Davidsson and Gruenhagen 2021; Urbano et al. 2022), our review presents a descriptive analysis shedding light on the general structure and characteristics of the published body of knowledge on CE in the digital age under scrutiny in order to make insightful inferences and identify the relative trends.

3.1 Publications per year, type of source, and research methods

Examination of the articles revealed the following findings about the publications per year, type of source, and research methods. First, our results show that interest in digital technologies in CE has increased in recent years, as shown in Fig. 2, with a growing number of publications since 2015. Looking at the longitudinal distribution of the articles, a notable growth in attention followed Arvidsson and Mønsted's (2018) seminal work, which, to the best of our knowledge, represents the first study that explicitly defined CE with reference to digital technologies. Indeed,

the increasing number of publications on CE in the digital age can be explained by the rapid adoption and pervasiveness of digital technologies, as evidenced by recent studies and reports (World Economic Forum 2020; Cho et al. 2023). This rapid proliferation of studies at the intersection of CE and digital technologies reflects an overall enthusiasm toward digitalization that has gained considerable momentum in business and management (Kraus et al. 2022b).

studies on the subject have been published in journals across various fields, encompassing relevant areas such as entrepreneurship, innovation, business, and management (e.g., *Journal of Business Research*, *Journal of Business Venturing*, *Journal of Management Studies*, *Long Range Planning*, *Strategic Entrepreneurship Journal*, *Technological Forecasting and Social Change*), as well as in areas less related to the topic (e.g., *Sustainability and New Technology*, *Work and Employment*). The papers in the sample are contained in 34 different scientific journals (see Table 6 in the Appendix).

Third, among the articles in the sample, 13% (7 studies) adopt a conceptual approach, while 80% (43 studies) employ an empirical methodology drawing conclusions from case studies and surveys. The remaining 7% (4 studies) consist of review papers. Regarding corporate entrepreneurship (CE) in the digital age, 43% of the articles (23 studies) utilize qualitative methodology based on case studies, 20% (11 studies) employ conceptual-based methodology, 13% (7 studies) rely on survey-based studies, and 24% (13 studies) use other empirical methods (e.g., mathematical models, simulations). Within the empirical studies, qualitative methods, such as case studies, are predominant, accounting for 43% of the articles (23 studies), while 37% of the articles (20 studies) utilize quantitative methods. Currently, the field lacks the integration of mixed methods that leverage multiple sources of evidence, a methodology known for augmenting the validity and reliability of research findings. The predominance of articles relying on case study methodology further underscores the emergent nature of the topic. Case studies are often employed to shed initial exploratory light on understanding novel phenomena in their early stages (Eisenhardt 1989; Voss et al. 2002; Eisenhardt and Graebner 2007).

Fourth, studies on CE in the digital age transcend conventional boundaries of academic disciplines, encompassing areas from innovation management (44% of the articles) to organizational theory and design (37%) and strategy (24%). Consequently, we acknowledge that the overarching phenomenon of CE in the digital age resides at the intersection of various mainstream academic disciplines (Sharma and Chrisman 1999).

Fifth, concerning the theoretical lenses adopted in the studies on CE in the digital age, the most primary theories explicitly adopted in CE and digital studies are dynamic capabilities theory (e.g., Teece et al. 1997), resource-based view theory (e.g., Barney 1991), effectuation theory (e.g., Sarasvathy 2001), contingency theory (e.g., Lawrence and Lorsch 1967), and bricolage theory (e.g., Baker and Nelson 2005). Based on contingency theory, organizations adapt to rapid development of digital technologies to achieve success (Joshi et al. 2019). Digital technologies present incumbents with abundant opportunities—that is, action potentials or possibilities offered by digital technologies for CE. Specifically, the interplay between incumbents' resources and digital opportunities in CE can be

conceptualized built on the resource-based view and dynamic capabilities theory (Amit and Han 2017 Kör et al. 2021). Furthermore, drawing on effectuation theory and bricolage theory, the literature suggests that digital technologies create new opportunities in the context of incumbent organizations, which ultimately increases CE (Hevner and Gregor 2022; Vassilakopoulou and Grisot 2020). Other less prominent theories present in CE and digital studies are mainly related to knowledge management, including knowledge spillover theory (Acs et al. 2013) and Nonaka's theory of knowledge creation (Nonaka 1994), and the socio-technical component, including socio-technical system theory (Leavitt 2013) and the sociomateriality theory (Orlikowski and Scott 2008). Overall, 22 various types of theories are explicitly used in the studies analyzed (see Table 7 in the Appendix).

Finally, considering the level of analysis, the 72% of the articles are focused on firm level, while 28% focus on the individual level. In addition, 24% of the articles are specifically focused on digital platforms emerging as a prominent digital technology category in CE in the digital age.

3.2 Geographic areas and industry sectors

Our descriptive analysis provides insights into the geographic areas and industry sectors covered by the selected studies. Out of the 54 articles reviewed, 31 specified the geographic area considered. Most empirical investigations centered around organizations based in Germany (e.g., Aslam et al. 2021; Prügl and Spitzley 2021; Petzsche et al. 2023). The USA is the second most recurring country in the studies analyzed (e.g., Joshi et al. 2019; Ambos and Tatarinov 2022; Mancha and Shankaranarayanan 2021). In addition to Germany and the USA, studies analyzed report research conducted in other recurring locations such as Norway (Arvidsson and Mønsted 2018; Vassilakopoulou and Grisot 2020), Sweden (Simonsson et al. 2020; Steiber and Alänge 2020), China (An et al. 2018; Wan and Liu 2021), the United Kingdom (Lischka 2019; Mariani and Nambisan 2021), and Italy (Cozzolino et al. 2018; Cavallo et al. 2020). Specifically, empirical studies utilize evidence from 21 different countries (see Table 8 in the Appendix). In addition, 6 papers use multi-country data.

In total, 26 papers reported specific industry sectors in their research. The most common industries are banking (with 5 studies), manufacturing (4 studies), media publishing (4 studies), and ICT (4 studies). Other industries analyzed include healthcare and energy, with 2 studies for each industry.

3.3 Intellectual core

In our systematic literature review, we also pinpointed the intellectual core of CE in the digital age (McCain 1990; Sidorova et al. 2008). For each considered article, Scopus citation analysis determined which contributions significantly influenced the field. Our article database received a total of 1,103 Scopus citations from January 2013 to September 2022. To establish the intellectual core, we compared the average number of citations referring to the articles in our database (average

of 24.62 citations) with each article's actual citations (Di Stefano et al. 2010). Articles exceeding the average were included in the core, and we identified 10 Scopus articles with more than 9 citations, collectively constituting the intellectual core for CE in the digital age literature (refer to Table 9 in the Appendix). These 10 articles received a total of 950 citations, equivalent to 74.2% of the entire Scopus citations for our working database. Upon closer examination, six articles (11.1%) had no citations (five published in the last 2 years), and 17 articles (31.4%) were cited between 1 and 5 times (13 published in the last two years). These outcomes further underscore the emergent nature of the topic. In the following sections, we explore the emerging conceptualizations of CE in the digital age, and subsequently, we present our integrative framework.

4 Corporate entrepreneurship in the digital age: emerging conceptualizations and perspectives

Before the extant literature is analyzed, it is worth digging deeper into the inherent meaning of CE in the digital age, with a discussion on its conceptualizations in light of the rapid development of digital technologies. The term corporate entrepreneurship has been defined and widely discussed since Burgelman's seminal work (1983)[2], giving rise to a distinct field of research that has constantly progressed in the last 40 years or so (Covin et al. 2020). However, we believe it is relevant to discuss how the CE construct is evolving and whether there are emerging and distinctive conceptualizations in an age highly influenced by the pervasive digital technologies. Earlier research has already made several attempts to conceptualize CE in the digital age. Table 1 contains a list of the main conceptualizations of CE in the digital age provided in the literature.

The first evidence emerging clearly from our review is that there is not yet an explicit conceptualization on which scholars widely agree. This comes as no surprise, given the early stage of research focusing on the intersection of CE and digital technologies (Murtinu et al. 2021). We identified several implicit conceptualizations, each one focusing on some specific CE practice or form (Guth and Ginsberg 1990; Covin and Miles 1999; Sharma and Chriman 1999) and/or specific digital technologies. For instance, Mariani and Nambisan (2021) focus on achieving strategic renewal within CE through the utilization of big data analytics and crowdsourcing platforms. These tools facilitate extensive, cost-effective, swift, and intricate experimentation involving real-world customers. Kraus et al. (2022a) emphasize strategic renewal as connected to digital transformation. This view is particularly present in papers where the central focus is not explicitly CE but rather the digital transformation of the organization (Prügl and Spitzley 2021). They tend to see strategic renewal

[2] Burgelman's (1983) original definition of CE: "*the process whereby firms engage in diversification through internal development. Such diversification requires new resource combinations to extend the firm's activities in areas unrelated, or marginally related, to its current domain of competence and corresponding opportunity set*" (p. 1349).

Table 1 Emerging conceptualizations of corporate entrepreneurship in the digital age

Author (year)	Definition of corporate entrepreneurship in the digital age
Arvidsson and Mønsted (2018)	"Corporate entrepreneurship with digital technology may then be more precisely defined as the entrepreneurial action by which organization members identify opportunities and pursue them by recombining resources in such a way that the development and scaling of new applications creates potent stepping stones for further action" (p. 371)
Yunis et al. (2018)	Corporate entrepreneurship in the digital age requires "a deeper understanding of the role it plays in enabling ICT and innovation to be well integrated into an organization's resources and strategies and consequently drive organizational performance to higher levels" (p. 1)
Joshi et al. (2019)	Corporate entrepreneurship in the digital era requires firms to use digital technologies to recreate themselves to survive and thrive in the changing environment and, fundamentally, this will translate in organizational renewal and changes in internal processes
Martín-Rojas et al. (2020)	A strategic behavior or attitude by which individuals within organizations undertake new activities to extend the firm's domain of competence and enhance its opportunity set through innovation
Reibenspiess et al. (2022)	Corporate entrepreneurship in the digital age can leverage digital platforms as collectors and catalyzers of employees' ideas, providing a vehicle to incentivize participation of employees who are intended as a bottom-up force of corporate entrepreneurship
Vassilakopoulou and Grisot (2020)	"Corporate entrepreneurship in the digital age can be defined as in-house form of digital entrepreneurship where organizational members create innovations by pursuing new activities that depart from the customary ones with the use of digital technologies" (p. 2)
Ben Arfi and Hikkerova (2021)	Digital technologies (and digital platforms) enable the strategic renewal of an organization through improving the speed of collective and individual learning experiences, which is at the core of every transformation (p. 1995)
Ghosh et al. (2021)	Digital entrepreneurship in existing organizations (corporate digital entrepreneurship)
Prügl and Spitzley (2021)	Digital transformation is at the heart of corporate entrepreneurship activity because it involves fundamental transformation in firms' value creation (p. 135) Especially true for the digital age, transformation means an increasing focus on activities outside firm boundaries—i.e., external corporate venturing (p. 136)
Mariani and Nambisan (2021)	Digital platforms and big data analytics as "powerful tools for digital innovation experimentation, enabling firms to innovate more effectively and transform their business models to adapt to rapidly changing market conditions" (p. 1)
Wan and Liu (2021)	"Can big data enable employee intrapreneurship and can the effect extend to enterprise innovation performance?" (p. 844)
Kraus et al. (2022a)	Organizations, through adopting digital technologies and making the most out of them, need to introduce new processes and mechanisms that can affect the key structures of how a company does business

Table 1 (continued)

Author (year)	Definition of corporate entrepreneurship in the digital age
Petzsche et al. (2023)	Corporate entrepreneurship in the digital era should consider digital technologies and associated (digital) affordances as powerful enablers that enhance as well as restrain corporate entrepreneurship (employee entrepreneurship) (p. 2)

(a form of CE) as a factor that enables digital transformation (Yunis et al. 2018). This is a different angle but still suggests that the use of digital technologies and CE forms are considered interrelated and interdependent with each other in the current competitive scenario. In essence, scholars argue that to make the most of digital technologies, organizations may need a proper CE strategy and related forms (strategic renewal, corporate venturing, etc.), and vice versa—if organizations want to have a proper CE strategy in the digital age, they need to leverage digital technologies in the proper way. Ben Arfi and Hikkerova (2021) also focus on strategic renewal and the role of the digital platform as an enabling tool to change the business model and search for new revenues. They argue that digital technologies can represent a way for companies to speed-up the learning process leading to CE, and strategic renewal in particular. Other scholars focus on what can follow a strategic renewal, which is organizational rejuvenation (e.g., Joshi et al. 2019)—another CE form as per Covin and Miles (1999). Prügl and Spitzley (2021) focus on corporate venturing as a CE form in the context of family business (Kraus et al. 2012). They also express the need for CE in the digital age to look at the external world by pursuing an external corporate venture. Conversely, other scholars investigate CE more from an internal perspective, emphasizing the role of internal employees. For instance, Wan and Liu (2021) refer to the role of big data technologies intended as key resources to enable employee entrepreneurship with the goal of achieving innovation performance. The context of application and theoretical debate is focused on HR management. Similarly, Reibenspiess et al. (2022) and Vassilakopoulou and Grisot (2020) investigate digital intrapreneurship as a form of CE involving the employee as a powerful bottom-up force for CE. This is in line with a recent trend to focus less on top managers (entrepreneurial) orientation and consider more the employee role in CE (Covin et al. 2020), which is also consistent with the original conceptualization of CE that emphasized internal development (Burgelman 1983). Scholars argue that the role of the employee in fostering CE is even amplified because of digital platforms, acting as collectors and catalyzers of employees' ideas and as powerful vehicles to incentivize employee participation (Reibenspiess et al. 2022; Vassilakopoulou and Grisot 2020). In a similar vein, Petzsche et al. (2023) provide interesting research at the intersection of internal CE activities considering the employee and the (digital) affordances derived by digital technologies (Autio et al. 2018). The relevant aspect, however, of their conceptualization of CE in the digital age is that they not only see digital technologies as powerful enablers of CE activities but also as potential factors that can negatively affect CE activities. In essence, they shed light on the dark side of digital technologies in the CE setting. Other authors focus on this aspect but

with reference to entrepreneurship (Berger et al. 2021). We consider this a relevant perspective that complements the dominant view of digital technologies as powerful enablers of CE (Arvidsson and Mønsted 2018; Ben Arfi and Hikkerova 2021).

CE not only consists of forms or practices; it also regards attitudes and behaviors (Covin and Slevin 1989). Martín-Rojas et al. (2020) investigate how digital technologies can influence entrepreneurial orientation—which includes corporate entrepreneurial attitude and behaviors (Covin and Wales 2019). Therefore, their conceptualization of CE in the digital age considers how entrepreneurial attitudes are influenced by digital technologies.

Most of the emerging conceptualizations discussed share a common feature, as aforementioned—that is, they are implicit. However, two exceptions exist. Ghosh et al. (2021) refer to CE in the digital age by using the term "corporate digital entrepreneurship" as the digital entrepreneurship happening in an established organization. We believe that such a conceptualization implicitly suggests that we are at the start of a new distinct sub-field, just like Nambisan (2017) proposed with reference to digital entrepreneurship. This is probably not yet the case, due to the still early stage of research at the intersection of digital technologies and CE as witnessed by the recent call for papers to advance and mature such an intriguing locus of investigation. Arvidsson and Mønsted (2018) provide another, though much more prudent, explicit conceptualization of CE in the digital age.

Overall, we argue that CE in the digital age should be conceptualized more comprehensively including the relevant factors that we have identified and discussed through reviewing the stock of knowledge to date. Therefore, we suggest that CE in the digital age may be more precisely defined as *CE in its various forms/practices and attitudes, enhanced (or hindered) by digital technologies and related affordances.*

5 Integrative framework for corporate entrepreneurship in the digital age

Following the "input–process–output" logic (Ghezzi et al. 2018; Fernhaber and Zou 2022), we scrutinized the content of the 54 articles. In summary, 31% of the articles centered on the utilization of digital technologies in CE, representing the input of CE in the digital age. Nearly 47% of the articles delved into the overarching phenomenon of how digital technologies are reshaping CE, while 22% investigated the consequences or outcomes of employing digital technologies in CE. It's worth noting that some articles might contribute to more than one area concurrently (e.g., both input and process).

Derived from our review, we introduce in Fig. 3 and elaborate in the subsequent sections our comprehensive organizing framework, encapsulating the current understanding of CE in the digital age. This resultant framework delineates CE in the digital age as a phenomenon wherein digital technologies instigate corporate entrepreneurial responses. Established organizations harness digital technologies to capitalize on and exploit the capabilities provided by these technologies, ensuring their competitiveness. To achieve

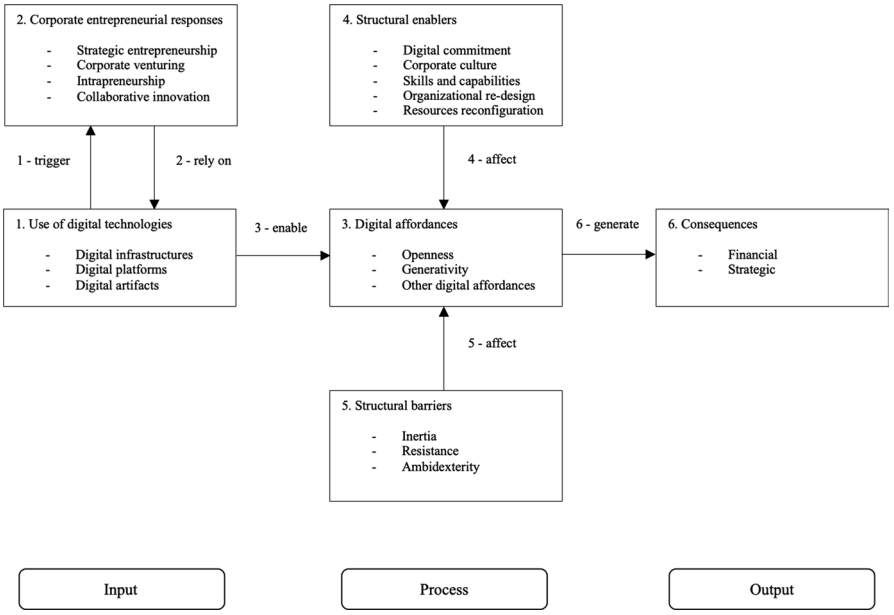

Fig. 3 Building blocks of corporate entrepreneurship in the digital age

this, they need to establish structural enablers and overcome barriers that impede the full potential of digital technologies for corporate entrepreneurship. The digital affordances facilitated by digital technologies can, in turn, yield tangible impacts on CE.

5.1 Input

5.1.1 The use of digital technologies in corporate entrepreneurship

In the context of entrepreneurship, digital technologies are characterized through three interrelated elements—digital artifacts, digital platforms, and digital infrastructure (Nambisan 2017; Nambisan et al. 2019). Nambisan (2017) defines a digital artifact as either an independent software/hardware component on a physical device or, more frequently, as an integral part of a digital platform. A digital platform is characterized as a collectively used set of services and architecture that accommodates complementary offerings, including digital artifacts. Digital infrastructure comprises digital technology tools and systems that form the basis for entrepreneurial activities. Instances of modern digital artifacts encompass smartphone apps and Internet-of-Things (IoT)-connected devices, including home automation devices, smart kitchen appliances, and wearables (Von Briel and Recker 2017). Additional examples of digital platforms include Apple iOS and Google's Android platform. Digital infrastructures extend to include resources such as cloud computing, exemplified by Amazon Web Services, as well as components like data analytics, online communities, social media, 3D printing, and digital makerspaces

(Rippa and Secundo 2019). The majority of the digital technologies within our sample align with the classification provided by Nambisan (2017) (see Table 10 in the Appendix). Even if these elements are related, we found digital platforms to be an important category in CE in the digital age field (e.g., Reibenspiess et al. 2022; Ben Arfi and Hikkerova 2021). Digital infrastructures (Browder et al. 2019; Martín-Rojas et al. 2020; Aslam et al. 2021; Wan and Liu 2021) and digital artifacts (Arvidsson and Mønsted 2018; Vassilakopoulou and Grisot 2020; Aslam et al. 2021) are also present but less prominent in the literature.

Based on another valuable classification of digital technologies (social, mobile, analytics, cloud, and IoT technologies—SMACIT) (Sebastian et al. 2020), analytics figure as a dominant category in CE in the digital age (Amit and Han 2017; Mariani and Nambisan 2021; Van Zeebroeck et al. 2021; Wan and Liu 2021; Watson et al. 2021; Chatterjee et al. 2022). However, social (Amit and Han 2017; Martín-Rojas et al. 2020), cloud (Van Zeebroeck et al. 2021), and IoT technologies (Browder et al. 2019; Latilla et al. 2020; Ghosh et al. 2021; Van Zeebroeck et al. 2021) can also be observed in the CE in the digital age literature, while mobile technologies (Van Zeebroeck et al. 2021) are seldom present. Despite the common tendency in the literature to emphasize one specific type, digital technologies frequently operate in close combinations (Bharadwaj et al. 2013). We observe that such combinations of technologies hold particular relevance in the context of CE, as highlighted in the literature (Arvidsson and Mønsted 2018; Yunis et al. 2018; Mariani and Nambisan 2021). For instance, a company's capacity to employ innovation analytics might hinge on its ability to actively involve real-world customers through digital platforms. This involves harnessing the capabilities of contemporary AI-based big data analytics to derive innovative insights in the digital era.

5.1.2 Corporate entrepreneurial responses

CE is considered traditionally essential to respond to a changing and dynamic environment (Zahra 1993; Lumpkin and Dess 1996). The rapid development of digital technologies can be viewed as a relevant event (Zahra 1991; Hornsby et al. 1993) that provides the impetus to behave entrepreneurially. Specifically, a number of studies in the literature examined (17 sources) presents digital technologies as a trigger of CE and CE as a response to the pervasiveness of digital technologies. This view is consistent with contingency theory (Lawrence and Lorsch 1967; Hofer 1975), which suggests that firms have to adjust their structures and processes to achieve alignment with changes in the external environment (Venkatraman 1989). Although the generic concept of CE is often invoked to explain this response to digitalization, the literature shows a set of responses as CE domains and related forms (see Table 11 in the Appendix). First, the literature analyzed refers to the established CE domains: strategic entrepreneurship (Covin and Miles 1999; Hitt et al. 2001; Kuratko and Audretsch 2013) and corporate venturing (Biggadike 1989; Guth and Ginsberg 1990; Phan et al. 2009).

At a higher analytical level, the amalgamation and integration of opportunity-seeking activities and advantage-seeking activities—referred to as strategic entrepreneurship—may be crucial for adapting to the contemporary dynamic and disruptive

environment shaped by digital disruption (Hitt et al. 2011; Utoyo et al. 2020; Karimi and Walter 2021). Within the realm of strategic entrepreneurship, which encompasses diverse forms and initiatives (Morris et al. 2010), organizational rejuvenation, also known as organizational renewal (Hurst et al. 1989), holds a central position in the literature. Joshi et al. (2019) specifically delve into digitalization as a catalyst for environmental change, linking it to organizational rejuvenation as a form of CE. In this form, the organization aims to sustain or improve its competitive position by altering its internal processes, structures, and/or capabilities (Covin and Miles 1999, p. 52). Covin and Miles illustrate how low-tech firms typically engage in external technology acquisitions, while high-tech industry firms simultaneously pursue internal development of products and services along with external searches. Examining strategic renewal, Van Zeebroeck et al. (2021) demonstrate a positive association between the adoption of digital technology and strategic renewal, defined as the transformation of organizations through the renewal of key foundational ideas (Guth and Ginsberg 1990, p. 5). Moreover, the study notes a robust positive correlation between the magnitude of strategy change and the level of overall adoption of digital technologies. This implies a profound interdependence between strategy and the technological structure. Similarly, Lischka (2019) scrutinizes the strategic renewal undertaken by six established news companies grappling with competence-destroying technological change. The findings of this investigation reveal that the strategic renewal of incumbents hinges on the delicate balance between willpower (i.e., the inclination for renewal and the capability to anticipate positive corporate outcomes) and a cost–benefit analysis. Other studies in the sample focus on how incumbents reconfigure their current business models to match the dynamic changes in their environment due to digitalization (Cozzolino et al. 2018; Brenk et al. 2019; Latilla et al. 2020; Lamperti et al. 2023). Specifically, the diffusion of digital technologies is seriously triggering the extant business model of incumbent companies (Teece 2010; Cavallo et al. 2023). Brenk et al. (2019) view digitalization as an internally driven change rather than one prompted by external factors. They propose a separation of the existing business model from new ones by shifting the decision-making logic from causation to effectuation, adopting an entrepreneurial perspective. With reference to another CE form—that is, the business model reconstruction/innovation form (Kuratko and Audretsch 2013), Latilla et al. (2020) examine the organizational re-design process that enables incumbent organizations to innovate their business models while exploiting digital technologies. The findings show how the organizational re-design requires the creation of a business unit dedicated to digital technologies exploitation to enable the company's business model innovation. Examining the drivers and mechanisms of business model reconstruction post-digital disruption, Cozzolino et al. (2018) assert that the presence of disruptive digital technologies creates fresh opportunities. This fosters experimentation by incumbents with new business models, resulting in novel forms of value creation and capture. The authors contend that, to harness value from emerging digital technologies, incumbents should enhance access to external knowledge. They provide empirical evidence supporting the phenomenon of opening a business model to external sources. Focusing on the corporate venturing domain (Covin and Miles 2007; Morris et al. 2010), Prügl and Spitzley (2021) emphasize a growing focus on corporate venturing activities as a response to digitalization. This entails establishing new business organizations outside the current organizational domain, known as external

corporate venturing (Sharma and Chrisman 1999). Rossi et al. (2020) illuminate the involvement of corporate venture capitalists in supporting digital technologies, presenting it as a viable strategy for companies to acquire insights into early-stage digital technologies with disruptive potential, especially in the context of market uncertainty. Besides the two established CE domains illustrated as CE responses, the literature proposes another two key concepts that can be reconducted to CE field in the digital age: intrapreneurship (Pinchot 1985; Antoncic and Hisrich 2003) and collaborative innovation (Matzler et al. 2018; Steiber et al. 2021). Pinchot and Soltanifar (2021) present digital intrapreneurship as a corporate solution to the rapid diffusion of digital technologies. They posit that the firm's capability to cultivate intrapreneurial behavior (Carrier 1996, p. 6) significantly influences its capacity to capitalize on the opportunities presented by digital technologies and to sustain competitiveness in the digital landscape. In line with Pinchot and Soltanifar (2021), other studies clarify the importance of digital intrapreneurs to make organizations more entrepreneurial and navigate in the digital era, emphasizing the need to increase the intrapreneurial capability (e.g., Kör et al. 2021; Watson et al. 2021). Moreover, the literature emphasizes also collaborative innovation as corporate entrepreneurial response to the rapid development of digital technologies (Matzler et al. 2018; Steiber and Alänge 2020; Steiber et al. 2021). In particular, the studies within the sample demonstrate how engaging in partnerships with startups can be a strategy to navigate the challenges posed by digitalization (Matzler et al. 2018). By engaging startups, incumbent can foster CE by accessing to new technologies but also, they can gain access to the broader entrepreneurial ecosystems (Cosenz et al. 2023) and look for investment opportunities through for instance their corporate venture funds, and/or by syndicating investments with other independent venture capital funds or angels (Basu et al. 2020; Bouncken and Kraus 2022). Steiber and Alänge (2020) found that collaboration with startups positively affects the firms' business transformation and exploitation of digital technologies.

5.2 Process

5.2.1 Digital affordances in corporate entrepreneurship

The literature argues that digital affordances enhance CE (Majchrzak and Markus 2013; Autio et al. 2018; Belitski et al. 2023) (see Table 12 in the Appendix). A consistent strand of CE in the digital age research (27 papers) presents digital technologies as enablers of CE. The studies included in the sample appear to align with the prevailing optimistic perspective on digital affordances within the current entrepreneurship literature (Nambisan 2017; Autio et al. 2018; Von Briel et al. 2018). Digital affordances have raised two broad implications that underline our extant understanding of CE in the digital age. First, digital technologies have expanded the scope of resources firms could utilize for CE. Second, digital technologies have increased the scale by which applications can be developed on digital infrastructure and platforms in the organization. As a consequence, digital affordances have made CE less bounded in terms of inputs/resources, processes, and outcomes. This relates to the structural boundaries of corporate entrepreneurial activities.

The impact of digital affordances in CE can be observed at the firm and individual levels. At the individual level, Petzsche et al. (2023) argue that the digital affordances are organizational resources that carry resource gains by reducing the effort of employees while engaging in CE activities (Autio et al. 2018). Digital affordances, such as generativity and disintermediation, alleviate employee work overload, providing space and releasing resources for engagement in corporate entrepreneurial projects. At the firm level, Arvidsson and Mønsted (2018) emphasize the adaptability of digital technologies, enabling the development and scalability of software applications on digital infrastructure and platforms within the organization (Yoo et al. 2010; Bygstad 2017). This enhances the potency and productivity of corporate entrepreneurial activities (Lyytinen et al. 2016; Nambisan 2017). Specifically, the study reveals that propagating new technology by marshalling many applications synergistically is an important tactic by which digital entrepreneurs in organizations may generate innovation potential in incumbent organizations (Arvidsson and Mønsted 2018).

Likewise, Amit and Han (2017) contend that digital technologies can broaden the array of resources accessible to firms, empowering them to envision and formulate innovative resource configurations. This, in turn, facilitates value creation with a more extensive spectrum of partners, including customers (Amit and Zott 2012).

Overall, the literature shows two prominent digital affordances in CE—i.e., generativity and openness—and other, less frequent, digital affordances (see Table 12 in the Appendix). These digital affordances are related to intrinsic characteristics of digital technologies, for example their reprogrammability, malleability, and expansibility (Faulkner and Runde 2009; Yoo et al. 2010; Kallinikos et al. 2013). Generativity denotes the capacity of digital technologies to enable spontaneous innovative contributions from extensive, diverse, and uncoordinated audiences. It permits the recombination of elements and facilitates the assembly, extension, and redistribution of functionality (Nambisan et al. 2019, p. 3). In simpler terms, generativity empowers everyone to collaboratively create content, allowing the amalgamation of any information on the network (Tilson et al. 2010). This opens avenues for experimentation, encourages interactions with multiple stakeholders (Autio et al. 2018), and thereby promotes the expansion and scale of CE.

Digital technologies have redefined the extent and nature of openness in CE, influencing the participants (actors), their contributions (inputs/resources), the contribution methods (processes/governance), and the ultimate objectives (outcomes) (Nambisan et al. 2019, p. 3). Notably, digital platforms and infrastructures play pivotal roles in fostering openness in CE across various levels. For instance, at the individual level, Reibenspiess et al. (2022) contend that digital intrapreneurship platforms serve as accelerators and catalysts for employee-driven innovation. They provide incumbent organizations with opportunities to engage intrapreneurs in innovating within the organizational boundaries. At the firm level, Mariani and Nambisan (2021) describe a research-driven platform that allows large-scale digital experimentation involving large numbers of potential customers from across the world. Ben Arfi and Hikkerova (2021) show how digital platforms enhance product innovation and CE by supporting knowledge creation and the

sharing of tacit and explicit knowledge in the organization. In line with Ben Arfi and Hikkerova (2021), Martín-Rojas et al. (2020) focus on how social media enables open communication within the organization and increases connectivity with customers and partners. The study illustrates the favorable impact of social media on CE, fostering the creation of new business units and nurturing proactive and innovative capabilities to seize market opportunities through novel business ventures.

Other digital affordance categories are also evident in the CE literature. Vassilakopoulou and Grisot (2020) emphasize the ability of digital technologies to be evocative, disposable, and responsive. These technologies enable the exploration of the future by generating novelty and fostering the co-development of future-oriented trajectories with stakeholders. They facilitate trials and experimentation with multiple ideas while allowing for manageable losses. Additionally, digital technologies support the exploitation of contingencies by adapting to emerging needs.

Another notable digital affordance within CE is disintermediation, that is the capacity of digital technologies to facilitate direct interactions between individuals (Gellman 1996). Disintermediation streamlines the process of innovation creation by enabling direct communication irrespective of geographical location (Autio et al. 2018), thereby promoting the exchange of knowledge and information (Černe et al. 2013) and encouraging experimentation with novel ideas (Autio et al. 2018).

5.2.2 Structural enablers

To leverage and harness the affordances offered by digital technologies, the literature illustrates a wide variety of structural enablers (see Table 13 in the Appendix). One of these is digital commitment (Warner and Wäger 2019; Ghosh et al. 2021; Pinchot and Soltanifar 2021; Watson et al. 2021). These studies argue that digital commitment from the top, especially the CEO and chief digital officer (CDO), should enable the use of digital technologies in corporate entrepreneurial initiatives by allocating the necessary resources. Specifically, the literature highlights the CDO's role in driving CE initiatives (Nadkarni and Prügl 2021). Further, Pinchot and Soltanifar (2021) argue that the presence of sponsors in organizations may support bottom-up CE in the digital age.

A second key structural change required is cultural transformation (An et al. 2018; Utoyo et al. 2020; Ben Arfi and Hikkerova 2021; Ghosh et al. 2021; Mancha and Shankaranarayanan 2021; Pinchot and Soltanifar 2021; Watson et al. 2021). Digital technologies force existing organizations to change their culture and develop a more entrepreneurial organization. To embrace the possibilities offered by digital technologies, organizations need, first, to foster a company-wide entrepreneurial culture that encourages experimentation, which should be democratized throughout the organization and no longer be confined to research and development departments (Utoyo et al. 2020; Watson et al. 2021). Second, employees within corporations require a comprehensive understanding of the potential applications of digital technologies that impact their organization, along with an awareness of their benefits and challenges (Nadkarni and Prügl 2021). The literature emphasizes that fostering a digital culture encompasses an organization's comprehension and innovative utilization of digital

technology (Ghosh et al. 2021). It also involves identifying digital intrapreneurs, providing support, and empowering them within a conducive environment that encourages the manifestation of their intrapreneurial behavior (Pinchot and Soltanifar 2021). Managers can implement various measures to foster a shared digital and entrepreneurial culture throughout different levels of a firm (An et al. 2018). These measures include developing a learning culture by inviting external experts to introduce cutting-edge techniques and knowledge. Additionally, cultivating a clear organizational vision for digitalization, having more managers serve as effective sponsors, and empowering cross-functional teams to enhance cross-organizational collaboration are effective strategies (Pinchot and Soltanifar 2021). However, organizations may encounter challenges related to digital culture and training, as all employees should possess the skills to experiment with digital technologies. Ghosh et al. (2021) identify four cultural challenges for corporate entrepreneurship in the digital age within incumbent organizations: attracting and retaining talent, building a digital workforce, assembling a digital leadership team, and transitioning from a risk-averse culture to more entrepreneurial approaches.

A third element consistently acknowledged in many studies is skills and capabilities. While the technology itself is a crucial factor (Yoo et al. 2010), the effective adoption and utilization of digital technologies in corporate entrepreneurship hinge on employee capabilities and skills (Mancha and Shankaranarayanan 2021; Nadkarni and Prügl 2021; Pinchot and Soltanifar 2021; Ritala et al. 2021; Watson et al. 2021). Digitalization represents a socio-technical transformation (Tilson et al. 2010), and beyond investing in digital technologies, organizations must ensure their workforce is prepared to innovate with digital technologies and embark on CE initiatives leveraging these technologies. Therefore, in the digital age, organizations need to cultivate a digital workforce equipped with the necessary digital skill set and knowledge to discover and exploit opportunities using digital technologies, as well as the ability to experiment with these technologies to create value (Van Laar et al. 2017; Nadkarni and Prügl 2021). To achieve this, companies should foster entrepreneurial traits within their workforce, instilling the confidence to implement and deploy digital technologies, and consider training or retraining employees in digital technologies (Mancha and Shankaranarayanan 2021). Nevertheless, there exists a potential risk of a disparity in digital skills between workers predating digitization and those recently hired with digital proficiency (Nadkarni and Prügl 2021). In this regard, organizations should assess their digital needs and implement appropriate training and programs to bridge the digital divide among their employees.

Organizational redesign (Boyles 2016; Holotiuk 2020; Latilla et al. 2020) constitutes a fourth aspect. Organizations aiming to foster corporate entrepreneurship through digital technologies need to prioritize the integration of digital affordances into their associated structures. This involves facilitating the seamless dissemination of applications throughout the organization and establishing structures that promote the retention of expertise and the sharing of experiences (Arvidsson and Mønsted 2018). For example, this goal can be accomplished by establishing a digital infrastructure marked by elevated generativity and disintermediation. This may involve implementing cloud-based digital technologies accessible from various devices, facilitating direct and seamless exchange among employees (Petzsche et al. 2023). Moreover, the literature

highlights how the creation of separate organizational units dedicated to digital technologies exploitation can enable CE in the digital age. Separate organizational units can help organizations to leverage the existing resources of the firm, providing an appropriate structure for the development of CE solutions based on digital technologies and balancing exploration and exploitation. These units are often small structures with people temporarily transferred from the organization and aim to achieve a complete "reintegration" of outcomes (e.g., CE solutions) or the workforce (e.g., teams or people) at a later stage (Holotiuk 2020).

Lastly, a fundamental alteration in resources emerges as a structural change essential for the adoption of digital technologies in CE (Joshi et al. 2019; Warner and Wäger 2019; Ben Arfi and Hikkerova 2021; Nadkarni and Prügl 2021; Pinchot and Soltanifar 2021). This involves the strategic orchestration and alignment of resources to better leverage digital affordances (Sirmon et al. 2011; Amit and Han 2017). Within the framework of the resource-based view (Barney 1991), the utilization of digital technologies for CE might require the redistribution of resources. This involves either developing or acquiring new resources or repositioning existing ones through reconfiguration and modification, as outlined by Joshi et al. (2019). According to the proposal by Amit and Han (2017), digital technologies encourage firms to adopt a system-based perspective when designing and organizing their resource configurations.

5.2.3 Structural barriers

Despite the opportunities presented by digitalization, the integration of digital technologies in CE encounters challenges for various reasons (refer to Table 14 in the Appendix). These challenges are rooted in the "conflict" between existing resources and capabilities and the new ones, akin to what Chesbrough (2010) refers to as "structural" impediments in configuring new business models (Chesbrough and Tucci 2020). Studies acknowledge that digital technologies simultaneously induce inertia and change. Inertia and resistance to change have the potential to impede the effectiveness of digital affordances for CE.

A prominent barrier to the integration of digital technologies in CE is inertia (Arvidsson and Mønsted 2018; Cozzolino et al. 2018; Paek and Lee 2018; Lischka 2019). Several factors contribute to incumbents' inertia in adopting digitalization for CE, including the rigidity of existing routines and competences (Arvidsson and Mønsted 2018), complexity-induced uncertainty (Vassilakopoulou and Grisot 2020), and familiarity and maturity traps (Joshi et al. 2019). These factors collectively act as inertial forces that may impede the successful adaptation of digital technologies in CE. Inertia is closely linked to established organizations that grow larger and older, necessitating interconnected structures to manage increased complexity (Lischka 2019). These scholars argue that path dependency creates a lock-in effect within a firm, potentially preventing it from recognizing the opportunities presented by digital technologies and keeping it on its historical trajectory. Established firms are susceptible to "familiarity" and "maturity" traps, indicating a predisposition to favor the known over the unknown and the mature over the nascent (Ahuja and Lampert 2001; Joshi et al. 2019). Overcoming these traps involves actively exploring and experimenting with

novel, emerging, and pioneering ideas as well as new technologies (Ahuja and Lampert 2001). This approach fosters an entrepreneurial mindset within the organization, enabling the creation of successful future paths through valuable experiences with new technologies. Arvidsson and Mønsted (2018) identify four challenges linked to the integration of digital technologies in CE within incumbent organizations, all of which can be traced back to the inertia barrier. The initial challenge arises from the necessity for entrepreneurs to clandestinely develop applications until justifiable investments are attainable (Jarvenpaa and Ives 1996; Grisot et al. 2013). The second challenge arises from the necessity to adapt applications for use across diverse organizational contexts to justify investments. Entrepreneurs are tasked with strategically prioritizing and aligning various motives and intentions to garner support (Chae and Poole 2005; Hanseth and Lyytinen 2010). The third challenge involves implementing applications in a manner that improves the conditions for change (Sambamurthy et al. 2003; Sanner et al. 2014). Furthermore, inertia may be associated with the uncertainty stemming from the complexity inherent in the use of digital technologies (Vassilakopoulou and Grisot 2020). Significantly, the literature underscores the role of digital technologies characterized as evocative, disposable, and responsive in navigating complex and uncertainty-laden contexts.

Another barrier to the implementation of digital technologies in CE is resistance to change at the individual level (Arvidsson and Mønsted 2018; Warner and Wäger 2019; Vassilakopoulou and Grisot 2020; Niemand et al. 2021; Chatterjee et al. 2023). This resistance is characterized by psychological inertia, wherein employees exhibit reluctance to organizational change, often associating it with fear, anger, or loss (Godkin and Allcorn 2008; Lischka 2019). Senior leadership teams lacking digitalization experience and employees not well-versed in digital technologies may manifest this resistance when confronted with disruptive digital technologies within an organization. Chatterjee et al. (2023) align this aspect with the status quo bias theory (Samuelson and Zeckhauser 1988), positing that individuals, when faced with the prospect of using a new technology, initially harbor uncertainty about the outcomes and resist change due to a perceived potential loss outweighing potential gain. To address this challenge, organizations should promote the adoption of digital technologies among their workforce, fostering an understanding of the potential benefits that can enhance the organization's competitiveness (Hu et al. 2016).

A third significant barrier in the application of digital technologies in CE is ambidexterity (O'Reilly and Tushman 2008, 2013), involving the equilibrium between existing resources and capabilities and the new ones demanded. The literature identifies two key facets of ambidexterity in the application of digital technologies in CE: firstly, the clash between established business models and new ones required to seize and capitalize on opportunities presented by digital technologies (Cozzolino et al. 2018; Brenk et al. 2019; Cavallo et al. 2023); and secondly, the balance between new digital capabilities required and traditional ones (Montealegre and Iyengar 2021; Nadkarni and Prügl 2021; Ritala et al. 2021; Lamperti et al. 2023).

5.3 Output: consequences of using digital technologies in corporate entrepreneurship

Overall, there is a consensus that digital technologies can enhance the productivity and performance of Corporate Entrepreneurship (CE), as outlined in Table 15 of the Appendix. These technologies yield diverse outcomes at both individual and organizational levels, exemplified by the 23 papers centered on the consequences of digital technology in CE. Some studies delve into the strategic objectives pursued through the application of digital technologies in CE, while others concentrate on the financial goals stemming from their integration into corporate entrepreneurial activities. Strategically, firms may embrace digital technologies in CE due to various advantages, including knowledge sharing and organizational learning (Ben Arfi and Hikkerova 2021), enhanced responsiveness (Martín-Rojas et al. 2020), and the facilitation of digital innovation experimentation (Mariani and Nambisan 2021). Notably, it is argued that digital technologies can exert widespread impacts at the strategic level (Van Zeebroeck et al. 2021; Lischka 2019) by enabling strategic renewal (Joshi et al. 2019; Vassilakopoulou and Grisot 2020); contributing to the generation of organizational novelty derived from digital technologies enhancing internal processes, structures, and/or capabilities (Browder et al. 2019; Mariani and Nambisan 2021); enabling firms to redesign or innovate their business models to adapt to rapidly changing market conditions; and fostering product innovation (Ben Arfi and Hikkerova 2021; Chatterjee et al. 2022).

While strategic objectives remain prominent, an increasing number of studies have shifted their focus to the financial implications of digital technologies in CE activities. Financially, there is a consensus in the literature that digital technologies positively impact CE (Zahra 1993; Knight 1997; Martín-Rojas et al. 2020). For instance, Yunis et al. (2018) highlight the catalyzing effect of CE in the relationship between digital technologies and firm performance. They suggest that the adoption of digital technologies has a positive impact on a firm's competitiveness and performance when opportunities arising from innovation are effectively identified and managed within an organizational culture marked by CE. Similarly, Niemand et al. (2021) assert that organizations developing a visionary approach to digitalization, marked by an entrepreneurial mindset (Kraus et al. 2019), enhance their performance. They argue that an organization's level of digitalization doesn't solely determine profitability; rather, the critical factor is the strategic embrace of digitalization, accompanied by an entrepreneurial orientation, leading to a competitive advantage. Consequently, further exploration of the reciprocal relationship between digital technologies and CE is crucial.

Drawing on the crucial insights distilled from our extensive review, Fig. 3 offers a cohesive framework that summarizes and blends the most relevant concepts.

6 The future of corporate entrepreneurship in the digital age

In this section, we put forward and express a range of promising directions for future research that could augment our current comprehension of CE in the digital age. Our exploration of research avenues is depicted and structured using the integrative framework (Fig. 3).

6.1 Input

6.1.1 Research avenues on the use of digital technologies in corporate entrepreneurship

The literature emphasizes the significance of digital platforms in CE, but there are existing research gaps. Initially, studies have shown that the creation of experimental spaces empowers organizational members to challenge existing business models, prototype envisioned components, and engage in identity work. Future research avenues could explore how digital experimental spaces, rooted in digital infrastructures, differ from physical counterparts in facilitating business model experimentation and broader corporate experimentation. It's crucial to investigate the impact of these digital spaces on organizational identity during corporate experimentation.

Second, there's a need for exploration into how digital artifacts, such as apps on personal devices, contribute to the dynamic emergence of novel CE opportunities from the grassroots efforts of employees within incumbent organizations.

Moreover, following the SMACIT classification of digital technologies (Sebastian et al. 2020), our review underscores analytics and social media technologies as deserving more research attention as catalysts for CE. While these technologies can enhance a firm's entrepreneurial stance and competitiveness, empirical research on their influence on CE is limited. To address this gap, a mixed-method approach could be employed (Johnson et al. 2007). Researchers can conduct large-scale surveys on digital technology adoption, identify specific cases through qualitative research, and comprehensively investigate the enabling and hindering factors associated with the use of digital technologies in CE.

6.1.2 Research avenues on corporate entrepreneurial responses

Our comprehensive review and the integrative framework underscore the role of digital technology diffusion in compelling organizations to adopt corporate entrepreneurial responses for gaining or sustaining a competitive edge. Building on this, we posit that the adoption of CE by firms in response to the evolving digital landscape is a promising research area warranting further exploration. To delve deeper into this domain, future research, employing a qualitative methodology rooted in contingency theory (Lawrence and Lorsch 1967), could investigate whether corporate entrepreneurial responses to rapid digitalization vary based on the technological maturity of firms or the sector they operate in. Alternatively, employing a quantitative methodology could enable scholars

to assess the extent to which the use and ubiquity of digital technologies lead to diverse CE strategies on a larger scale.

While the literature has documented various responses in the form of CE actions triggered by digitalization, the underexplored realm of domain redefinition, characterized by the creation and exploitation of a new, previously unoccupied product/market arena (Covin and Miles 1999, p. 57), warrants attention. Given the adaptability of digital technologies (Arvidsson and Mønsted 2018), they enable the application of a particular need or function in one domain to fulfill a different need or serve a different market in an entirely distinct field, thereby reshaping the domain of use and application for products or services. Future qualitative studies could illuminate this unexplored avenue by selecting relevant cases of companies that either succeeded or failed in employing digital technologies in alternative markets, potentially revealing evolutionary patterns in the process.

6.2 Process

6.2.1 Research avenues on the digital affordances in corporate entrepreneurship

Digital technologies are fundamentally reshaping the conventional approaches of pursuing entrepreneurial opportunities within incumbent organizations. To attain a more profound comprehension of the implications arising from the integration of digital technologies in CE, it becomes imperative to blend concepts and constructs related to digital technology with those existing in entrepreneurship theories, such as effectuation (Sarasvathy 2001) and bricolage (Baker and Nelson 2005). Notably, the generativity and openness (Nambisan 2017) facilitated by digital technologies present intriguing avenues for future research in CE in the digital age. The generativity emanating from digital artifacts and platforms provides opportunities for pursuing entrepreneurial endeavors within established organizations.

The collaborative nature of corporate entrepreneurial agency, facilitated by digital technologies, shapes the processes and outcomes of corporate entrepreneurship. Subsequent studies could delve into how the potentiality of these digital affordances reshapes existing CE theories and necessitates the development of new theoretical frameworks in the context of CE. For instance, the generativity facilitated by digital technologies could be explored through the lens of exaptation theory (Dew et al. 2004), where exaptation, signifying the co-optation of a technology feature for its present role from a different origin, connects technology with a new domain of use.

Lastly, unexplored digital affordances in CE, such as the exaptive possibilities created by new technologies, present opportunities for future studies. These avenues can guide further conceptual and empirical work on CE in the digital age, initially addressed through qualitative methodologies like case studies to identify significant instances of exaptation within CE initiatives and advocate for the emergence of this practice. Subsequent quantitative studies may seek to unveil the relationship between exaptation and innovation performance, considering mitigating or facilitating factors (Chan and Lim 2023).

6.2.2 Research avenues on the structural enablers of corporate entrepreneurship in the digital age

The existing literature on CE lacks a comprehensive exploration of how incumbent organizations structurally organize themselves to embrace digital technologies. A fruitful avenue for future research involves the utilization of multiple case studies to delve into the organizational and process-level managerial actions that are necessary for and facilitated by digital technologies, aiding firms in the development of CE. Bridging this gap in understanding could be achieved by adopting the theoretical perspective of change management (Goodman and Dean 1982; Tidd and Bessant 2020; Kotter 2007).

Moreover, the integration of digital technologies also prompts inquiries about organizational design. The incorporation of digital technologies in CE may necessitate an organizational change process, potentially leading to the establishment of new business units or the definition of novel internal functions, involving the reallocation of internal resources. An area ripe for exploration in this context is the examination of skills and capabilities relevant to CE in the digital age. Qualitative methodologies can be employed to investigate the individuals within an incumbent organization who should be engaged in designing and utilizing digital technologies in the realm of CE. It is plausible that the adoption of digital technologies in CE may demand new competencies and skills, prompting future studies to scrutinize the specific competences and skills that incumbents need for effective engagement in corporate entrepreneurial activities.

6.2.3 Research avenues on the structural barriers of corporate entrepreneurship in the digital age

Despite the significance of digital technologies for incumbent organizations, there is a paucity of studies delving into how these firms adopt them and navigate the associated challenges. Specifically, there is a dearth of research on the strategies and tactics that enable incumbents to facilitate the implementation and adoption of digital technologies, fostering CE. One critical aspect that remains underexplored is the variation among organizations in their cognitive openness toward digital technologies in the realm of CE. This prompts the question of whether certain organizations, influenced by cognitive structures like their organizational identity, exhibit greater openness to adopting digital technologies in the context of CE than others.

Future research endeavors could employ a combination of quantitative and qualitative approaches to document how challenges and tactics associated with using digital technologies in CE manifest for different types of firms. For instance, exploring similarities and differences in approaches and challenges between firms from diverse sectors (traditional and high-tech), family-owned and non-family-owned businesses, would be particularly intriguing. Additionally, we advocate for longitudinal research that delves into how barriers and facilitating or hindering tactics for CE in the digital age evolve over time within incumbent organizations.

6.3 Output: research avenues on the consequences of using digital technologies in corporate entrepreneurship

The integration of digital technologies into CE prompts an exploration of its outcomes. An initial consideration revolves around whether the adoption of digital technologies enhances the entrepreneurial and innovative aspects of incumbent organizations. Currently, there is a dearth of evidence substantiating the efficacy of digital technologies in fostering CE, necessitating empirical validation and identification of contextual limitations. Utilizing quantitative methodologies, researchers can systematically disentangle digital technologies from other contextual factors, establishing their causal impact on CE's financial outcomes and entrepreneurial orientation within incumbent organizations (Covin and Wales 2019). Our analysis underscores deficiencies and suggests avenues for further research in terms of gauging the impact of digital technologies on CE. There is limited insight into how to operationalize this impact, emphasizing the need for the development of measurement scales, which should attract the attention of both scholars and practitioners (e.g., Hinkin 1995).

A second promising avenue for future research delves into the reciprocal relationship between digital technologies and CE. The opportunities presented by digital technologies may profoundly influence organizational performance when leveraged within an entrepreneurial-oriented environment. Future studies could probe the extent and origins of this mutually reinforcing relationship. For instance, longitudinal quantitative research could scrutinize the impact of digital technologies on various indicators of company performance over time, offering a more dynamic comprehension of the interplay between digital technologies and CE.

Another crucial avenue involves extending the understanding of the "dark side" or adverse outcomes associated with digital technologies in CE. While a substantial portion of existing research accentuates the positive opportunities and beneficial impacts of digital technologies on CE activities, scant attention has been given to potential downsides. Hence, a more nuanced understanding is imperative to comprehensively grasp the effects of digital technologies on CE. Future research, by examining cases where incumbents faced challenges in integrating digital technologies into CE, could shed light on the impact of role conflicts or inherent paradoxes, advancing our understanding of potential pitfalls in this intersection.

In conclusion, we have delineated several areas that offer promising opportunities for management scholars interested in formulating research inquiries related to CE in the digital age. Table 2 summarizes our discussion by presenting potential future research questions on CE in the digital age.

7 Conclusions

Our review highlights an emerging body of literature that contributes to our understanding of CE in the digital age. We contend that the debate on CE in the digital age is still in its infancy and deserves more scholarly attention. In this regard, we

Table 2 Future research directions and illustrative research questions

Building blocks of the framework	Illustrative future research questions	Related possible theoretical perspectives and concepts
The use of digital technologies in corporate entrepreneurship	How can incumbents incentivize employees' commitment and motivation to experiment and innovate with digital platforms in the corporate entrepreneurship context? How do digital experimental spaces, based on digital infrastructures (e.g., virtual spaces), differ from physical experimental spaces in enabling corporate entrepreneurship? How do digital artifacts (e.g., apps on personal devices) influence the dynamic emergence and evolution of novel corporate entrepreneurial opportunities in incumbent organizations? What types of digital technologies are most amenable to corporate entrepreneurship?	Characteristics and tensions in digital platform governance (Tiwana et al. 2010; Bresnahan and Greenstein 2014) Digital experimental spaces in corporate entrepreneurship (Mariani and Nambisan 2021) Characteristics of digital artifacts, such as reprogrammability, recombinability, and expansibility (Yoo et al. 2010; Kallinikos et al. 2013) Sociomateriality perspective (Orlikowski 2007; Orlikowski and Scott 2008) and the role of socio-material routines (Leonardi 2011; Lyytinen et al. 2016)
Corporate entrepreneurial responses to digitalization	How do corporate entrepreneurial responses emanating in response to rapid digitalization differ based on the technology level of firms? What types of sectors are most amenable to adopting digital technologies in corporate entrepreneurship? How can incumbent organizations redefine the product/market arena in response to digitalization?	Contingency theory (Lawrence and Lorsch 1967; Hofer 1975) Dynamic capabilities theory (Teece et al. 1997; Eisenhardt and Martin 2000) Exaptation theory (Dew et al. 2004) Domain redefinition (Covin and Miles 1999)
Digital affordances in corporate entrepreneurship	How does the generativity afforded by digital technologies enable the pursuing of entrepreneurial opportunities in incumbent organizations? How does the collective nature of corporate entrepreneurial agency afforded by digital technologies shape corporate entrepreneurial processes and outcomes? How do digital affordances reshape existing corporate entrepreneurship theories and create a need for new theorizing in corporate entrepreneurship?	Generativity (Zittrain 2009; Nambisan 2017) Entrepreneurial agency (Nambisan 2017; Nambisan et al. 2019) Bricolage theory (Baker and Nelson 2005) Effectuation theory (Sarasvathy 2001) Exaptation theory (Dew et al. 2004)

Table 2 (continued)

Building blocks of the framework	Illustrative future research questions	Related possible theoretical perspectives and concepts
Structural enablers in using digital technologies in corporate entrepreneurship	What managerial actions do incumbents perform to implement digital technologies in their corporate entrepreneurship activities? What organizational designs enable the adoption of digital technologies in corporate entrepreneurship? Who in the incumbent organizations should be involved in the design and use of digital technologies in corporate entrepreneurship? What competences and skills do incumbents need to build for digital technologies in corporate entrepreneurship?	Organizational design (Hosmer 1995; Daft 2004) Change management (Goodman and Dean 1982; Tidd and Bessant 2020; Kotter 2007) Resource orchestration (Hitt et al. 2011; Chadwick et al. 2015) Digital skills (Van Laar et al. 2017; Laar et al. 2020)
Structural barriers in using digital technologies in corporate entrepreneurship	What are the challenges that may be faced when implementing digital technologies in corporate entrepreneurship? How do incumbents deal with the challenges related to the implementation of digital technologies in corporate entrepreneurship?	Organizational ambidexterity (O'Reilly and Tushman 2013; Turner et al. 2013) Uncertainty (Venkatraman 1989; McMullen and Shepherd 2006) Organizational identity (Scott and Lane 2000; Ravasi and Schultz 2006) Structural inertia theory (Hannan and Freeman 1977, 1984) Conservation of resources theory (Hobfoll 1989, 2001)
Consequences of using digital technologies in corporate entrepreneurship	How do digital technologies affect corporate entrepreneurship performance? How can incumbents measure the impact of digital technologies on corporate entrepreneurship? To what extent do digital technologies and corporate entrepreneurship influence each other? What are the origins of this relationship? What are the tensions or paradoxes inherent in using digital technologies in corporate entrepreneurship?	Entrepreneurial orientation (Bolton and Lane 2012) Operationalize the impact of digital technologies on corporate entrepreneurship Two-way relationship between digital technologies and corporate entrepreneurship (Yunis et al. 2018) Dark side of digital technologies in corporate entrepreneurship (Petzsche et al. 2023)

provide guidelines for future research to address current research challenges that are still in need of additional investigation.

This study is not free of limitations. First, during the first selection of studies, the criteria did not discriminate on the quality of sources. We opted for this more inclusive search strategy to include the grey literature (Adams et al. 2016, 2017). This approach is consistent with previous systematic literature reviews covering emerging topics (Cavallo et al. 2019). Second, the inclusion of only one database (Scopus) can be seen as a limitation, and the authors acknowledge the search process may have omitted some works. However, previous research acknowledges that the use of the Scopus database for literature reviews provides wider coverage of search results compared to other popular databases, such as Web of Science (Thelwall 2018). Third, although we tried to include the most relevant keywords, some scholars may find such a list incomplete. We tried to mend this potential limitation by using an "open" query strategy. For instance, similarly to previous reviews, we adopted the comprehensive term "digital*" in order to include all related keywords (Kraus et al. 2019).

Despite its limitations, our study contributes to the literature on CE in the digital age in three main ways. First, we help to establish the relevance of research at the intersection of CE and digital technologies in a way that no study has done so far. We consider CE in the digital age as an augmented CE due to the characteristics of digital technologies that can significantly influence CE (e.g., reprogrammability). Therefore, we provide an original conceptualization of CE in the digital age.

Second, we uncover the relevance of digital affordances, which have expanded the scope of resources firms can utilize for CE, and they have increased the scale of digital solutions.

Third, we provide an overarching integrative framework to analyze the current state of the literature on CE in the digital age and to describe the key constructs of CE in the digital age. Our organizing framework describes CE in the digital age as a phenomenon where digital technologies trigger or enable CE responses. In particular, we outline the various components, including structural barriers and enablers, that shape CE action in the digital age.

Admittedly, our review and the related framework proposed should be seen as a starting point for further research on this promising topic. Overall, it is hoped that this review can act as a cornerstone for future scholarly explorations in this area.

Appendix

See Tables 3,4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15.

Table 3 Search string, keywords and number of papers obtained in Scopus

Search string	Keywords	Number of articles obtained in Scopus
TITLE-ABS-KEY ((corporate AND entrepreneur* AND digital)	Corporate entrepreneur* and digital	143
OR (intrapreneur* AND digital)	Intrapreneur* and digital	29
OR (internal AND entrepreneur* AND digital)	Internal entrepreneur* and digital	71
OR (strategic AND entrepreneur* AND digital)	Strategic entrepreneur* and digital	255
OR (corporate AND ventur* AND digital)	Corporate ventur* and digital	55
OR (strategic AND renewal AND digital)	Strategic renewal and digital	49
OR (entrepreneurial AND employee AND digital)	Entrepreneurial employee and digital	56
OR (internal AND ventur* AND digital)	Internal ventur* and digital	34
OR (organizational AND renewal AND digital)).	Organizational renewal and digital	51
Total		743

Table 4 Inclusive criteria for the review

Inclusion criteria	
Language	English
Timespan	No limitation
Document types	Journals and conference proceedings
Subject areas	"Business, Management and Accounting", "Social Sciences", "Economics, Econometrics and Finance" and "Decision Sciences"
Research focus	Corporate entrepreneurship in digital context; Digital technologies in corporate entrepreneurship

Table 5 Articles in the review

No	Authors (Year)	Source	Research method	Key findings
1	Basu and Wadhwa (2013)	Journal of Product Innovation Management	Empirical	CVC investments generate growth opportunities in both new and existing businesses, without leading firms to withdraw from their existing business ventures in the digital age
2	Mondal et al. (2015)	Proceedings of the 2015 IEEE 3rd International Conference on MOOCs, Innovation and Technology in Education, MITE 2015	Empirical	Massive open online courses provide a flexible learning avenue for education in corporate entrepreneurship
3	Day and Schoemaker (2016)	California Management Review	Empirical	Guided by an entrepreneurial mindset, dynamic capabilities empower a firm to continuously adjust to dynamic and uncertain conditions, such as those prevalent in the digital age
4	Boyles (2016)	Digital Journalism	Empirical	The presence of three layers of tension (executive, practitioner, and internal) within digital news organizations might constrain the dissemination of ideas originating from intrapreneurial units
5	Amit and Han (2017)	Strategic Entrepreneurship Journal	Conceptual	Incorporating digital technologies requires firms to embrace a perspective centered on system-based value creation when designing and organizing their resource configurations
6	Arvidsson and Mønsted (2018)	Journal of Strategic Information Systems	Empirical	Digital entrepreneurs create opportunities for innovation within organizations through four strategies: concealing, sequencing, anchoring, and propagating
7	An et al. (2018)	Journal of Product Innovation Management	Empirical	Engaging in bricolage enhances the identification of opportunities, thereby boosting the probability of corporate entrepreneurship in the digital age
8	Eckhardt et al. (2018)	Strategic Entrepreneurship Journal	Empirical	Within platform ecosystems, various types of information are generated, and a subset of this information promotes entrepreneurship through the commercialization of complementary products

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
9	Paek and Lee (2018)	International Entrepreneurship and Management Journal	Empirical	A firm with a higher level of strategic entrepreneurship can better develop dynamic capabilities and sustain competitive advantage in the digital age
10	Matzler et al. (2018)	Journal of Business Strategy	Conceptual	Digital technologies influence three distinct levels: digital products and services, digital processes and decisions, and entirely novel digital business models
11	Yunis et al. (2018)	Journal of Business Research	Empirical	The opportunities arising from ICT resources and innovation can significantly influence organizational performance when they are seized and effectively managed within a corporate entrepreneurship-driven organizational culture
12	Cozzolino et al. (2018)	Journal of Management Studies	Empirical	The digital disruptive process involves two distinct forces: (i) the initial emergence of disruptive technologies and (ii) the subsequent entry of disruptors
13	Warner and Wäger (2019)	Long Range Planning	Empirical	Agility is acknowledged as the central mechanism for the strategic renewal of an organization's (i) business model, (ii) collaborative approach, and ultimately, (iii) culture
14	Brenk et al. (2019)	Journal of Business Economics	Empirical	Distinguishing the alternative business model from the existing one can diminish the cognitive uncertainty linked to the processes of business model innovation
15	Lischka (2019)	Journal of Media Business Studies	Empirical	The rejuvenation of incumbents depends on the negotiation between determination and a cost–benefit analysis

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
16	Browder et al. (2019)	Journal of Business Venturing	Conceptual	Central components of the maker movement for corporate entrepreneurship, virtual sharing spaces facilitate the combination of resources
17	Joshi et al. (2019)	Journal of Entrepreneurship	Empirical	The spread of digital technologies results in the incorporation of corporate entrepreneurship, subsequently influencing organizational renewa.
18	Aroles et al. (2020)	New Technology, Work and Employment	Conceptual	Digital nomadism has the potential to challenge the formality of organizations
19	Vassilakopoulou and Grisot (2020)	Journal of Strategic Information Systems	Empirical	The potential of digital technologies that are evocative, disposable, and responsive enables venturing in complex, uncertainty-ridden contexts
20	Hevner and Gregor (2022)	Information and Management	Conceptual	Organizational digital innovation opportunities arise through four entrepreneurial strategies: (i) invention, (ii) exaptation, (iii) advancement, and (iv) exploitation
21	Cavallo et al. (2020)	Proceedings of the European Conference on Innovation and Entrepreneurship, ECIE	Empirical	The critical positive role performed by digital technologies in terms of openness, affordances, and generativity for corporate entrepreneurship activities
22	Latilla et al. (2020)	International Journal of Innovation Management	Empirical	The establishment of a business unit dedicated to digital technologies can enable the company's business model innovation
23	Simonsson et al. (2020)	Technology Innovation Management Review	Empirical	The significance of a select few individuals, the primary innovators, in recognizing the necessity for novel platform types
24	Reibenspiess et al. (2022)	Information and Management	Empirical	The utilization of a digital intrapreneurship platform positively influences employees in developing innovative ideas.

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
25	Utoyo et al. (2020)	International Journal of Innovation Management	Empirical	In the face of disruptive change induced by digital technologies, entrepreneurial leadership plays a more dominant role than entrepreneurial culture in defining resource management and innovation strategies
26	Żur (2020)	Education Sciences	Empirical	Horizontal knowledge spillovers on a large scale can be influenced by three factors: (i) shared interests and aspirations among participants, (ii) induced mobilization, and (iii) the optional anonymity of participants
27	Rossi et al. (2020)	Journal of Business Research	Empirical	The correlation between the quantities and values of deals made by corporate venture capitalists, particularly in the context of digital and potentially disruptive technologies
28	Martín-Rojas et al. (2020)	Journal of Business Research	Empirical	The utilization of social media tools affects every aspect of corporate entrepreneurship and boosts firm performance
29	Steiber and Alänge (2020)	European Journal of Innovation Management	Empirical	Engaging in collaborations with startups has a positive impact on the business transformation of firms in the digital age
30	Holotiuk (2020)	Proceedings of the 15th International Conference on Business Information Systems 2020 "Developments, Opportunities and Challenges of Digitization"	Empirical	The organizational structure of digital innovation labs incorporates aspects of structural, contextual, and sequential ambidexterity
31	Ambos and Tatarinov (2022)	Journal of Management Studies	Empirical	Digital solutions that scale through headquarters have the potential to promote organizational learning for digital transformation

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
32	Ben Arfi and Hikkerova (2021)	Small Business Economics	Empirical	Digital platforms facilitate corporate entrepreneurship processes and foster an environment conducive to the unrestricted exchange and capture of knowledge
33	Van Zeebroeck et al. (2021)	IEEE Transactions on Engineering Management	Empirical	There is a robust positive correlation between the degree of strategy change and the stage of adoption of advanced digital technologies in general
34	Ritala et al. (2021)	Technological Forecasting and Social Change	Empirical	Individual proactiveness and a propensity for risk-taking are correlated positively with individual performance in attaining an organization's digital strategy objectives
35	Ghosh et al. (2021)	Digital Entrepreneurship	Empirical	To nurture digital corporate entrepreneurship within organizations, it is imperative to undergo business model transformation, operating model transformation, and cultural transformation
36	Nadkarni and Prügl (2021)	Management Review Quarterly	Literature review	The significant perspective of middle management on corporate entrepreneurship in the digital age
37	Niemand et al. (2021)	European Management Journal	Empirical	Entrepreneurial orientation moderates the relationship between a bank's strategic vision on digitalization and its performance
38	Flamini et al. (2021)	International Journal of Entrepreneurial Behaviour and Research	Literature review	At the intersection of entrepreneurship and open innovation, digital technologies have unveiled new opportunities
39	Kör et al. (2021)	Technovation	Empirical	Perceived organizational innovativeness, self-leadership, and strategies of self-leadership are positively related to a manager's individual-level innovative behavior

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
40	Mariani and Nambisan (2021)	Technological Forecasting and Social Change	Empirical	A research-driven online review platform is a pivotal element for any innovation initiative in a digital context
41	Wan and Liu (2021)	Chinese Management Studies	Empirical	The positive impact on employee intrapreneurship is a result of the synergy between big data-enabled human resource management and empowerment-focused approaches
42	Mancha and Shankaranarayanan (2021)	Information Technology and People	Empirical	Digital technologies possess distinct properties compared to analog technologies, demanding a unique set of characteristics for individuals to innovate successfully with them
43	Montealegre and Iyengar (2021)	Business Horizons	Conceptual	Balancing renewal and refinement in the evolution of a digital business platform is enabled by three pairs of organizational capabilities, namely identifying–nourishing, expanding–legitimating, and augmenting–embedding
44	Prügl and Spitzley (2021)	Journal of Management Studies	Empirical	The relationship between family communication patterns and the strategic priority of external corporate venture to embrace digital transformation is mediated by family identification with the firm
45	Karimi and Walter (2021)	Sustainability (Switzerland)	Empirical	Building capabilities for product and business model innovation in the digital platform is influenced by entrepreneurial agility
46	Aslam et al. (2021)	International Journal of Entrepreneurial Behaviour and Research	Empirical	The flow of communication in maker spaces is influenced by materiality in the form of integrated digital technologies, including applications and platforms

Table 5 (continued)

No	Authors (Year)	Source	Research method	Key findings
47	Watson et al. (2021)	Business Horizons	Conceptual	To effectively navigate the era of artificial intelligence, senior leaders must cultivate an intrapreneurial culture and prioritize the reskilling of the workforce
48	Pinchot and Soltanifar (2021)	Digital entrepreneurship	Empirical	Establishing systems and fostering a corporate culture that supports digital intrapreneurs is a fundamental competency in the digital age
49	Steiber et al. (2021)	International Journal of Innovation Management	Literature review	Evaluation Framework for Corporate-Startup Co-Creation Programs
50	Chatterjee et al. (2022)	Journal of Strategy and Management	Empirical	The corporate digital entrepreneurship of small and medium enterprises in India is significantly influenced by perceived usefulness, perceived ease of use, and willingness to change
51	Scuotto et al. (2022)	Journal of Business Research	Empirical	In the gig economy, the structured knowledge-sharing environment within established digital organizations provides a framework. However, the primary knowledge utilized for firm development is derived from the personal experiences of the individuals engaged in the project
52	Petzsche et al. (2023)	European Management Review	Empirical	Digital affordances are essential for working in innovative and creative environments
53	Opland et al. (2022)	Journal of Business Research	Literature review	Two primary research streams have emerged from the literature on employee-driven digital innovation: (i) the outcomes and (ii) the utilization of digital tools to support employee-driven innovation processes
54	Chatterjee et al. (2023)	Journal of Enterprising Communities	Empirical	Strategic planning and the utilization of modern technology platforms can enable family firms to thrive in the digital age

Table 6 Journal outlets of studies at the intersection of corporate entrepreneurship and digital technologies

Area	Journal	No
Entrepreneurship and small business management	(1) International Journal of Entrepreneurial Behaviour and Research	2
	(2) Strategic Entrepreneurship Journal	2
	(3) International Entrepreneurship and Management Journal	1
	(4) Journal of Business Venturing	1
	(5) Journal of Enterprising Communities	1
	(6) Journal of Entrepreneurship	1
	(7) Small Business Economics	1
General management	(8) Journal of Business Research	5
	(9) Journal of Management Studies	3
	(10) Business Horizons	2
	(11) California Management Review	1
	(12) European Management Journal	1
	(13) European Management Review	1
Innovation	(14) International Journal of Innovation Management	3
	(15) Journal of Product Innovation Management	2
	(16) Technological Forecasting and Social Change	2
	(17) European Journal of Innovation Management	1
	(18) Technology Innovation Management Review	1
	(19) Technovation	1
Strategy	(20) Journal of Business Strategy	1
	(21) Journal of Strategy and Management	1
	(22) Long Range Planning	1
	(23) Management Review Quarterly	1

Table 6 (continued)

Area	Journal	No
Information management	(24) Information and Management	2
	(25) Journal of Strategic Information Systems	2
	(26) Information Technology and People	1
Economics	(27) Journal of Business Economics	1
Education sciences	(28) Education Sciences	1
Human resource management and employment studies	(29) New Technology, Work and Employment	1
International business and area studies	(30) Chinese Management Studies	1
Journalism	(31) Digital Journalism	1
Media	(32) Journal of Media Business Studies	1
Operations and technology management	(33) IEEE Transactions on Engineering Management	1
Sustainability	(34) Sustainability	1

Table 7 Theories explicitly adopted in studies at the intersection of corporate entrepreneurship and digital technologies

Theory explicitly adopted	Number of articles
(1) Bricolage theory (Baker and Nelson 2005)	2
(2) Conservation of resources theory (Hobfoll 1989)	1
(3) Contingency theory (Lawrence and Lorsch 1967)	3
(4) Discovery and Creation theory approaches (Alvarez and Barney 2007)	1
(5) Dynamic cabapilities (Teece et al. 1997)	10
(6) Effectuation (Sarasvathy 2001)	3
(7) Exaptation (Dew et al. 2004)	1
(8) Structural inertia theory (Hannan and Freeman 1984)	1
(9) Information-based theories of entrepreneurship (Venkatraman 1989; Casson 2005)	1
(10) Innovation translation theory (Law 1992)	1
(11) Institutional theory (Lounsbury 2002)	1
(12) Knowledge spillover theory (Acs et al. 2013)	1
(13) Network theory (Borgatti and Halgin 2011)	1
(14) Nonaka's theory of knowledge creation (Nonaka 1994)	1
(15) Organizational behaviour theory (Conger and Kanungo 1987)	1
(16) Real options theory (Bowman and Hurry 1993)	1
(17) Resource-based view theory (Barney 1991)	3
(18) Social cognitive theory (Bandura 2001)	1
(19) Social exchange theory (Blau 2017)	1
(20) Socio-technical system theory (Leavitt 2013)	1
(21) Sociomateriality (Orlikowski and Scott 2008)	1

Table 8 Countries context of studies analyzed at the intersection of corporate entrepreneurship and digital technologies

Country	Number of articles
(1) Austria	1
(2) Canada	1
(3) China	2
(4) Finland	1
(5) France	1
(6) Germany	7
(7) India	1
(8) Indonesia	1
(9) Italy	2
(10) Libano	1
(11) Liechtenstein	1
(12) Norway	2
(13) Poland	1
(14) Spain	1
(15) Sweden	2
(16) Swiss	1
(17) Tunisia	1
(18) Turkey	1
(19) Switzerland	2
(20) UK	2
(21) USA	6

Table 9 The intellectual core of studies at the intersection of corporate entrepreneurship and digital technologies

Authors (year)	Article's Title	Source	Number of citations
Warner and Wäger (2019)	Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal	Long Range Planning	309
Yunis et al. (2018)	The role of ICT and innovation in enhancing organizational performance: The catalysing effect of corporate entrepreneurship	Journal of Business Research	131
Amit and Han (2017)	Value Creation through Novel Resource Configurations in a Digitally Enabled World	Strategic Entrepreneurship Journal	121
Cozzolino et al. (2018)	Unpacking the disruption process: New technology, business models, and incumbent adaptation	Journal of Management Studies	83
An et al. (2018)	How Bricolage Drives Corporate Entrepreneurship: The Roles of Opportunity Identification and Learning Orientation	Journal of Product Innovation Management	64
Browder et al. (2019)	The emergence of the maker movement: Implications for entrepreneurship research	Journal of Business Venturing	63
Nadkarni and Prügl (2021)	Digital transformation: a review, synthesis and opportunities for future research	Management Review Quarterly	62
Day and Schoemaker (2016)	Adapting to fast-changing markets and technologies	California Management Review	59
Boyles (2016)	The Isolation of Innovation: Restructuring the digital newsroom through intrapreneurship	Digital Journalism	32
Arvidsson and Mønsted (2018)	Generating innovation potential: How digital entrepreneurs conceal, sequence, anchor, and propagate new technology	Journal of Strategic Information Systems	26

Table 10 Digital technologies in corporate entrepreneurship

Digital technology	Definition	Examples in corporate entrepreneurship in the digital age literature	Related literature in corporate entrepreneurship in the digital age
Digital artifact	"A digital component, application, or media content that is part of a new product (or service) and offers a specific functionality or value to the end-user" (Nambisan 2017, p. 1031)	Web-based solution for supporting the communication between patients and hospitals (Vassilakopoulou and Grisot 2020) Application for patient-oriented time planning and resource analytics (Arvidsson and Mønsted 2018) Applications that facilitate users in a coworking-space to perform different tasks, e.g., booking a meeting or conference room, requesting an event or mentor or connecting with other users of a particular profession (Aslam et al. 2021)	3 papers: Arvidsson and Mønsted (2018), Vassilakopoulou and Grisot (2020), Aslam et al. (2021)
Digital platform	"A shared, common set of services and architecture that serves to host complementary offerings, including digital artifacts" (Nambisan 2017, p. 1032)	Collaborative digital platforms (Ben Arfi and Hikkerova 2021) Research-driven online review platforms (digital analytics platform) (Mariani and Nambisan 2021) Digital intrapreneurship platforms (Reibenspiess et al. 2022) MOOC platforms (Żur 2020) Technology platforms (i.e., AI-based platforms; blockchain-enabled platforms; social networking platforms, (Chatterjee et al. 2023) Digital business platforms (Montealegre and Iyengar 2021) Digital product-service platforms (Simonsson et al. 2020)	9 papers: Eckhardt et al. (2018), Simonsson et al. (2020), Reibenspiess et al. (2022), Żur (2020), Ben Arfi and Hikkerova (2021), Karimi and Walter (2021), Mariani and Nambisan (2021), Montealegre and Iyengar (2021), Chatterjee et al. (2023)

Table 10 (continued)

Digital technology	Definition	Examples in corporate entrepreneurship in the digital age literature	Related literature in corporate entrepreneurship in the digital age
Digital infrastructure	"Digital technology tools and systems (e.g., cloud computing, data analytics, online communities, social media, 3D printing, digital makerspaces, etc.) that offer communication, collaboration, and/or computing capabilities to support innovation and entrepreneurship" (Nambisan 2017, p. 1032)	Virtual prototyping and 3D printing (Browder et al. 2019) Big data information systems (Wan and Liu 2021) Social media (Martín-Rojas et al. 2020)	4 papers: Browder et al. (2019), Martín-Rojas et al. (2020), Aslam et al. (2021), Wan and Liu 2021)

Table 11 Corporate entrepreneurial responses to digitalization

Corporate entrepreneurial response (domain)	Corporate entrepreneurial responses (form)	Related sources
Strategic entrepreneurship	Strategic renewal	3 papers: Lischka (2019), Warner and Wäger (2019), Van Zeebroeck et al. (2021
	Organizational rejuvenation	3 papers: Joshi et al. (2019), Utoyo et al. (2020), Karimi and Walter (2021
	Business model reconstruction	3 papers: Cozzolino et al. (2018), Brenk et al. (2019), Latilla et al. (2020
Corporate venturing	External corporate venturing	2 papers: Rossi et al. (2020), Prügl and Spitzley (2021
Intrapreneurship	Intrapreneurship	3 papers: Kör et al. (2021), Pinchot and Soltanifar (2021), Watson et al. (2021
Collaborative innovation	Collaborative innovation with startup	3 papers: Matzler et al. (2018), Steiber and Alänge (2020), Steiber et al. (2021)

Table 12 Digital affordances in corporate entrepreneurship

Digital affordancy	Related sources
Generativity	8 papers: Amit and Han (2017), Arvidsson and Mønsted (2018), Warner and Wäger (2019), Hevner and Gregor (2022), Żur (2020), Aslam et al. (2021), Karimi and Walter (2021), Petzsche et al. (2023
Openness	9 papers: Mondal et al. (2015), Amit and Han (2017), Martín-Rojas et al. (2020), Reibenspiess et al. (2022), Żur (2020), Aslam et al. (2021), Ben Arfi and Hikkerova (2021), Mariani and Nambisan (2021), Scuotto et al. (2022
Other digital affordances (i.e., disintermediation; evocative, disposable, responsive)	10 papers: Amit and Han (2017), Arvidsson and Mønsted (2018), Warner and Wäger (2019), Vassilakopoulou and Grisot (2020), Żur (2020), Ambos and Tatarinov (2022), Aslam et al. (2021), Ghosh et al. (2021), Ritala et al. (2021), Petzsche et al. (2023)

Table 13 Structural enablers required for using digital technologies in corporate entrepreneurship

Structural change	Related sources
Digital commitment	4 papers: Warner and Wäger (2019), Ghosh et al. (2021), Pinchot and Soltanifar (2021), Watson et al. (2021
Corporate culture	7 papers: An et al. (2018), Utoyo et al. (2020), Ben Arfi and Hikkerova (2021), Ghosh et al. (2021), Mancha and Shankaranarayanan (2021), Pinchot and Soltanifar (2021), Watson et al. (2021)
Skills and capabilities	5 papers: Mancha and Shankaranarayanan (2021), Nadkarni and Prügl (2021), Pinchot and Soltanifar (2021), Ritala et al. (2021), Watson et al. (2021
Organizational re-design	5 papers: Boyles (2016), Arvidsson and Mønsted (2018), Joshi et al. (2019), Holotiuk (2020), Latilla et al. (2020)
Resources reconfiguration	5 papers: Joshi et al. (2019), Warner and Wäger (2019), Ben Arfi and Hikkerova (2021), Nadkarni and Prügl (2021), Pinchot and Soltanifar (2021)

Table 14 Structural barriers in using digital technologies in corporate entrepreneurship

Structural barrier	Related sources
Inertia	10 papers: Arvidsson and Mønsted (2018), Cozzolino et al. (2018), Paek and Lee (2018), Joshi et al. (2019), Lischka (2019), Warner and Wäger (2019), Latilla et al. (2020), Vassilakopoulou and Grisot (2020), Ambos and Tatarinov (2022), Ghosh et al. (2021)
Resistance to change	5 papers: Arvidsson and Mønsted (2018), Warner and Wäger (2019), Vassilakopoulou and Grisot (2020), Niemand et al. (2021), Chatterjee et al. (2023)
Ambidexterity	6 papers: Cozzolino et al. (2018), Brenk et al. (2019), Latilla et al. (2020), Montealegre and Iyengar (2021), Nadkarni and Prügl (2021), Ritala et al. (2021)

Table 15 Consequences in using digital technologies in corporate entrepreneurship

Consequence	Categories	Related sources
Strategic	Strategic renewal	2 papers: Van Zeebroeck et al. (2021), Lischka (2019)
	Organizational novelty and rejuvenation	2 papers: Joshi et al. (2019), Vassilakopoulou and Grisot (2020)
	Facilitating digital innovation experimentation	2 papers: Browder et al. (2019), Mariani and Nambisan (2021)
	Enhancing product innovation	2 papers: Ben Arfi and Hikkerova (2021), Chatterjee et al. (2022)
	Generating and exploiting employees' innovation potential	4 papers: Arvidsson and Mønsted (2018), Browder et al. (2019), Reibenspiess et al. (2022), Aslam et al. (2021)
	Enlarging the scope of entrepreneurial opportunities	2 papers: Amit and Han (2017), An et al. (2018
	Knowledge sharing, organizational learning and absorptive capacity	2 papers: Martín-Rojas et al. (2020), Ben Arfi and Hikkerova (2021
Financial	Organizational performance	3 papers: Yunis et al. (2018), Martín-Rojas et al. (2020), Karimi and Walter (2021)
	Innovation performance	2 papers: Utoyo et al. (2020), Wan and Liu (2021
	Firm performance	1 paper: Niemand et al. (2021)
	Business model performance	1 paper: Karimi and Walter (2021)

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Declarations

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