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A scientific approach to the formulation of digital innovation strategies in high-risk and high-uncertainty environments

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Al Magnifico Rettore
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residente a __Acquaviva delle Fonti_ in via_____Gabriele D'Annunzio, 88____ e-mail__ilaria.mancuso@poliba.it___
iscritto al 3° anno di Corso di Dottorato di Ricerca in ___Ingegneria Meccanica e Gestionale_____ ciclo___37°_

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Politecnico di Bari

Department of Mechanics, Mathematics and Management
MECHANICAL AND MANAGEMENT ENGINEERING
Ph.D. Program
SSD: IEGE-01/A BUSINESS AND MANAGEMENT ENGINEERING

Final Dissertation

A scientific approach to the formulation of digital innovation strategies in high-risk and high-uncertainty environments

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by
Ilaria Mancuso

Supervisors:
Prof. Antonio Messeni Petruzzelli
Prof. Umberto Panniello

Coordinator of Ph.D Program: Prof. Giuseppe Casalino

Course XXXVII, 01/11/2021 - 31/10/2024

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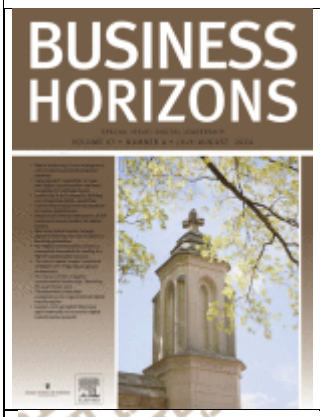
List of appended papers

This thesis encompasses an introduction and the subsequent four appended papers. The papers are referred to in the text by the letter prior to each title (A – D).

Paper A:

Mancuso, I., Petruzzelli, A. M., & Panniello, U. (2023). Innovating agri-food business models after the Covid-19 pandemic: The impact of digital technologies on the value creation and value capture mechanisms. *Technological Forecasting and Social Change*, 190, 122404.



Paper B:

Mancuso, I., Petruzzelli, A. M., Urbinati, A., & Matzler, K. (2024). Leadership in the metaverse: Building and integrating digital capabilities. *Business Horizons*, 67(4), 331-343.

Paper C:

Mancuso, I., Petruzzelli, A. M., Panniello, U., Frattini, F., & Del Giudice, M. (2024). Nurturing strategic agility through corporate venturing advisory: An exploratory analysis. *Industrial Marketing Management*, 121, 1-15.

Paper D:

Mancuso, I., Messeni Petruzzelli, A., Panniello, U., & Vaia, G. (submitted). The Dark Side of Digital Innovation for Sustainable Development: Understanding the Paradoxical Tension of Artificial Intelligence. *Technovation*.

List of additional publications

In addition, during my doctoral studies I have coauthored several scientific publications, a monography, a book chapter, and different conference papers. They appear here below in chronological order.

Publications in international peer review journals

Mancuso, I., Petruzzelli, A. M., Panniello, U., & Vaia, G. (2025). Business model innovation in the banking sector: How digital technologies transform innovation drivers in value mechanisms innovations. Journal of Engineering and Technology Management, 75, 101858.

Mancuso, I., Messeni Petruzzelli, A., & Panniello, U. (2024). Value creation in B2B multi-sided platforms: a model based on multiple case study. Industrial Marketing Management, 119, 1-14.

Mancuso, I., Petruzzelli, A. M., Panniello, U., & Nespoli, C. (2023). A microfoundation perspective on business model innovation: the cases of Roblox and Meta in metaverse. IEEE Transactions on Engineering Management.

Mancuso, I., Petruzzelli, A. M., & Panniello, U. (2023). Digital business model innovation in metaverse: How to approach virtual economy opportunities. Information Processing & Management, 60(5), 103457.

Book chapters

Mancuso, I., Petruzzelli, A. M., & Panniello, U. (2023). Industry 4.0 for AEC Sector: Impacts on Productivity and Sustainability. In Architecture and Design for Industry 4.0: Theory and Practice (pp. 33-50). Cham: Springer International Publishing.

Publications in international conference proceedings

Mancuso, I., Messeni Petruzzelli, A., & Panniello, U. (2024). The dark side of digital innovation for sustainable development: value destruction of artificial intelligence. Proceedings of the 2024 EU-SPRI Early Career Conference.

Mancuso, I., Messeni Petruzzelli, A., & Panniello, U. (2024). Business Model Innovation in the Banking sector: How digital technologies transform innovation drivers in value mechanisms innovations. Proceedings of the XXXV Annual Scientific Meeting of the Italian Association of Management Engineering.

Mancuso, I., Messeni Petruzzelli, A., Panniello, U., Frattini, F., & Del Giudice, M. (2024). Nurturing strategic agility through corporate venturing advisory: An exploratory analysis. Proceedings of R&D Management 2024 Conference.

Mancuso, I., Petruzzelli, A. M., Urbinati, A., & Matzler, K. (2023). Digital business in the metaverse: a capability-based perspective. Proceedings of the XXXIV Annual Scientific Meeting of the Italian Association of Management Engineering.

Mancuso, I., Petruzzelli, A. M., & Panniello, U. (2023). Applying micro lenses to macro phenomena: The microfoundations of business model innovation in the metaverse. Proceedings of the Druid 2023 Conference.

Carpentiere, C., **Mancuso, I.,** Albino, V., Petruzzelli, A., & Panniello, U. (2023). Innovative Business Models for the Future Smart City. Resourceedings, 3(1), 01-12.

Mancuso, I., Messeni Petruzzelli, A., & Panniello, U. (2022). Integrating digital technologies in B2B multi-sided platforms: How to create value in new ecosystems. Proceedings of the XXXIII Annual Scientific Meeting of the Italian Association of Management Engineering.

Mancuso, I., Messeni Petruzzelli, A., & Panniello, U. (2022). Integrating digital technologies in B2B multi-sided platforms: How to co-create value in new ecosystems. Proceedings of the Symplatform 2022 Conference.

Monographies

Panniello, U., Messeni Petruzzelli, A., & **Mancuso, I.** (2022). Trasformazione digitale e nuovi modelli di business per l'edilizia. Franco Angeli, Bari.

Papers under review

Mancuso, I., Messeni Petruzzelli, A., Panniello, U., & Del Giudice, M. (2nd round of revision). Value co-creation and value capture in digital innovation ecosystems: a multiple case study in the agrifood sector. R&D Management.

Di Paolo, F., **Mancuso, I.,** Lamberti, L., Bettiga, D., Messeni Petruzzelli, A., & Panniello, U. (2st round of revision). Exploring the metaverse business transformation: lessons learnt from four companies leveraging virtual experiences. Management Decision.

Introduction

A scientific approach to the formulation of digital innovation strategies in high-risk and high-uncertainty environments

"Innovation is inherently associated with risk and uncertainty, and the engagement of entrepreneurs with these is central to the innovation process"

Williams et al., 2021, p. 293

In today's innovation economy, businesses operate in complex and volatile environments shaped by rapid technological advancements, competition from unexpected markets, shifting consumer behaviors, and evolving regulatory pressures (Slagmulder and Devoldere, 2018). These dynamics create significant ambiguity and unpredictability, exposing firms to both risk and uncertainty in the innovation process (Williams et al., 2021). Consequently, the strategic management of risk and uncertainty has become essential to sustain firms' survival and competitive advantage in a constantly shifting landscape (Drnevich and West, 2023).

Although many scholars often treat risk and uncertainty as synonymous (Williams et al., 2021), these two conditions under which companies innovate are significantly different (Teece et al., 2016).

On the one hand, innovating under conditions of risk means developing new products, services, processes, or business models in environments where outcomes can be predicted with some level of probability (Teece et al., 2016). In such scenarios, the potential risks, such as financial losses, market rejection, or operational failures, can be quantified, and their likelihood estimated. This allows firms to manage the so-called *"known unknowns"* during the innovation process through traditional risk management tools (e.g., insurance, hedging, contingency planning, or partnerships) (Teece et al., 2016). Hence, firms innovating in risky environments focus on *"doing things right"* to minimize the potential downsides of innovation activities (Teece et al., 2016). A notable example of innovation amid risk is Apple's launch of the iPhone in 2007. The company faced significant risks due to the substantial financial investments required for this new product and concerns about consumer acceptance of a touchscreen device. To mitigate these risks, Apple conducted thorough market research revealing a rising consumer interest in multifunctional phones. Additionally, it capitalized on the success of the iPod and the iTunes ecosystem to foster adoption of the iPhone. Finally, strategic partnerships with telecom carriers like AT&T, which provided exclusive contracts, further bolstered Apple's position through a supportive distribution network.

On the other hand, innovating under conditions of uncertainty involves developing new products, services, or technologies in environments where the likelihood of success or failure cannot be reliably assessed (Teece et al., 2016). Unlike risk conditions, where challenges can be anticipated and planned for, uncertainty introduces *"unknown unknowns"*, where potential threats and opportunities for innovation remain obscure (Ehrig and Foss, 2022). This unpredictability renders traditional risk

management tools ineffective, requiring firms to focus on *"doing the right things"* during an innovation process that is driven by dynamic capabilities, experimentation, adaptability, and pivoting (Teece et al., 2016). A prominent example of innovation under uncertainty is SpaceX's development of reusable rockets in the early 2000s. SpaceX aimed to become the first private company to develop reusable rockets in an industry dominated by government agencies that relied on single-use technologies. The company encountered significant uncertainties in various areas, including technological feasibility, regulatory approval, and market acceptance. To address these challenges, SpaceX created entirely new engineering solutions, conducted numerous experimental launches (many of which initially failed), and invested substantial resources without any guarantee of costs' recovering. Through this process, the company successfully developed the Falcon 9, the first reusable rocket to reach orbit and return safely.

It is evident from the above examples that typically, in conditions of risk or uncertainty, a so-called champion or keystone firm creates a blueprint of innovation strategy, clearly defining how value is created, distributed, and captured (Dattée et al., 2018). In this way, risk and uncertainty are reduced and players are encouraged to innovate for the fear of *"missing the train"* (Dattée et al., 2018). Therefore, in risky and uncertain environments, innovation winners are the first-mover and fast-follower firms that rapidly adapt to environmental changes, using their innovation strategy to transform risk and uncertainty into new business opportunities (Mero and Haapio, 2022).

As emphasized by Teece et al. (2016, p. 15), risk and uncertainty have *"always been a feature of the business environment, but the tempo of surprises seems to be on the uptick"*. Indeed, the levels of risk and uncertainty are exponentially rising as the global economy is becoming more advanced and integrated thanks to digital innovation (Mero and Haapio, 2022). Digital innovation is defined as *"the creation, adoption, and exploitation of an inherently unbounded, value-adding novelty (e.g., product, service, process, or business model) through the incorporation of digital technology"* (Hund et al., 2021, p. 2). When managing digital innovation *"existing rules are being changed, and entirely new rules are being invented"* (Teece et al., 2016, p. 16) due to the speed, scale, and interconnectedness of digital technologies and their impact on business processes, products, and markets (Felicetti et al., 2024).

Indeed, digital innovation occurs at a much faster pace than traditional innovation. Digital technologies such as artificial intelligence, cloud computing, and data analytics evolve rapidly. As a result, firms are forced to innovate much more quickly than in the past via creation and recombination of existing and new technologies (Chen and Tian, 2022).

Additionally, digital innovation can scale more rapidly than traditional innovation thanks to modular components (Coviello et al., 2024). For example, new software can be launched globally with minimal infrastructure, compared to traditional innovations such as manufacturing products that require extensive supply chains, logistics, and distribution networks.

Finally, digital innovation is highly interconnected, creating complex ecosystems of technologies and stakeholders (Bohnsack et al., 2024). Unlike traditional innovations, which often occur within a more defined and linear value chain, digital innovations typically involve networks of users, developers, partners, and data flows.

The significant changes that digital technologies bring to traditional non-digital innovation process also introduce high risk and high uncertainty for firms, due to the rapid pace of technological development and the increased complexity of digital ecosystems (Felicetti et al., 2024). As a result, scholars recognize that digital innovation is more complex and unpredictable than traditional non-digital innovation (Hund et al., 2021; Soto-Acosta, 2024). At the same time, practitioners identify risks and uncertainties as the primary obstacles in digital innovation and admit a widespread immaturity to address such challenges (Statista, 2024; ERM Initiative, 2023).

Despite the widely acknowledged theoretical and practical importance in understanding how to navigate

digital innovation in high-risk and high-uncertainty environments (Soto-Acosta, 2024), theoretical and managerial gaps still exist in this area.

From a practical viewpoint, managers lack a roadmap and tools to cope with high-risk and high-uncertainty in digital innovation processes. Indeed, since digital innovation entails higher risk and uncertainty than traditional non-digital innovation, firms cannot rely on the same strategies used for traditional innovation when operating in high-risk and high-uncertainty digital environments. In particular, in such contexts champions may lack sufficient visibility to position themselves effectively for designing a blueprint of the innovation strategy (Dattée et al., 2018). Furthermore, although numerous studies unveil the nature of methods such as scenario planning, environmental scanning, and real options for managing risk and uncertainty in traditional innovation processes (Mero and Haapio, 2022; Ehrig and Foss, 2022), there is no evidence that they can address the unique challenges of the digital economy. As a result, the dangers of *"value missing"*, where organizations fail to realize their innovation strategy (Bocken et al., 2015), and *"value slippage"*, where organizations fail to capitalize on the innovation strategy (Cova and Paranque, 2016), increase when firms attempt digital innovation in high-risk and high-uncertainty conditions.

From a theoretical standpoint, scholarity attention focuses primarily on how to execute digital innovation strategies, leaving digital strategy formulation in high-risk and high-uncertainty environments largely unexamined (Slagmulder and Devoldere, 2018). Specifically, as noted by Slagmulder and Devoldere (2018, p. 733): *"In today's dynamic business context, companies must not only increase the speed and impact of their strategy execution but also continuously explore the development of new strategies in response to disruptive events or emerging opportunities".* However, although *"it is important to formulate a digital strategy"* (Satwekar et al., 2024, p. 7816), most of the academic production in strategy and innovation management do not provide enough emphasis on the *"shift in thinking from individual causal elements to interactions among them"* (Park and Mithas, 2020, p. 86). Instead, this focus is needed to fully understand how to *"formulating successful strategies in such digital environments"* (Park and Mithas, 2020, p. 86).

In this landscape, the overall objective of the present doctoral dissertation is to extend the current theoretical understanding and practical knowledge of how firms can formulate effective digital innovation strategies in high-risk and high-uncertainty environments, turning unexpected contingencies into drivers of new value creation.

Research question of the thesis:

How can firms formulate digital innovation strategies in high-risk and high-uncertainty environments?

This broad and ambitious objective is further broken down into individual research goals, which have been explored through four distinct papers (named Paper A, Paper B, Paper C, and Paper D). The following sections explain both the methodology and the rationale behind the collection of these papers.

Methodological approach

From a methodological perspective, the four studies adopt a range of approaches aimed at capturing the complexities of risk and uncertainty in digital innovation.

Three papers employ empirical methods, specifically qualitative research. Single or multiple cases of

companies approaching digital strategy formulation were deeply studied in an exploratory or inductive manner (Yin, 2014). In particular, exploratory case studies focus on uncovering new insights or generating hypotheses about poorly understood phenomena, while inductive case studies seek to build theory from the ground up, relying on the data gathered during the research process rather than testing pre-existing theories. The analysis of case studies allowed for closely examining specific real-world phenomena with the aim of understanding firms' processes, challenges, and outcomes in real-world contexts. Furthermore, expert interviews, conducted in parallel with case studies, provide deep, qualitative insights by gathering perspectives from industry professionals who are directly involved in managing digital innovation projects. These interviews help to contextualize the data collected in case studies and contribute to a more nuanced understanding of how firms formulate digital innovation strategies in high-risk and high-uncertainty environments.

In addition to empirical qualitative methods, one of the papers relies on a conceptual approach, focusing on theory building (Fisher et al., 2023). Rather than drawing on empirical data, it aims to develop a theoretical framework for understanding the dynamics of digital innovation strategy formulation. Conceptual studies are crucial in fields where empirical evidence is still emerging or where traditional theories fall short of explaining new developments, such as the complexity of digital strategy formulation. In this context, the conceptual study proposes new ways to think about the challenges firms face in digital environments characterized by high risk and uncertainty. The specific approach used for the conceptual paper was the phenomenon-based research, which *"involves recognizing and understanding a real-world phenomenon and then identifying or proposing a theory that can fully capture its inherent complexity […] by transcending artificial distinctions such as disciplinary silos or the micro-macro divide"* (Lumineau et al., 2024, p. 3).

The combination of empirical and conceptual methodologies is particularly valuable, as it allows for both theoretical exploration and refinement. Moreover, these methodological choices are consistent with observations raised by Williams et al. (2021). They note that, despite the growing body of literature on risk and uncertainty in the innovation process, much of the existing research relies heavily on quantitative methods. Such quantitative approaches often fail to capture the deeper meanings and understandings of formulating digital innovation strategies in high-risk and high-uncertainty environments. In contrast, qualitative and conceptual methodologies may reveal subtleties that are overlooked in large-scale quantitative analyses through a specific focus on how firms experience and navigate digital innovation in practice (Williams et al., 2021).

Research structure and summary of the research papers

To address the overarching research question of this doctoral thesis, i.e., *"How can firms formulate digital innovation strategies in high-risk and high-uncertainty environments?"*, four sub-questions were identified, each contributing to the final objective. These sub-questions guided the development of one or more papers and are closely aligned with the framework proposed by Yin et al. (2024). Specifically, in their recent paper published in the prestigious Academy of Management Annals, Yin et al. (2024) outline the four critical questions that individuals consider when facing contingencies (referred to as *"changes"* by the authors) that may introduce risk or uncertainty into human reasoning. Specifically, they argue that individuals must ask: *"What is the change?"*, *"What is the value of the change?"*, *"How will the change come about?"*, and *"What is the broader impact of the change?"*. I leveraged this conceptualization and extended it to the contingencies that firms face when formulating digital innovation strategies in high-risk and high-uncertainty environments.

"What is the change?"* and *"What is the value of the change?"

The first critical question that firms must address when formulating a digital innovation strategy in high-risk or high-uncertainty environments concerns identifying the nature of the change or contingency

they are facing. Specifically, companies must determine whether the change leads to a condition of risk or uncertainty. This aligns with Teece's (2016, p. 27) arguments: *"The first task in managing business enterprises competing in environments exposed to perturbation and disruption is to determine whether the source of change is primarily risk or primarily uncertainty"*.

In this regard, the first two papers of the doctoral thesis aim to address the questions *"What is the change?"* and *"What is the value of the change?"*. Specifically, Paper A analyses a change that generates high uncertainty for digital strategy formulation, while Paper B explores a change that produces high risk for companies formulating a digital innovation strategy.

Paper A is a study on digital innovation during one of the most recent and exemplary conditions of high uncertainty: the Covid-19 crisis. The pandemic represented an unprecedented exogenous shock, causing widespread disruptions in global supply chains, consumer behavior, and business operations (Martinez et al., 2021). Firms faced *"unknown unknowns"*, with no historical data or models to predict the trajectory of the pandemic, its duration, or how markets and regulations would respond. To navigate the crisis, many companies rapidly digitized their operations, shifted to remote work, or adopted new business models, all while lacking clarity on what the future held. In formulating digital innovation strategies during Covid-19, companies needed to account for the three types of uncertainty theorized by Milliken (1987): *"state uncertainty"* (uncertainty about the changes occurring in the environment), *"effect uncertainty"* (uncertainty about how these external changes will impact the organization), and *"response uncertainty"* (uncertainty about how to respond effectively to these changes). As Wenzel et al. (2020, p. 14) note, uncertainty is *"an integral part of responses to crises"*, making it challenging for managers to know in advance which strategic response will help firms survive and recover. In this landscape, Paper A examines how two leading food retailers, namely Walmart and Carrefour, formulated digital innovation strategies during the pandemic, emphasizing the importance of a two-step approach. This strategy involves a rapid modification of value mechanisms followed by long-term changes and exploration of growth opportunities, both underpinned by specific enabling factors.

Paper B examines digital innovation in the context of a high-risk environment, focusing on the emergence of the metaverse. The metaverse is an immersive and shared virtual world where users can interact with each other and with virtual assets and services for work, recreation, or investment (Belk et al., 2022). It gained significant attention in 2021, particularly following Facebook's rebranding to Meta. While the metaverse represents a relatively new contingency, it builds on established digital technologies such as virtual reality, augmented reality, and blockchain, which had already undergone development and market testing. As a result, although doubts on the speed of widespread metaverse adoption and the dominant platform design, the metaverse represented a risk condition under which companies can digitally innovate (Kumar et al., 2023). In this context, Paper B analyzes the digital innovation strategies of four leading companies, namely Nike, Gucci, Samsung, and Hyundai, as they formulated digital strategies in the metaverse. The paper also incorporates insights from industry experts to identify how firms can develop both digital and organizational capabilities for operating in the metaverse, as well as the key strategic factors that must be considered in strategy formulation. These strategic factors include the creation of a clear roadmap and the establishment of a strong leadership profile, both essential for driving digital innovation in a high-risk environment like the metaverse.

"How will the change come about?"

After understanding the change nature, it is important to understand the process through which change will occur into the firm (Yin et al., 2024). The existing literature underscores that in environments characterized by high risk and uncertainty, digital innovation strategies are fundamentally reliant on strategic agility, defined as a firm's ability to adapt its strategic direction to create new value (Teece, 2016; Slagmulder and Devoldere, 2018). This notion is succinctly encapsulated by Hund et al. (2021, p. 10): *"As digital innovation often leads to unanticipated upheaval within established industries […], agility, which involves the capability to identify and respond swiftly to unexpected changes and*

opportunities, is frequently highlighted as an important organizational capability in the context of deep uncertainty". Therefore, it is evident that when formulating a digital innovation strategy in high-risk or high-uncertainty environments, firms should aim at developing strategic agility. Indeed, through strategic agility firms can successfully leverage the changes in the environment for enhancing their operations. In this context, Paper C investigates how companies aiming for digital innovation in conditions of risk or uncertainty can develop agility to formulate their innovation strategies. Specifically, the paper focuses on how traditional, non-digital firms can cultivate strategic agility through corporate venturing activities related to the management of new digital ventures. The paper posits that, given the complexities inherent in digital innovation strategies within risky or uncertain contexts, corporations can greatly benefit from collaborating with specialized advisors. These advisors facilitate the interaction between established non-digital corporates and new digital ventures, thereby equipping firms with the strategic agility necessary to navigate the risks and uncertainties associated with digital innovation. Through a detailed analysis of a case study involving one such advisor (i.e., Gellify), Paper C outlines four primary approaches to fostering strategic agility: *"venture clienting"*, which enables a corporate to purchase products or services from a digital startup; *"venture acquisition"*, which facilitates the acquisition of a digital startup; *"venture building"*, which involves creating and developing a new digital venture; and *"venture builder building"*, which allows a corporate to establish a venture builder for the development of new digital ventures from the ground up.

"What is the broader impact of the change?"

The final question that companies must consider when formulating a digital innovation strategy in a high-risk or high-uncertain environment pertains to the broader impact of the change (Yin et al., 2024). At this regard, *"risk management has traditionally focused on protection against downside risks while paying little attention to strategic opportunities or upsides. This one-sided perspective is problematic in responding adequately to strategic risks because it overlooks an important source of value creation"* (Slagmulder and Devoldere, 2018, p. 735). The need to consider the broader impacts of risky and uncertain contingencies on digital strategies formulation has been widely acknowledged in recent studies. For instance, Drnevich and West (2023) emphasize that, on one hand, uncertainty poses significant challenges to business success and survival, introducing numerous liabilities concerning resource and capability quality, value, and availability, while on the other hand it can create disruptive opportunities for new entrants and foster firm growth. Recognizing the broader impact of risky and uncertain contingencies on the formulation of digital strategies, Griffin and Grote (2020) advocate moving beyond *"uncertainty management"*, which primarily focuses on reducing the negative impacts of contingencies, towards *"uncertainty regulation"*, which acknowledges the constructive impact of uncertainty for innovation strategies. In this context, Paper D aims to provide a comprehensive framework for understanding how conditions of risk or uncertainty can lead to simultaneous and paradoxical impacts on both value creation and value destruction for firms. Such factors must be considered holistically when formulating a digital innovation strategy in the face of risk or uncertainty. Utilizing a conceptual approach supported by illustrative cases, Paper D defines the antecedents and the nature of the paradoxical tension between value creation and destruction when managing artificial intelligence innovation to achieve sustainable development. It demonstrates firms can either create value by mitigating or reducing a grand challenge through digital innovation or destroy value by failing to resolve an issue or inadvertently introducing new challenges as a result of digital innovation.

Figure 1 resumes the overall objectives of the thesis as well as the individual questions addressed in the four papers, opening the way for the subsequent chapters.

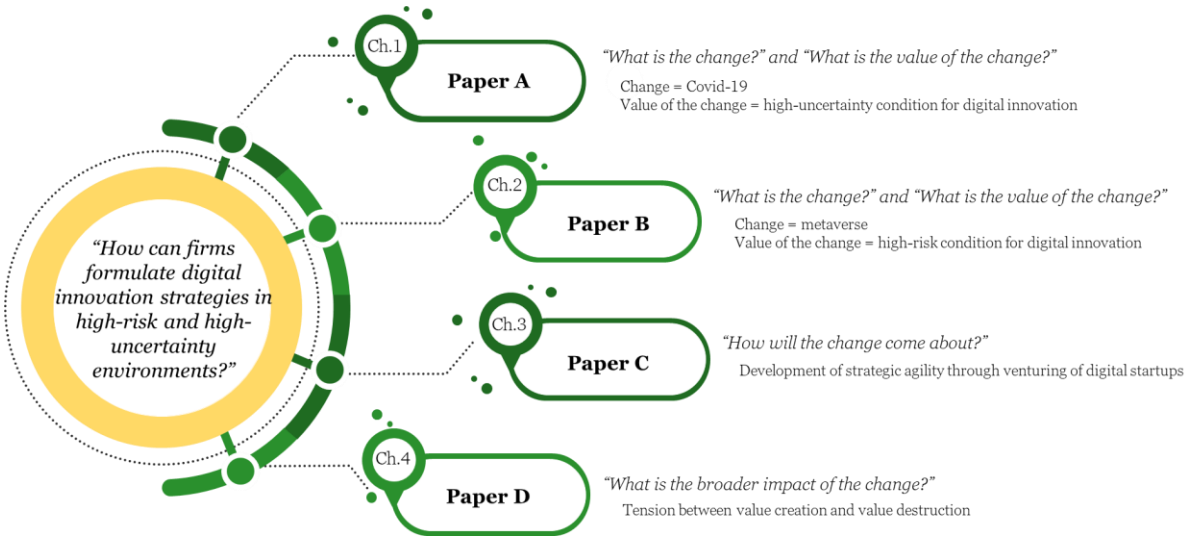


Figure 1 - Research structure and summary of the research papers

Chapter 1

Paper A

Title	Innovating agri-food business models after the Covid-19 pandemic: The impact of digital technologies on the value creation and value capture mechanisms.
Coauthors	Petruzzelli, A. M., & Panniello, U.
Type	Qualitative empirical study
Methodology	Comparative multiple-case study
Link with the Research Questions of the thesis	• What is the change? • What is the value of the change?
Paper specific Research Question(s)	How have digital technologies allowed food retailers to innovate the mechanisms of value creation and value capture of their business models to respond to the Covid-19 crisis?
Theoretical contribution	Frame a model of how digital business model innovation takes place in response to crises
Conference presentation(s)	-
Journal	Technological Forecasting and Social Change (AiIG: Gold; ABS: 3; JIF: 12.9)
Status	Published in 2023 in the Special Issue "Technologies and digital transformation for sustainability in agribusiness"

Table 1 - Paper A's summary.

Abstract

This paper investigates the phenomenon of business models innovation (BMI) empowered by digital technologies and activated as a response to Covid-19 crisis. In fact, during the crisis numerous digital redesigns of businesses occurred to pursue both continuity and competitive advantage. Amongst these, the food retail sector has undergone under the pressure of the crisis intense digital changes, which, however, have not yet been investigated under the theoretical lens of BMI. To fill this gap, the paper analyzes the digital actions taken during the pandemic crisis by two large food retailers, namely Walmart and Carrefour. Covering a wide temporal interval of the pandemic evolution and reviewing multiple geographical markets, the authors interpreted the grocer's digital responses to the crisis in terms of innovation in value creation and capture mechanisms. As a result, three phases of digital BMI have been reconstructed, each characterized by specific mechanisms of value creation and capture experienced by the two grocers during the pandemic. Leveraging these findings, the paper proposes a model capable of defining how digital BMI takes place in response to crises. Results broaden theoretical knowledge and practical suggestions on digital BMI in terms of enabling factors, actionable value mechanisms, and future business opportunities.

Keywords: business model innovation, value creation, value capture, digital technologies, Covid-19 crisis, food retail

1. Introduction

Business Models (BMs) and Business Models Innovation (BMI) concepts are gaining a growing interest in academia and industry since they photograph the mechanisms that organizations use to create, deliver, and capture value (Osterwalder and Pigneur, 2010; Amit and Zott, 2015; Foss and Saebi, 2017; Teece, 2018), as well as seize the transformations that these mechanisms experience to ensure growth and competitive advantage in a constantly changing environment (Demil and Lecocq 2010; Teece, 2010; Amit and Zott, 2012; Foss and Saebi, 2017).

One of the major factors inspiring new opportunities for BMI is represented by the emergence of digital technologies that are radically and quickly reshaping the business landscape (Berman, 2012; Rachinger et al., 2019; Li, 2020; Latilla et al., 2021; Vaska et al., 2021). Indeed, digital technologies generate new value creation and value capture pathways and enrich traditional ones (Parida et al., 2019; Rachinger et al., 2019; Sjödin et al., 2020; Linde, 2021; Tavoletti et al., 2021) throughout the empowerment of brand portfolio, the better understanding of customer needs, the process optimization, and the improvement of products and services delivered (Vaska et al., 2021), to name a few.

The application of digital technologies for BMI purposes turned out to be particularly valuable in facing the threats and disruptive changes experienced with the advent of the Covid-19 pandemic (Priyono et al., 2020; Coskun and Tanrikulu, 2021; Kronblad and Pregmark, 2021; Mostaghel et al., 2022). In fact, as a result of what is considered the worst crisis since World War[1], organizations rethought and redesigned their BMs (Seetharaman, 2020; Martinez et al., 2021; Martínez-Velasco et al., 2022), both in the short and long run, also exploiting the strategic opportunities incorporated in digital technologies (Kraus et al., 2020; Hazaa et al., 2021; Gkeredakis et al., 2021; Buck et al., 2022) to gain business continuity, resilience, and competitiveness (Akpan, 2020; Gregurec, 2021; Corvello et al., 2022). In this sense, the pandemic triggered and accelerated the use of digital technologies by organizations to innovate BMs, also overcoming the resistance encountered in no crisis times for this practice (IBM Institute for Business Value, 2020; Chakraborty et al., 2020; Jacobides and Reeves, 2020).

Among the sectors that have experienced the phenomenon of rapid rise of new digital BMs during the Covid-19 crisis, the agri-food stood out. Actually, across the agri-food chain, which collects the set of actors involved "from field to fork", namely from farm equipment and production to processing, distribution and consumption (Humphrey and Memedovic, 2006; FAO, 2017), there are several actors responding to the crisis with a digital BMI. For example, agricultural producers overcame a lack of seasonal agricultural workers due to international borders closure (FAO, 2020) thanks to mechanization and smart farming technologies, which decreased the reliance on human labor (EIT Food and Lantern, 2020; Lioutas and Charatsari, 2021). At the same time, food service actors, seeing their businesses closed as a result of the national lockdowns, shifted their BMs towards innovative approaches in online food delivery (Gavilan, 2021), using existing platforms or developing their own (EIT Food and Lantern, 2020).

However, if these changes could be short-term modifications imposed by the contingency of the pandemic, there is a stage of the agri-food chain that during the pandemic crisis enhanced a variety of digital solutions destined to change irreversibly traditional value creation and capture mechanisms of BMs, that is food retail. In fact, to decrease the chances of contagion, food retailers have on the one hand increased self-checkout and contactless payment methods in physical stores (Aull et al., 2020), while on the other hand they have encouraged online delivery and pick-up options (Aull et al., 2020; Hobbs, 2020; Abbu et al., 2021). Therefore, food retailers used digital technologies both to redesign traditional brick and mortar BMs and to enable new e-commerce ones, which were the protagonists of a huge surge during the pandemic (Keyes, 2020; Herbert et al., 2021).

In reference to the change in food retail by virtue of Covid-19, many scholars have been interested in the rapid development of online grocery and food delivery (Dannenberg et al., 2020; Gavilan et al.,

2021), in the raise of "click and collect" services (Mohamad et al., 2020) and, more generally, in the investigation of the key digital drivers and technologies used in food retail (Abbu et al., 2021) to cope with the Covid-19 crisis. However, although academics have questioned the emergence and development of changes experienced by food retailers, the digital innovation of grocers' BMs following the Covid-19 was not the subject of in-depth and detailed studies. In particular, the role of digital technologies for innovating the mechanisms of value creation and value capture of retailers' BMs to respond to the Covid-19 crisis has not been fully explored, so calling for further investigations.

To close this knowledge gap, we aim at understanding how the value creation and value capture mechanisms underpinning BMs of food retailers have changed, with particular reference to the digital initiatives that companies have adopted to cope with the Covid-19 crisis.

To reach our purpose, we chose to analyze the cases of Walmart and Carrefour. In fact, Walmart e Carrefour are two of the largest food retailers in the world and faced the pandemic with the introduction of digital changes in their models of value creation and capture, achieving extraordinary financial performance[2]. For this reason, we believe Walmart and Carrefour are exemplary case studies to answer our research question and investigate innovation and business strategies in food retail as a response to the crisis.

Using a multiple case study approach (Yin, 2014), we analyzed the actions taken by the two grocers in the year of the pandemic (February 2020 – April 2021) and we identified three clear stages representing their digital BMI, based on different value creation and capture mechanisms. In particular, findings show the succession of a phase of close synergy between digital and physical processes marked by an improvement in the level of service offered, a phase of expansion of customer portfolio in B2C and B2B domains through new shopping experience and digital platforms, and finally a phase focused on the new functionalities of physical stores aimed at transforming both back-end and front-end activities in an omnichannel perspective. In addition, the discussion of our results leads to the elaboration of a model that categorizes and evaluates the interweaving between the elements enabling a digital BMI in times of crisis. With these results, we aim at contributing to the stream of research on digital BMI (Rachinger et al., 2019; Parida et al., 2019; Li, 2020; Sjödin et al. 2020; Vaska et al., 2021) in two ways. First, we improved the understanding of how value creation and capture mechanisms can be digitally innovated during a crisis thus modifying existing BMs. Second, we framed and unveiled the positive role of this practice for innovation management in crisis times thus defining how it can lead to the definition of completely new digital BMs. Moreover, we also provided practical insights for companies to pursue a successful digital BMI path following crisis.

The rest of the article is organized as follows. Section 2 contains a review about the use of digital technologies for BMI, especially in food retail. Section 3 investigates the multiple case study methodology adopted for sample selection, data collection, and data analysis. Section 4 shows the impact of digital technologies on Walmart and Carrefour's value creation and capture mechanisms. Section 5 reports the discussion of the patterns traced in the light of the main flow of literature on BMI and digital technologies. Finally, Section 6 addresses the implications and limitations of the paper, outlining new directions for future research.

2. Theoretical Background

2.1 Digital Business Model Innovation

BMI can be defined as a business transformation process that happens when firms modify or improve at least one of the foundational elements of value creation, delivery, and capture (Abdelkafi et al., 2013;

Ghezzi and Cavallo, 2020) that define BMs (Shafer et al., 2005; Osterwalder and Pigneur, 2010; Gassman et al., 2014). Specifically, organizations can innovate their value creation and capture mechanisms through new combinations of core competencies and key resources, complementary assets and value networks (Rayna and Striukova, 2016), as well as through changes to cost structure, revenue formula, and profit allocation across the value chain (Sirmon et al., 2007; Teece, 2010; Holm et al., 2013).

An effective way to act on all these mechanisms, allowing the development of new BMs and renewal in existing ones, is to employ digital technologies for promoting BMI (Kohli and Melville, 2019; Rachinger et al., 2019; D'Ippolito et al., 2019; Li et al., 2020; Bosler et al., 2021). In fact, in recent years digital technologies have inspired a number of innovative methods to generate and appropriate value (Sjödin et al., 2020), such as extreme personalization throughout servitization and new pricing models based on subscriptions, pay-per-use or similar methods (Parida et al., 2019; Kohtamäki et al., 2020; Vaska et al., 2021). As a result, digital BMI has been studied and implemented for gaining revenue growth, competitive advantage, and performance improvement (Zhang et al., 2016; Parida et al., 2019; Correani et al., 2020; Tavoletti et al., 2021).

Moreover, digital technologies trigger BMs transformations in very fast and not linear ways (Priyono et al., 2020), ensuring a powerful survival in crisis times. In fact, during these times, uncertainties about the direction of technological change, demand conditions, and new market opportunities (Archibugi et al., 2013) limit the amount of time available to respond and solve problems without incurring disastrous consequences (Ardito et al., 2021; Gkeredakis et al., 2021). Thus, to respond the crisis, fast growing and dynamic firms are pushed to increase their innovative activities and explorative strategies in product and market domains (Archibugi et al., 2013), both using digital technologies and BMs changes to accelerate innovation (Ritter and Pedersen, 2020; Gkeredakis et al., 2021). At this regard, scholars have emphasized how digital technologies are able to amplify the beneficial potential of non-digital BMI to cope with disruptive environmental changes (Priyono et al., 2020), generating firm survival and long-term performance (Grewal and Tansuhaj, 2001; Lindgart et al., 2009; George and Bock, 2011; Cucculelli and Peruzzi, 2020) through modification and formulation of new value creation and capture mechanisms (Amit and Zott, 2010; Breier et al., 2021).

There are numerous examples of companies that grasped the opportunity to digitally innovate BMs during crises, such as Airbnb and Uber, born from the ashes of the 2008 financial crisis leveraging digital platforms, and Alibaba, which launched the C2C Taobao online shop as a response to the 2003 SARS epidemic crisis.

It is therefore clear that digital BMI is a potentially very profitable practice, even in crisis times, since it is capable of opening up new strategic growth path. In the next section, we deepen this issue by contextualizing it within the dynamics of the food retail sector, which has been shaped by numerous digital changes in recent times (Nosratabadi et al., 2020).

2.2 Digital Business Model Innovation in food retail

Food retailers traditionally adopt brick and mortar BMs that have proven to be extremely rooted and hardly influenced by digital disruption, until recently (Abbu et al., 2021; Vazquez-Noguerol, 2021). In fact, in latest years food retailers are innovating traditional mechanisms of their BMs thanks to digital technologies (Vojvodić, 2019; Kraak, 2020; Lagorio and Pinto, 2020; Nosratabadi et al., 2020), thus resulting in a closest synergy between physical and digital channels (Yrjölä, 2014; Fagerstrøm et al., 2017; Sturiale and Scuderi, 2017). This practice allowed reimagining the functioning of the stores, enhanced with new digital tools, as well as using these traditional assets as the fulcrum of new e-commerce BMs.

Various technologies can be applied in stores to valorize and digitalize the shopping experience. For instance, mobile apps or digital displays for providing useful information on products and shopping suggestions, as well as "scan and go" and self-service solutions for offering new checkout methods generate time and cost saving, increased transparency, and personalization, while modifying the monetization methods with semi or fully automatic payment systems (Inman and Nikolova, 2017; Sloot, 2018; Spanke, 2020; Fagerstrøm et al., 2020; Böttcher et al., 2021; Abbu et al., 2021).

In addition to this, the use of sophisticated technologies such as robots and micro-fulfillment centers in stores optimize picking and inventory management in such an efficient way that physical stores become strategic points for quickly fulfilling orders placed online, sometimes devoting themselves entirely to this function, as in the case of "dark stores" (Grewal et al., 2020; Kraak, 2020). The use of food retail stores for activating e-commerce BMs brings new value creation and capture mechanisms, including the reduction in time spent and information asymmetries for customers (Güsken, 2018; Mason, 2019), the definition of new resources and activities to manage customer demand, transport, and fulfillment issues (Hübner et al., 2019; Davies et al., 2019; Vazquez-Noguerol, 2021), and the development of subscription options (Belavina et al., 2016; Wagner et al., 2021).

The BMI of food retailers guided and enriched by digital technologies has become increasingly diffused during the Covid-19 pandemic, which accelerated rapid reorganizations of in-store and online activities with digital technologies (Abbu et al., 2021). This is because the health emergency that began in 2020 was an unprecedented event, which required rapid interventions in terms of digital innovation of grocers' BMs to reduce contacts and visit times and at the same time manage the phenomenon of panic buying. At this regard, there has been a growing adoption of cashier-less or semi-self-checkout systems and an extensive use of mobile apps for a safer in-store shopping experience (Takashima, 2020), as well as a greater reliance on delivery and pick-up services (Hobbs, 2020; Chenarides et al., 2020; Dannenberg et al., 2020) also thanks to the conversion of stores into variously automated dark stores for faster deliveries (Takashima, 2020; Končar et al., 2021).

2.3 Research Gap and Objective

Downstream of the review, it is evident how the digital BMI of food retailers is a recent phenomenon and how it has been accelerated by the Covid-19 pandemic, the first real huge crisis that put food retailers to the test with reorganizations of in-store and online activities with digital technologies. While some studies have analyzed the occurrence of these phenomena (Dannenberg et al., 2020; Abbu et al., 2021), there are no works in the literature that unify the digital actions of food retailers undertaken during the Covid-19 and analyze these trends under the theoretical lenses of BMI. Moreover, the topic of innovation in crisis times is of paramount importance, since emergencies affect the decisions of firms to invest or abandon innovation efforts (Archibugi et al., 2013). In fact, companies can decide to change and innovate BMs' value mechanisms as well as to adopt digital technologies to escape from, adapt to, or even thrive on opportunities embedded in crises (Osiyevskyy and Dewald, 2018; Gkeredakis et al., 2021).

Starting from this consideration and with the aim of filling the gap in the existing literature regarding the role of digital technologies for innovating the mechanisms of value creation and value capture to respond to the Covid-19 crisis, this paper undertakes to answer the following research question:

"How have digital technologies allowed food retailers to innovate the mechanisms of value creation and value capture of their BMs to respond to the Covid-19 crisis?"

We attempt to answer this question by examining the innovation actions of Walmart and Carrefour. The two food retailers have in fact exploited the pressure times of the pandemic to successfully accelerate

digital driven projects within the entire organization, establishing themselves as examples of BMI in food retail during the crisis.

3. Research Methodology

To achieve our research purpose, we believe that a multiple case study approach is an adequate analysis strategy. Actually, this research methodology is suitable for examining contemporary and complex events within the real-life context in order to address "how" and "why" questions (Yin, 2014). Such characteristics make the case study approach particularly effective for the aim of our paper. In fact, digital BMI in response to the Covid-19 crisis is a novel and complex phenomenon lacking in adequate understanding, on which qualitative approaches guarantee deepen exploration and effective theory building (Eisenhardt 1989; Ghauri and Gronhaug, 2005; Myers, 2009). In addition, research by means of case studies has been widely adopted to investigate the domain of BMI and digital technologies, being able to trace the evolution of these phenomena within organizations (Abrell et al., 2016; Ghezzi and Cavallo, 2020; Correani et al., 2020; Presenza et al., 2021).

We decided to analyze two cases, i.e., Walmart and Carrefour, to obtain greater robustness and generalizability than that obtained by studying a single case, thanks to the possibility of accessing varied empirical evidence and conducting comparative analysis (Eisenhardt, 1989; Eisenhardt and Graebner, 2007; Yin, 2014) to search for similar patterns in the digital BMI occurred during the crisis.

3.1 Sample

To ensure rigorous analysis and select critical and extreme case studies (Eisenhardt, 1989; Yin, 2014), the selection procedure was characterized by three criteria. First, we took in account historically leading companies in the food retail sector that have embraced or are embracing a path of digital innovation on multiple areas, to capture diversified shifts to BMs. Second, we identified companies that continued to have excellent financial and operational performance during the pandemic, emerging victorious from the crisis thanks to their digital strategies. Third, we focused our attention on companies on which qualitative and quantitative information abound, to build a detailed BM representation and trace the innovation path in detail. As a result, we selected Walmart and Carrefour, two of the most successful food retailers in the world that accelerated digital transformation initiatives and achieved leaps in sales in 2020.

Below we provide a preliminary description of the two cases and a summary of contextual information in Table 1.1.

Table 1.1
Case study overview.

	Walmart	**Carrefour**
Company description	At the top of all the global retail, American food retail and corporate companies' rankings[3], Walmart's value derives from its strategy of "Every Day Low Prices" and "Every Day Low Costs"	Leading food retailer from east to west, Carrefour creates and captures value around quality, organic and traced food
Company digital background	Walmart made massive investments since 2015 in digital technologies for logistics and supply chain optimization (e.g., blockchain for transparency and faster decision making; software and hardware solutions for inventory tracking and managing;	Carrefour released a five-year transformation plan in 2018 which provides, among others, digital measures to promote the sustainability of food (e.g., expansion of blockchain technology for higher quality and control of the supply chain) as

	machine learning for transportation and delivery routes) and user experience improvement (e.g., expansion of online channels and integration with physical ones for more accurate profiling and customization of offers)	well as the creation of an omnichannel ecosystem that leveraged stores and e-commerce (e.g., new e-commerce sites in each country, increase in pick up options, delivery and cash and carry, investments in digital payments, virtual shopping assistant)
Covid-19 impact on business performance	In the fiscal year ended January 31, 2021, Walmart's global revenue increased by nearly 7% compared to a year earlier, thanks to massive gains in both store and e-commerce sales. In particular, Walmart U.S. e-commerce sales grew 74% in Q1 FY21, with strong results for grocery pickup, delivery services, walmart.com, and marketplace, continuing to raise an additional 37% across all channels in Q1 FY22	In 2020, with revenue growth of more than 7.8% on a like-for-like basis, Carrefour has achieved its best performance in at least 20 years. In this scenario, progress in food e-commerce was vigorous with a 70% boom in gross merchandise volume and confirmation of the appeal of organic products (+18% revenue growth in this market). Moreover, customer satisfaction has risen sharply, with a 12-point increase in Net Promoter Score at Group level
Covid-19 impact on digital innovation strategies	The crisis has spurred Walmart's innovation by focusing on the optimization of online shopping thanks to a branched physical presence and new purchase and delivery methods, as well as on the digital efficiency of logistics and in-store activities	Carrefour reacted to the 2020 sharp increase in online traffic with adjustments on purchasing platforms, increases in pickup and delivery through expansion of convenience stores, and with the automated transformation of warehouse and in-store operations

Walmart

Founded in 1962 and with more than 10,500 stores and clubs in 24 countries constituting its core asset, Walmart's strategy is to provide consistent discounts and optimize its supply chain, operating on various formats like supermarkets, hypermarkets, supercenters, warehouse clubs, cash-and-carry stores, discount stores, neighborhood markets, and e-commerce platforms.

In recent years, Walmart accounted important investments in digital innovation, such as the world's largest e-commerce deal with Flipkart's acquisition and the co-foundation of an online grocery delivery company in China. Moreover, the retailer cultivates digital solution in its own technology incubator and partnered with specialists in cloud technologies, big data, machine learning, Internet of Things (IoT), robotics, and blockchain to improve nearly all areas of its business system.

The pandemic has accelerated Walmart's innovative drive, so much that the grocer recorded a huge climb in the ranking of the world most innovative companies of 2020 based on data from Boston Consulting Group (+29 positions compared to the previous year)[4]. To respond to the rise in digital ordering during the pandemic, Walmart leveraged more than 4,700 physical stores located within 15 minutes of 90% of the U.S. population for online order distribution. Specifically, Walmart acted on in-store automation and advanced technology solutions and took advantage from a number of strategic partnerships with startups and high-tech companies for testing new forms of grocery delivery and scaling micro-fulfillment center. At the same time, the grocer focused its efforts on optimizing online purchases with new forms of subscription, delivery, and collection without contact, based on servitization and personalization offerings.

Carrefour

Dated 1959 in France, the Carrefour Group is one of the Europe and South America leading food retailers[5], with a network of some 13,000 stores in more than 30 countries that includes hypermarkets, shopping centers, groceries, convenience stores, food markets, and own commercial formats.

The grocer's business strategy is based on the promotion of food transition, encouraging access to high-quality, local, and affordable food through short and tracked distribution channels. With this aim, Carrefour has increased quality, authenticity, and traceability thanks to the introduction of the first European food blockchain, combining this initiative with the geographical expansion of convenience stores and the acquisition of food e-commerce startups (e.g., the meal kit delivery specialists Quitoque and Dejbox, the supplier of extra fresh basket from local producers Potager City) to enhance greater access to sustainable food. Furthermore, Carrefour has entered in agreements with world market leaders in big data, artificial intelligence, digital payments, and mobile services (e.g., Google, Tencent) for the improvement of shopping experience and for the joint creation of an innovation lab on acceleration of digitization in France.

In this wake, Carrefour acted during the pandemic with the release of new platforms and mobile apps and with stores' acquisition in large cities to ensure everyone to purchase food online or choose "click and collect", while proceeding with conversion of sites to dark stores, with increase in automation in fulfillment centers, and with new partnerships for delivery service.

3.2 Data Collection

Once the companies were selected, we proceeded to analyze the cases as distinct and discrete experiments (Eisenhardt and Graebner, 2007) before conducting a comparative cross-case analysis (Eisenhardt, 1989). We collected data from multiple secondary sources (i.e., documentary information and archival records) to triangulate for gaining more robustness, avoiding bias, and increasing quality (Eisenhardt, 1989; Yin, 2014).

In particular, the data collection process followed a three-step strategy, each characterized by specific research objectives and specific data sources.

Initially we collected data and information useful to have a preliminary knowledge of the two cases, reconstructing the strategies and mechanisms of value creation and value capture that characterize the BMs of Walmart and Carrefour. To achieve the aim of the first phase of the data collection strategy we consulted the corporate websites (i.e., https://corporate.walmart.com/; https://www.carrefour.com/en/group), which included an overview of the businesses dynamics of Walmart and Carrefour (e.g., the history of the two groups, the vision and critical activities on which the grocers compete and create value, the long-term growth strategies and the digital actions they have taken or are working on to achieve business goals), as well as corporate reports and financial information. Alongside those data, academic papers who investigated the Walmart and Carrefour cases (e.g., Minadeo, 2010; Hocquelet, 2014), business newspapers (e.g., Financial Times, CNBC, Bloomberg), market research portals (i.e., Statista), and consulting agencies' reports (e.g., IDC, McKinsey, Accenture) were extremely relevant to reconstruct the background and innovation strategies adopted by Walmart and Carrefour and to acquire preliminary knowledge on their digital moves.

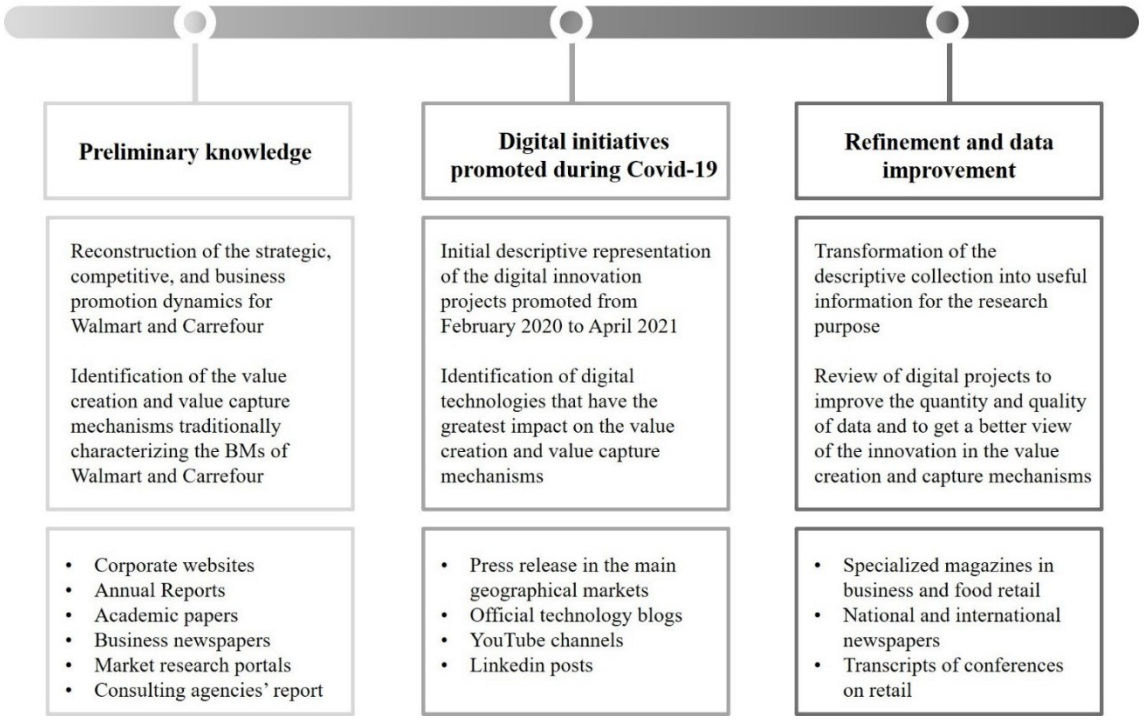
After framing the context in which Walmart and Carrefour operate, the second step of the data collection strategy was to gather descriptive information related to the retailers' digital initiatives promoted as a response to the Covid-19 crisis, in order to identify the digital technologies that determined the greatest innovations in the value creation and value capture mechanisms for the two grocers. The main data sources for this data collection step were the newsroom sections of the Walmart and Carrefour webpages, sieved from February 2020 to April 2021. In particular, both the newsroom sections of the corporate group pages and the local websites of the most important countries in which the companies operate (e.g., USA, Canada, Mexico, Brazil, Argentina, France, Italy, Spain, Belgium, UAE, China) were examined, as well as the website of Sam's Club (i.e., the chain of membership-only warehouse clubs owned and operated by Walmart) and Majid Al Futtaim (i.e., the exclusive franchisee for

Carrefour in the Middle East, Africa, and Asia). In addition to the press releases, further material useful in this phase was found in other official channels, such as the groups' blogs dedicated to digital and technological initiatives (i.e., Horizons by Carrefour, Walmart Global Tech), YouTube channels owned by the two grocers, and Linkedin pages both of the two organizations and of the operating, commercial and innovation managers who posted trending content.

As a third step of the data collection strategy, we tracked additional documentary information for each action undertaken by the companies during the pandemic, to refine and improve the quantity and quality of data available for our research purpose. Specifically, we consulted sites of companies specialized in dealing with food retail and business issues (e.g., Supermarket News, Institute of Grocery Distribution), national and international newspapers (e.g., The New York Times, Le Figaro), and transcripts of conferences on retail (e.g., Bank of America 2021 Consumer & Retail Technology Conference, Morgan Stanley Virtual Global Consumer & Retail Conference). These data contained descriptive material of technological projects carried out and/or in-depth studies by qualified analysts in the evaluation of strategic and digital plans, also reporting interviews with managers and technological partners involved in the initiatives. In this way, the characteristics of each innovation were reconstructed, as well as the mechanisms that made these changes concrete.

The data collection strategy presenting the gathering phases and their contribution to research objectives, together with the archival and documentary sources used, is indicated in Figure 1.1.

Figure 1.1
Data collection strategy.



3.3 Data Analysis

Data collected were critically and inductively analyzed following the insights of Miles and Huberman (1984), Eisenhardt (1989), Strauss and Corbin (1998), and Yin (2014), with the aim of identifying common patterns between the two companies in reference to digital BMI occurred during the pandemic crisis.

Specifically, the vast amount of data collected was ordered, organized, and structured following a specific coding scheme that allowed to identify relevant elements for our scope. The scheme was derived from the research questions and existing theoretical frameworks of BMs and BMI (Zott et al. 2000; Shafer et al. 2005; Amit and Zott, 2012; Parida et al. 2019; Sjödin et al. 2020). In this way, two first-order categories, i.e., "value creation" or "value capture", were developed for guiding the within-case analysis. In particular, every innovation developed by Walmart and Carrefour has been grouped and tabled regarding the association with a mechanism of value creation or capture in the retailer's BM, and was also ordered by time scale to assure a correct temporal tracking. Thanks to this first action of coding, we managed to summarize the enormous quantity of data collected, thus simplifying the comparative analysis of the cases and the extraction of patterns.

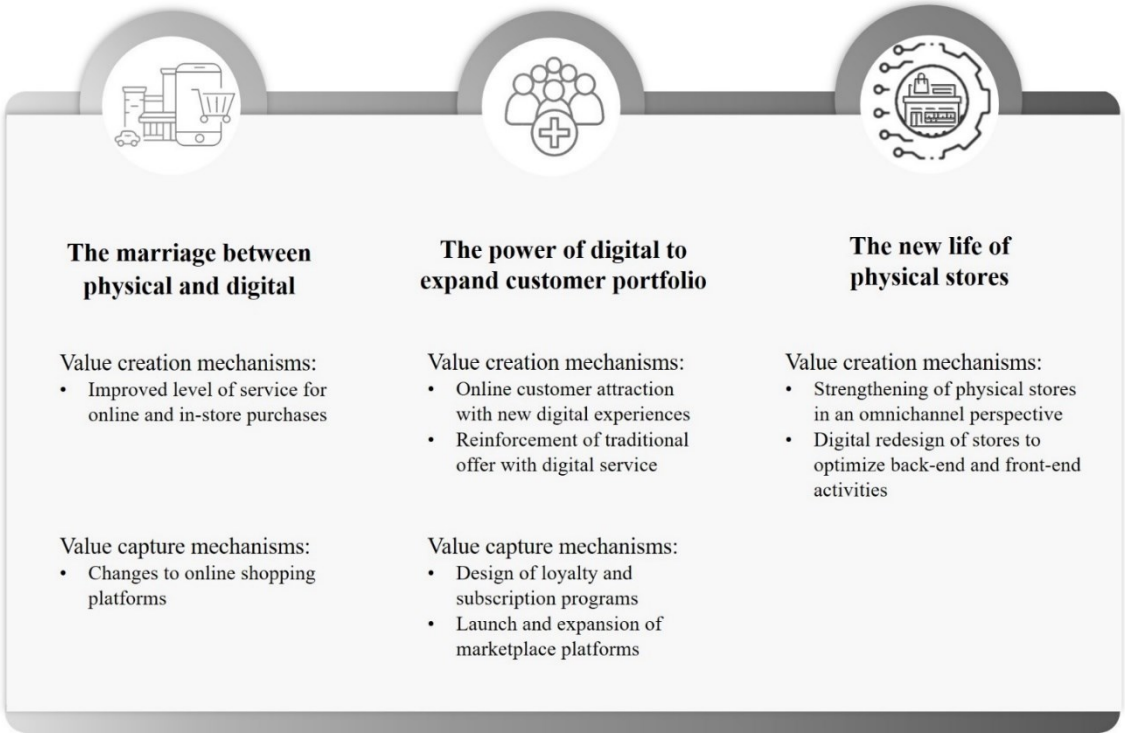
In fact, after all data were coded, we identified relationships and patterns among data. In particular, second-order themes were developed (e.g., "level of service", "marketplace platforms"), to be the object of internal discussion and further comparisons with BMs and BMI theories. This practice continued until saturation, i.e., until no new themes were able to identify mechanisms of value creation and capture, and, at the same time, no refinement to existing themes were necessary to clarify the retailers' innovation actions. For this reason, the internal discussion has been supported by new collection of empirical data to correctly group the different value mechanisms emerged into three main phases representing the digital BMI occurred to Walmart and Carrefour following the crisis. Finally, thanks to a continuous comparison with the main literature on BMI and digital innovation in food retail, the discussion led to the development of a model answering our research question and aimed at generalizing the digital BMI phenomenon in response to the crisis.

4. Findings

This section is organized around three phases (i.e., "The marriage between physical and digital"; "The power of digital to expand customer portfolio"; "The new life of physical stores") that indicate how Walmart and Carrefour digitally innovated their mechanisms for creating and capturing value during the Covid-19 crisis. Specifically, the first phase (i.e., "The marriage between physical and digital") is characterized by optimization and new releases of platforms and applications to ensure a safe and effective purchase both online and in-store. Instead, in the second phase (i.e., "The power of digital to expand customer portfolio") a more structured development of solutions to support physical and virtual shopping experiences occurs, with the aim of providing new benefits to users, building loyalty, and exploring new proposals for additional customer segments. Finally, the third phase (i.e., "The new life of physical stores") focuses on long-term actions that can transform physical stores into strategic units capable of satisfying physical and digital purchasing processes more efficiently and effectively.

Figure 1.2 schematizes the three phases of the digital BMI experienced by Walmart and Carrefour during the pandemic crisis, highlighting the changes in the mechanisms of value creation and capture for the two grocers.

Figure 1.2
The innovations in value creation and value capture mechanisms for Walmart and Carrefour.



4.1 The marriage between physical and digital

The fuse triggered by the pandemic determined for Walmart and Carrefour an intensification of their efforts in digital technology towards the streamlining of online and in-store shopping processes. In fact, in this first phase the two grocers focused on the digital reorganization of purchasing processes, enhancing the level of service through more effective platforms capable of improving and combining navigation on virtual and physical stores.

Carrefour had to deal with an IT infrastructure not sized for the dizzying increase in traffic recorded on online platforms, whose access was initially characterized by inefficiencies and queues. However, the French brand promptly resolved those problems and innovated its value creation mechanisms by improving the level of service in online and in-store purchases. In particular, two lines of action were elaborated to reach this goal. Firstly, Carrefour completely renewed the interface of its websites and apps with a user-centered approach, exploiting internal expertise in user experience (UX) design[6] and collaborations with freelancers[7] and companies specialized in e-commerce[8]. As a result, Carrefour released new resilient and ease to use website and app versions in France[9], Italy[10], Belgium[11], Brazil[12], and created an ex-novo platform in Argentina[13], where they had never been successfully developed before. In addition, the new enhanced platforms increased the breadth of the omnichannel proposals partially experienced before the pandemic. In fact, the platforms simplified the article search function and the view of the promotions and offers for the items available online and in the store at that moment, thus allowing customers to choose the most convenient purchase option for their frequently purchased items and shopping lists. At the same time, the app updates diffused a “phygital” shopping process among multiple division of the group. Specifically, apps were equipped with scanning functions useful to buy and check out from the stores, without any contact, and were empowered to enable “click and collect” via QR code at fully automatic grocery collection points. Besides the investments to expand safe and efficient pickups in traditional[14] and automatic[15] forms, Carrefour also worked for a greater capillarity of the delivery service[16]. Indeed, the grocer strengthened existing collaborations with food

delivery platforms (e.g., Glovo in France, Spain, Argentina, and Italy) and entered into new partnerships to make the service increasingly branched, accessible, and express (e.g., Uber Eats in France and Belgium; Deliveroo in France, Belgium, Spain and Italy; Glovo in Kenya and Georgia). The enhancement and development of new online shopping channels required not only IT competences, but also operational skills. In fact, since a predominant use of physical stores for multiply online orders' preparation capacity was essential for providing the value to customers, Carrefour hired temporary workers in local areas, regions, and central offices to assemble online orders[17].

Walmart, in the same way as Carrefour, innovated its mechanisms for creating value by making the purchase service more efficient, thanks to apps' updates useful for improving in-store experience. Specifically, Walmart scaled the access to a series of digital features already developed, such as Walmart Pay (i.e., system for paying in-store with the smartphone, made completely touch-free with the advent of the pandemic), Store Maps (i.e., system for facilitating shop navigation), and Item Finder (i.e., system for tracking down items in the shop)[18]. In addition, for what concerns the collection of groceries, if Carrefour invested in the spread of "click and collect" in fully automatic pickup points, Walmart initially preferred to rearrange the traditional curbside pickup process in contactless mode[19], reserving specific time slots for the pickup for specific categories of people (e.g., people at high risk, first responders)[20], and partnering with Nextdoor (hyperlocal social networking company) for a neighborhood solidarity shopping program[21]. In addition to the traditional pickup system, Walmart extended the geographical areas covered by the express delivery service, guaranteed thanks to the hiring of new personal shoppers for the orders' assembly[22] and to internally developed machine learning algorithms[23]. Regarding the delivery process, in contrast to Carrefour, Walmart initially preferred to manage the deliveries directly or keep the existing line of partners[24]. In fact, the grocer considered the service with high strategic potential since it can count on a dense network of stores from North to Central America within easy reach of most of the population.

As regards innovation in value capture pathways, Carrefour's strategic choice in France and Italy was to launch e-commerce platforms specifically dedicated to the purchase of prepackaged shopping boxes containing a mix of groceries and home and personal care products (i.e., "Les Essentials") structured to cover basic needs in a specific time interval[25]. This strategy of splitting the e-commerce channels and selling a new product bundle, with subscription option to receive packages on a regular basis, provided a complete solution to customers' needs with just one short visit to the platform, limited the dysfunctionalities of the platform, which in fact was independent from traditional e-commerce channels and became a lab-platform to pre-test e-commerce concepts before launch at scale, and facilitated the work of the warehouse teams, who were able to prepare packages in advance, delivered by Carrefour's food startup Potager City and DejBox in France and by partners such as ePrice in Italy.

If Carrefour focused on separating e-commerce platforms, allowing customers to simultaneously purchase a rich box of food and basic necessities, Walmart adopt a strategy with the same final purpose but a different concretization plan. Indeed, the grocer choose to integrate its Walmart Grocery app (for food purchases only) with the main Walmart app, so that consumers were able to buy items in multiple departments from the same application[26].

The innovations that Walmart and Carrefour promoted in their value creation and capture mechanisms during the first phase of their digital BMI are summarized in Table 1.2.

Table 1.2
Value creation and value capture for Walmart and Carrefour in "The marriage between physical and digital" phase.

Walmart	Carrefour
Value creation mechanism: Improved level of service for online and in-store purchases	

	Renewal and creation of digital platforms more resilient and user-centered
Spread of digital options and physical services: • App features for navigating the store, finding items, paying without contacts • Contactless checkout • Curbside pickup reorganization • Expansion and speeding up of the delivery service thanks to machine learning algorithms, new personal shoppers, and use of stores to fulfill orders	Spread of digital options and physical services: • Intuitive apps and platforms for easier online and in-store purchasing processes • Contactless checkout • Traditional and fully automatic pickup • Expansion and speeding up of the delivery service thanks to specialized partners, temporary workers, and use of stores to fulfill orders
Value capture mechanism: Changes to online shopping platforms	
Integration of the grocery platform with the main platform for the sale of food and basic necessities in a single app	Creation of a specific and separate platform for the sale of food and basic necessities in a new bundle of products

4.2 The power of digital to expand customer portfolio

Following the improvement of online and physical purchasing processes, the innovation path adopted by Walmart and Carrefour progressed to the increase in customer base and loyalty, unlocking new services and activities enabled by digital technologies. In particular, on one hand, new value-adding services were introduced in Walmart and Carrefour B2C businesses, focusing on personalization, emotional involvement, simplification and rewards for loyal behaviors. On the other hand, the grocers proposed new marketplace solution to increase the network of business relationships with other companies in the B2B sector.

As regards value creation mechanisms, Walmart and Carrefour activated new shopping experiences, often personalized.

For example, Carrefour launched in France a voice-based e-commerce grocery shopping experience within the framework of the strategic partnership signed in June 2018 with Google, which led to the birth of new skills in artificial intelligence (AI) and machine learning cultivated in a hub jointly built in Paris[27]. Thanks to these new abilities and contaminations and leveraging the connection of Google and Carrefour accounts, the two companies activated both the voice creation of a shopping list via Google Assistant to be automatically converted into a cart on Carrefour.fr website and the release of relevant product recommendations based on users' preferences, purchase histories, and the grocer's best sellers and best prices. Personalization is also the basis of another high-value service offered by Carrefour to intercept new customers, especially in the healthy food sector. The French division, in partnership with the food startup Innit, launched a custom nutritional score that provided online buyers with tailored alimentary information (e.g., suggestions on products to opt for, alternatives for products to avoid), based on standard health criteria and on own food habits, nutritional goals, and allergies[28]. For the development of the solution, Carrefour combined the experience of its innovation and e-commerce departments, specialized in managing cross functional teams and leading the technical integration and the UX design, with Innit's competences in nutrition science[29]. While Carrefour France devised new value creation mechanisms in collaboration with strategic partners, other divisions expanded innovations already well established within the group. This is the case of Majid Al Futtaim, which become the first retailer in the UAE to offer new levels of foods knowledge and transparency for

customers and an open-source platform for optimizing the work of growers, processors, and shippers, thanks to the blockchain-enabled ecosystem IBM Food Trust, to which the Carrefour group had joined since 2018 as a founding member[30]. Another project started by Majid Al Futtaim in UAE that took inspiration from an innovation already introduced by the group is Cookit Yourself, a chef-curated recipe box for sale in selected stores and online, designed to deliver ready-to-prepare meals with all the necessary ingredients, a step-by-step recipe imprinted on a visual card, and a dedicated tutorial on Carrefour's YouTube channel[31].

Walmart also innovated its value creation mechanisms through new shopping experiences that augmented the food purchasing process. For instance, the grocer developed Walmart Cookshop, an interactive celebrity-hosted cooking video series that featured customizable scenarios in a choose-your-own cooking experience, letting viewers to tailor the recipes they are watching with their specific tastes and dietary specifications, and to purchase products and ingredients directly through the videos, receiving them at home or prepared in pickup stores[32]. The new personalized video recipe concept took shape thanks to Eko, a video technology provider, with which Walmart had signed a partnership agreement since 2018 aimed at creating interactive storytelling and shows for entertainment and retail. If the strength of Walmart Cookshop is the personalization of the contents, which make a solution similar, in terms of value creation mechanism, to the experiences of voice shopping and nutritional score powered by Carrefour, there are other shopping experiences developed by Walmart that focused on close emotional contact rather than personalization. An example is the one promoted by Sam's Club to stimulate Christmas shopping. The warehouse club chain, counting on the help and skills of Obsess, a company specialized in virtual store platforms for experiential e-commerce, recreated the home setting of a well-known American Christmas film to suggest trendy gifts and holiday food products, allowing customers to buy what they need directly from the virtual experience[33]. In addition to these virtual shopping experiences enjoyable at any time, Walmart also successfully tested live streaming shopping experiences on the social network TikTok, reserving them at the moment for the purchase of clothing and beauty items, but declaring the willingness to expand this phenomenon by partnering with creators to showcase different products via different format[34], and being one step away from buying the Chinese platform[35]. If in USA Walmart did not experience the live streaming shopping of foods, in China, in collaboration with the "online to offline" e-commerce platform JD Daojia, it has been testing the promotion of food since 2017 within omnichannel shopping festivals[36].

Also, with regard to value capture mechanisms, Walmart and Carrefour chose similar strategies, based on loyalty and subscription programs, and on solutions capable of increasing sales in new markets.

Carrefour in France, thanks to the Group's payment fintech company Market Pay, combined its loyalty program with Apple Pay for use with Apple Wallet, allowing customers to use their iPhone or Apple Watch as a contactless means for paying for their shopping and simultaneously taking advantage of all the benefits provided by the Carrefour loyalty program[37]. Also the new version of "Meu Carrefour", the super app of Carrefour Brazil, which followed the update of the Brazilian e-commerce platform reported in the previous phase, was centered on a new loyalty program, "My Rewards", which provided benefits such as accumulation of virtual coins for online and in-store purchases convertible in discount coupons useful with program partners, greater offer periods for all product categories, and personalized recommendation for Carrefour private label products with 100% discounts[38].

Walmart also introduced options valuable for loyal customers, with the launch of the Walmart+ service[39] replacing the subscription service formerly known as Delivery Unlimited. The new premium subscription option, which had undergone adjustments since its release to encounter customer's preferences[40], provided unlimited free and fast deliveries, discounts on fuels, and access to the well-known "Scan & Go" in all stores, and in future could provide useful data for personalization options[41]. To secure the new service, Walmart loosened its direct customer relationship management and delivery policy, partnering shortly before the launch of Walmart+ with the grocery delivery platform Instacart,

which if it is an unpublished collaborator for Walmart USA, had already been a partner by Walmart Canada and the American Sam's Club stores[42].

Another new value capture mechanism developed by Walmart and Carrefour was the setting up of new business for new customers.

For example, Carrefour in France and UAE, together with software and logistic partners, launched online B2C marketplaces with the aims of boosting sales on websites by offering complementary products relevant with respect to food trends observed amongst e-commerce customers (e.g., organic, healthy, gourmet, local, international), and of helping small retailers in digitization with support teams and free limited use of platforms[43]. Also Atacadão, a Carrefour Brazil company dedicated to wholesale sales, launched for the first time, after having acquired 51% of CotaBest Informação e Tecnologia, startup active in the online wholesale market, a grocery marketplace addressed to the B2B (i.e., small and medium-sized merchants), to extend across the country thanks to new partnerships with the delivery applications Rappi and Cornershop and to the acquisitions of the Makro chain (30 "cash and carry" stores)[44].

Walmart, like Carrefour, focused on marketplaces to intercept new customers in its businesses, opening its well established B2C marketplace (i.e., Walmart Marketplace) to Shopify users, through the partnership with the all-in-one platform[45]. In parallel with the investment in its marketplace service to increase the user network, Walmart, in collaboration with technology partners, redesigned and expanded the vision of its media business, newly baptized Walmart Connect, which gathered sellers, buyers, and suppliers in a single ad-marketplace platform[46]. To "become one of the top ten advertising platforms in the United States", Walmart leveraged the vast omnichannel presence to offer advertisers complete information on customer behavior[47]. This great innovation could conceal a big step towards a further large-scale BMI activity for Walmart, which could benefit from recent investments in Connect and e-commerce, in healthcare services with the opening of new health centers next to Walmart stores[48], and in the creation of a new fintech startup[49], to develop its own super app[50]. In fact, the grocer's attention to this new digital ecosystem capable of providing multiple services through lightweight apps[51] was accentuated by the negotiations with the Tata group for an investment of 25 billion dollars in the super app of the Indian conglomerate[52].

Table 1.3 recaps how Walmart and Carrefour innovated their value creation and capture mechanisms in this second phase of the BMI process.

Table 1.3
Value creation and value capture for Walmart and Carrefour in "The power of digital to expand customer portfolio" phase.

Walmart	Carrefour
Value creation mechanism: Online customer attraction with new digital experiences	
New experience based on the customization of purchasing processes: • Interactive cooking video series with personalization and shopping speedup options to support meal preparation at home	New experiences based on the customization of purchasing processes: • Voice-based e-commerce grocery service with AI-generated recommendation options • Custom nutritional score with individual suggestions
New experience based on emotional customer engagement: • Virtual reconstruction of a film setting to showcase and shopping products • Live streaming events	New experience based on post sale service: • Sale of chef-curated recipe boxes with visual cards and online video tutorial to support meal preparation at home

Value creation mechanism: Reinforcement of traditional offer with digital service	
	Increase in the level of product information and purchase transparency with extension of the blockchain ecosystem in the group
Value capture mechanism: Design of loyalty and subscription programs	
New subscription program with augmented delivery and in-store options	New loyalty program and simplification in collecting loyalty benefits
Value capture mechanism: Launch and expansion of marketplace platforms	
Expansion of the B2C marketplace through partnerships and enlargement of B2B ad-marketplaces	Launch of B2C and B2B marketplaces

4.3 The new life of physical stores

The final phase of the BMI process that involved Walmart and Carrefour during the pandemic crisis presents as a leitmotif the relaunch of the role assumed by physical stores to innovate value creation mechanisms, leaving value capture mechanisms unchanged.

Specifically, the two grocers increased the levels of automation and physical services in stores to speed up online order fulfillment and solve e-commerce requests, thus strengthening omnichannel growth strategies.

At this regard, Majid Al Futtaim launched in UAE the first of three micro-fulfilment centers for faster and more efficient processing of online orders from the store, in partnership with the e-grocery innovator Takeoff Technologies[53]. The logistic center, equipped with artificial intelligence and autonomous mobile robots to process online orders, drastically increased the number of daily orders processed, and, although robotization requires 60% less manpower, no cuts in staff were registered. Personnel was redeployed, upgraded, and redeveloped, probably in view of the expansion of Carrefour in the UAE – planned to open 100 stores in 2021[54]. More generally, the group heavily focused on the role of physical stores, also declaring in France to increase the number of shops and points providing e-commerce services (e.g., drive pick-up points accessible by car or pedestrian users, next-day home delivery, one-hour express delivery) to 2000 before the end of 2021 (+ 500 additional points of sale)[55]. If the French initiative was mainly focused on promotion of e-commerce capacity in medium-sized cities that have not had access to the retailer's entire offer until now, in Spain the acquisition of new 172 stores was aimed at encouraging "click and collect" in small shops in large cities[56], while similar strategies were also adopted in the eastern market, with the acquisition of 224 proximity stores in Taiwan[57], and in the western one, with the acquisition of Brazil's third-biggest food retailer operating a multi-format network of 387 stores[58]. Finally, Carrefour also combined its investments in stores with those in central fulfillment centers, as happened in Belgium[59], where, with the support of partners including the supplier of e-grocery management solutions Food X-Technologies, the retailer created an e-commerce distribution center equipped with machine learning for order planning, just-in-time fulfilment, and dynamic last-mile routing.

Walmart, in the same way as Carrefour, strengthened stores to increase the ability to fulfill online orders and facilitate the e-commerce BMs. In particular, in America the grocer implemented new 12 local and modular fulfillment centers using robotics technology and artificial intelligence for speeding up e-

commerce grocery orders assembly within physical stores[60]. The automation of stores, following a two-year pilot, featured different configurations and collaborations with technology suppliers (i.e., Alert Innovation, Fabric, and Dematic), also providing for the installation of automatic collection points in some stores. Along with the consolidation of the pickup, Walmart also invested in various delivery formats for a safe, contactless, and potentially 24/7 food delivery experience, thanks to pilot projects activated with companies specialized in drones (i.e., Flytrex[61]), self-driving cars (i.e., Cruise[62]), and smart boxes controlled by IoT platforms (i.e., HomeValet[63]). Similar investments were released in Canada[64], with the construction of the first fully automated market fulfillment center, the addition of automated kiosks and pickup points in stores, and the spread of delivery to multiple communities, as well as in Mexico[65], Chile[66], and China[67], with the redesign and reinforcement of logistics and stores network to enable omnichannel growth and extend improved in-store and online services (e.g., buy online and pick up in-store or deliver at home) to all territories. Furthermore, Walmart in those regions promoted first and new omnichannel distribution centers, accompanying, like Carrefour, investments in stores to those in specialized centers in order to meet the needs of online users[68].

Another common strategy for the innovation of value creation mechanisms is related to the digital redesign of stores to optimize back-end and front-end activities.

As regard the enhancement of stores' back-end daily management, Majid Al Futtaim planned investments to optimize inventory management by scaling the autonomous shelf scanning units that in 2019 had been tested in selected stores in collaboration with Simbe Robotics, US startup for autonomous inventory[69].

In parallel, Walmart optimized store activities not connected with online order fulfillment and customer experience by leveraging the competencies of the Walmart Global Tech's IoT team to create an IoT proprietary platform capable of monitoring refrigeration units, remotely responding to energy consumption and equipment re-programming needs, detecting anomalous events in real time, and taking proactive maintenance and repair measures even remotely[70]. Additionally, Walmart transformed four US stores into e-commerce labs where teams of product managers, technologists, business owners, and designers tested new digital tools to optimize both back-end and front-end activities[71]. In these rapid prototyping environments, Walmart verified solutions such as augmented reality apps to accelerate the organization of merchandise from the backroom to the sales floor, the combination of portable devices and new in-store signage to speed up the order assembly, and new hardware and software solutions to optimize the automatic checkout. Furthermore, Walmart released in selected stores a new store layout and signage inspired by airport terminals to more easily guide customers equipped with Walmart app on phones in search of the necessary items in stores[72].

Also, Carrefour worked on new physical shopping experiences for customers, but in a different way compared to Walmart. In fact, in Brazil, Carrefour opened two small autonomous convenience stores in a residential condominium and in a coworking space addressed to proximity and neighborhood market[73]. The unmanned solution was based on the previous experience with "Scan and Go" technology in about 40 Express stores, on the "Meu Carrefour" super app, as well as on electronic shelf labels and digital signage, and could be expanded in the future to new stores and a franchise model[74]. In addition, the group also launched new different automatic store tests in Europe (Romania[75]) and Asia (Taiwan[76]).

A summary of the new value creation mechanisms that have distinguished this phase of BMI for Walmart and Carrefour is provided in Table 1.4.

Table 1.4
Value creation for Walmart and Carrefour in "The new life of physical stores" phase.

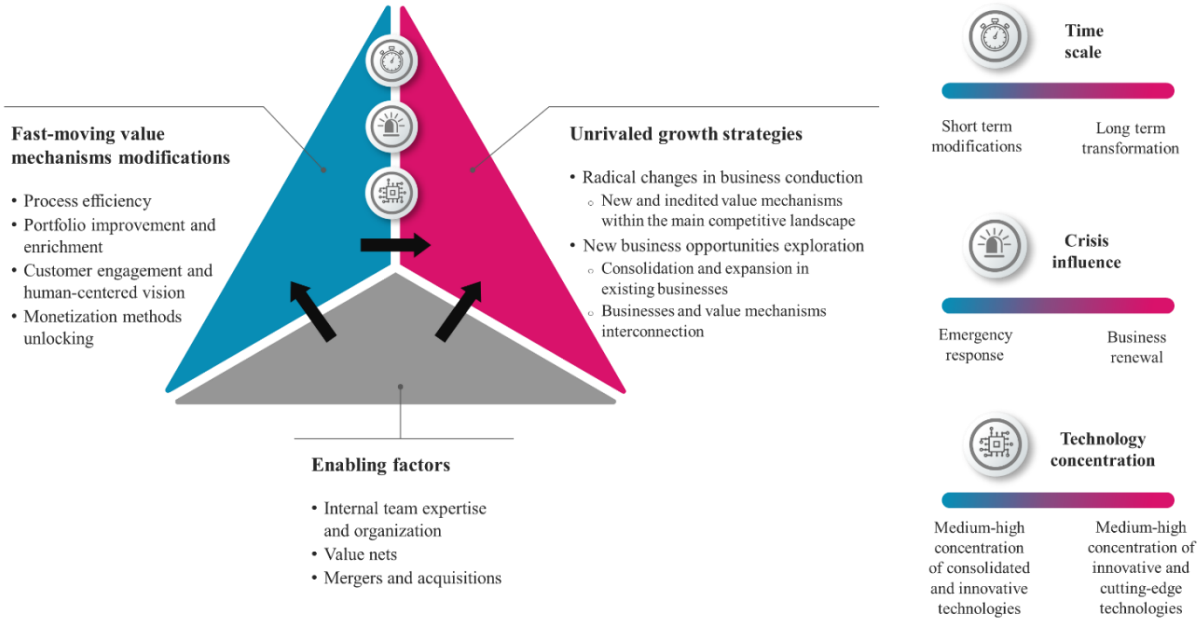
Walmart	Carrefour

Value creation mechanism: Strengthening of physical stores in an omnichannel perspective	
Physical and digital solutions to speed up online order fulfillment and solve e-commerce requests: • Expansion of local and automated fulfillment centers using AI and intelligent robots • Capillary shop fitting to offer pickup (traditional and automated) and delivery • Central omnichannel fulfilment centers	Physical and digital solutions to speed up online order fulfillment and solve e-commerce requests: • Launch of micro-fulfilment centers using AI and autonomous mobile robots • Capillary shop fitting to offer pickup (traditional and automated) and delivery • Specialized distribution center
Value creation mechanism: Digital redesign of stores to optimize back end and front end activities	
Digital solution for better daily management of stores: • Development of proprietary IoT platform • Labs to test useful options in the back end	Digital solution for better daily management of stores: • Expansion of autonomous shelf scanning units for inventory management
Digital solution for new physical shopping experience: • Launch of new store layout and signage • Labs to test useful options for checkout	Digital solution for new physical shopping experience: • Launch of different autonomous stores concepts

5. Discussion

The elaboration of our results is illustrated in the model proposed in Figure 1.3, which indicates how to innovate BMs leveraging digital technologies and crisis times. Specifically, the model is based on three constituent blocks, namely "Enabling factors", which includes the supporting, triggering, and facilitating factors of digital BMI activities, "Fast-moving value mechanisms modifications", which indicates the rapid responses to crisis unlocked by the kicking and driving levers, and "Unrivaled growth strategies", in which levers are used for broader and long-term innovation actions. The model is accompanied by three variables that mark the transition from fast-moving mechanisms modifications to unrivaled growth opportunities, that are time scale, crisis influence, and technology concentration. As a result, fast-moving mechanisms modifications are configured as short-term innovations released as a response to the first phases of the crisis and rely on both innovative and consolidated technologies, while unrivaled growth opportunities occur as long-term transformations in times of business renewal (i.e., return from the worst times of the crisis) leveraging innovative and cutting-edge technologies.

Figure 1.3
Model for digital BMI during crisis.



Enabling factors

The first aspect that deserves attention, being the block at the base of the proposed model and therefore enabling the subsequent considerations, consists of three enabling factors. These are elements both internal and external to the boundaries of the organization which underpin the innovation actions aimed at rapidly modifying value mechanisms during crisis and searching for future opportunities in times of business renewal.

The first enabling factor is the internal team expertise and organization. Indeed, the "people factor", recognized as relevant element for crisis management (Schmitt et al., 2010) and for the implementation of digital innovation strategies (Correani et al., 2020), was crucial for the digital BMI path of Walmart and Carrefour. Walmart, for example, internally developed machine learning algorithms for speeding up the delivery service and an IoT platform for remotely managing store equipment. Carrefour, instead, made great use of the expertise of its e-commerce technical teams for the optimization of websites and online purchasing platforms, and leveraged the transversal and cross-functional organizational nature of its innovation department to guide the release of the custom nutritional score.

The second enabling factor of the proposed model consists of value nets, namely ecosystems of actors who combine their skills and complementary resources for creating value through collaborations (Kähkönen, 2012; Palo and Tähtinen, 2013; Tavoletti et al., 2021). Indeed, the two grocers implemented almost all of their innovations during the crisis thanks to a precious network of partners, which plays a significant role to respond to crisis times (Zafari et al., 2020) and to quickly unlock both short-term and long-term value (Fasnacht, 2020). For example, Carrefour introduced the voice shopping service in partnership with Google, leveraging the co-founded AI hub, while Walmart revolutionized deliveries with drones, self-driving cars, and smart boxes by means of pilot projects in partnerships with specialized companies and startups. In addition to technical partnerships, the value net counts diversified collaborations, such as those established by Walmart with the TikTok creators to enable the live shopping experience.

The third enabling factor is represented by mergers and acquisitions (M&A), which are considered effective practices for exploring new value creation and capture mechanisms (Hanelt et al., 2021; Tavoletti et al., 2021), especially in times of crisis, when mergers and acquisitions allow to outperform

(Salsberg, 2020). Mergers and acquisitions were mainly employed by Carrefour, who leveraged the acquisition of 51% in the online wholesale startup CotaBest to create its B2B marketplace in Brazil, and, more generally, acquired several physical store chains to pursue its omnichannel expansion strategy.

Fast-moving value mechanisms modifications

Enabling factors, combined with the access to consolidated and innovative digital technologies and under the influence of pressure times deriving from the first periods of crisis, rapidly unlock new interesting mechanisms for creating and capturing value in the short term. Our case studies highlighted the existence of four ways in which fast-moving modifications can occur in BMs to ensure, on the one hand, survival at the first impact with the emergency and, on the other, the addition of new valuable solutions amid crisis. Therefore, the value mechanisms modifications spotted are based on the firms' perception of crisis as an opportunity to encourage more risk-taking behaviors and decisions in changing existing BMs (Archibugi et al., 2013; Saebi et al., 2017). In particular, the following value mechanisms concentrate on adjustment of current BMs with minor refinements on the way business is conducted, rather than on the entirely reengineering of processes for developing completely new digital BMs (Verhoeven and Johnson, 2017; Osiyevskyy and Dewald, 2018).

The first fast-moving value mechanism is the improvement of process efficiency, which is a digital-enabled value creation practice (Parida, 2019; Vaska, 2021) implemented by Walmart and Carrefour as a first step to cope with the crisis. Indeed, the initial move by the two grocers at the dawn of the crisis to avoid succumbing was the update of digital platforms, releasing more resilient versions and/or new applications that optimized the online purchase process.

The second fast-moving change in value creation mechanisms is represented by portfolio improvement and enrichment. In line with the considerations of Cenamor et al. (2017), Parida et al. (2019), and Vaska et al. (2021) we understand this term as the advancement of the offer portfolio by means of new digital-enabled supports and/or benefits with respect to the core proposals and resources. This is the case, for example, of novel complementary services on digital platforms that increase the value of the main offer thanks to product understanding, process facilitation, and other usefulness. At this regard, Walmart and Carrefour empowered their portfolios in order not only to survive the blow of the crisis but also to provide customers with high-value services. Specifically, they scaled and upgraded features already partially implemented, such as digital options to improve shop navigation, make contactless payments, achieve loyalty benefits, collect shopping in designed points or receive it at home. In this way the two grocers took advantage of an effective synergy between fairly consolidated digital technologies and their core physical resources (i.e., stores) to assure safe business continuity in crisis times.

The third fast-moving modification in the value mechanisms identified by our model is represented by the boost of customer engagement and the emphasis of a human-centered vision within the adoption of digital solutions. Those aspects are expressed in a focal attention to people, both customers and employees, when leveraging digital technologies to modify BMs. Indeed, Walmart and Carrefour improved efficiency and expanded offer portfolios with more intuitive digital services and innovative shopping experiences, following a human-centered shift in business practices triggered by the crisis and enabled by digital technologies (MacDonald et al., 2020; Fazio and Kuehnle, 2020). Examples are the voice shopping and custom nutritional score services designed by Carrefour for simpler and personalized shopping moments, as well as the Walmart's augmented purchase processes based on social networks, virtual settings, and interactive cooking videos. These value creation initiatives, aimed at increasing customer loyalty, are based on engagement mechanisms through personalization (Sandulli et al., 2014), individualization (Härting et al., 2018), and process facilitation for customers (Doern and Fey, 2006). In this sense, therefore, our results agree with Sebastian et al. (2017) in highlighting the

power of digital technologies in the BMI field to improve customer engagement, especially with a view to create stickiness (Zott et al., 2000). Moreover, the human-centered vision in digital BMI was evident also in back-end actions, as demonstrated by the transformation of Walmart stores into labs where to test augmented reality apps and new in-store signage for optimizing the daily work of the inventory staff.

The fourth modification quickly enabled in the BMI path is represented by the introduction of new monetization methods. Those are unlocked by a platform-based approach (Sorri et al., 2019), which generates fast connections and matchmaking during the crisis (Friederici et al., 2020). Indeed, Walmart and Carrefour took advantage of the growing profitability of digital platforms in the BMI field (Gatautis, 2017; Mancha and Gordon, 2021) to increase revenue during the crisis in two ways. On the one hand, they introduce new subscription programs, such as Walmart's one focused on unlimited and express deliveries and Carrefour' one for the receipt of essential product boxes. On the other hand, the two grocers launched new marketplaces and strengthened existing ones, both in the B2C and in the B2B sphere, thus increasing revenues by means of their networks.

Unrivaled growth strategies

Relying on enabling factors and on an increasing use of innovative and cutting-edge technologies, the digital BMI path leads to the exploration of long-term growth strategies in periods of business renewal, i.e., in returning from the more critical phases of the emergency. In this passage, therefore, our research emphasizes, in line with Kraus et al. (2020), the role of crises as events stimulating innovation not only in the short term but also in the long period. Specifically, the proposed model reveals how the digital BMI enables two forms of innovation in long-term business visions, which aims at totally creating new BMs (Kaulio et al., 2017) rather than acting on existing ones. These two forms of innovation are radical changes in businesses conduction and explorations of new opportunities

First, digital BMI can generate a radical change in business (Linz et al., 2017; Osiyevskyy and Dewald, 2018), aimed at transforming and reconfiguring the mechanisms of value creation and capture with digital technologies (Sjödin et al. 2020) in an unprecedented way within the competitive scenario (D'Ippolito, 2019). This state of radical long-term business transformation in the internal methods of conducting the business and/or in the approach to customers considers the crisis as a trigger and accelerator. Indeed, the fast-moving modifications implemented to rapidly counter the emergency unlock a wide-ranging innovation process able to radically reshape businesses. This is exactly what happened to Carrefour. The grocer in Brazil built the radically new concept of fully automatic and unmanned stores on its cutting-edge super app, enhanced in initial crisis phases to quickly increase efficiency and customer engagement.

Furthermore, BMI as a response to crisis can be used to consolidate and exploit current businesses with the aim of exploring future opportunities (Schmitt et al., 2010; Kraus et al., 2020). Specifically, our findings unify and extend to crisis times the study perspectives of Verhoeven and Johnson (2017), Kaulio et al. (2017), and Fasnacht (2020) on the long-term strategic potential of BMI. In fact, during the crisis it is possible to consider and strengthen diversified businesses with respect to the principal business, whose value mechanisms can be integrated thanks to a digital ecosystem, giving birth to new business opportunities. In this matter Walmart was a great example. First, the grocer consolidated and expanded its existing businesses, by investing in e-commerce shopping experiences, redefining its media activities within a new well-focused business, scaling its health clinics across USA, and creating a novel fintech startup as part of the improvement of its financial services. Second, the retailer announced and shown interested in practice towards the interconnections of its diversified businesses within a new powerful super app, leveraging a cutting-edge digital technology to seize new business opportunities for serving its customers in a better, complete, and integrated way.

Interplay among enabling factors, value mechanism modifications, and growth strategies

The three building blocks of the model are characterized by specific relationships and interplays. In particular, the enabling factors trigger both value mechanisms modifications and growth strategies. Indeed, internal team expertise (i.e., the cultivation of employees' skills) and organization (i.e., the formation of new dedicated teams and business units), value nets (i.e., strategic partnerships), and M&A activities support the establishment of a dynamic organizational environment, the generation and exchange of complementary knowledge, and the acquisition and sharing of resources and capabilities (Svahn et al., 2017; Fasnacht, 2020; Tavoletti et al., 2021; Smith and Beretta, 2021). These activities, which become more critical during times of crisis (Schmitt et al., 2010; Zafari et al., 2020), foster both value mechanisms modifications, which make it possible to change existing BMs, and growth strategies, which make it possible to create entirely new BMs (D'Ippolito et al., 2019; Correani et al., 2020; Hanelt et al., 2021).

Moreover, in accordance with Kraus et al. (2020), we spot that short-term value mechanisms modifications in existing BMs stimulate and facilitate the definition of long-term unrivaled growth strategies in the form of generation of totally new BMs. In fact, digital changes in existing BMs alter current business routines, processes, and practices (Verhoeven and Johnson, 2017; Osiyevskyy and Dewald, 2018). In this way, digital changes in existing BMs enhance firms' willingness, know-how, and capabilities to trigger the creation of totally new BMs (Saebi et al., 2017; Verhoeven and Johnson, 2017: Osiyevskyy and Dewald, 2018; Rachinger et al., 2019; Fasnacht, 2020).

6. Implications

6.1 Theoretical Implications

The present study contributes to the existing literature about BMI and digital innovation in three main ways, assuming a very interesting role in the scenario of great attention that both scholars and industrial firms pay to these issues (Sjödin et al. 2020), especially after the advent the Covid-19 pandemic (Coskun and Tanrikulu, 2021).

First, our paper broadens the knowledge about the mechanisms of value creation and capture that can be innovated and empowered thanks to digital technologies under the pressure times of crisis. Indeed, conducting digital BMI as a response to crisis enable fast-moving changes to value mechanisms, acting on process efficiency (Parida et al., 2019), portfolio improvement and enrichment (Vaska et al., 2021), and additional monetization methods (Sorri et al., 2019). These mechanisms were studied by researchers, but scant attention was given to the impact of crisis on their usage. In this sense, the present paper highlights how emergencies push firms towards innovative risk-taking behavior (Archibugi et al., 2013; Saebi et al., 2017), triggering new mechanisms to quickly respond to contingent situations. Moreover, our analysis reveals an additional value mechanism rapidly brought out by the crisis and digital technologies, which has so far been little investigated in the BMI literature. This is the digital redefinition of BMs through a human-centered vision. This approach especially emerged with the Covid-19 pandemic (MacDonald et al., 2020; Fazio and Kuehnle, 2020) and applies to modification of both front-end activities and back-end operations.

Second, this research focuses on the positive role of digital BMI in crisis times, during which innovative activities and innovative organizations are subject to changes and re-shaping (Archibugi et al., 2013). In particular, we discover that digital BMI acts not only as a response to the crisis in the short term but also as a sowing moment of long-term business opportunities. In this way, we support findings from Archibugi et al. (2013), Saebi et al. (2017), and Kraus et al. (2020), who spotted that crisis can trigger both short-term changes and long-term innovations in organizations. In fact, during the crisis, on the

one hand, digital BMI enables radical change in business (Linz et al., 2017; Osiyevskyy and Dewald, 2018), exploiting the fast-moving value modifications, born as a first response to the crisis, as bricks to revolutionize the competitive scenario (D'Ippolito, 2019). On the other hand, digital BMI enables the consolidation and expansion of diversified businesses during the crisis, especially augmenting the positive role of explorative strategies in markets, products, and services domains to cope with the crisis (Archibugi et al., 2013; Osiyevskyy and Dewald, 2018). In particular, we discover that the value mechanisms of diversified businesses, started and/or reinforced during the crisis, can be interconnected thanks to digital technologies with the aim of seizing new business opportunities (Verhoeven and Johnson, 2017; Kaulio et al., 2017; Fasnacht, 2020; Li, 2020).

Third, our paper contributes to the emerging literature on the use of digital technologies for changing existing BMs and for creating totally new BMs (Saebi et al., 2017; D'Ippolito et al., 2019). In particular, in accordance with Rachinger et al. (2019) our paper suggests that digital BMI can be considered as a succession of three steps: initially, optimization of the existing BM, then transformation of the existing BM through reconfiguration and extension of established business, and finally development of a new BM. Moreover, our results indicate that those three phases, under the effect of pressure times and the always greater concentration of digital technologies, tend to become more blurred and merged, thus accelerating innovation path (Fasnacht, 2020; Gkeredakis et al., 2021).

6.2 Managerial Implications

Our research also provides relevant managerial suggestions to successfully emerge from the crisis thanks to a digital BMI. In particular, we address growing and innovative incumbents, i.e., firms who are recognized for maintaining optimal innovative performance in crisis (Archibugi et al., 2013), but also for being ill prepared to identify, select, and implement digital innovations (Parida et al., 2019). We encourage managers of these firms to consider the importance of enabling factors that, especially in times of crisis, facilitate effective innovation paths. In this regard, we advise companies to equip with internal inter-communicating teams specialized in both technical and innovation issues, whose combination can assure prompt response to business perturbations. Moreover, it is very important to forge partnerships, especially but not limited to technical experts, to transform the potential of digital technologies into value, also through, for example, the co-foundation of innovation hubs, where to incubate high value digital solutions in times of crisis. Even partnerships and/or acquisitions of promising startups can prove to be a very profitable practice for investigating, developing, and accelerating the more specialized aspects of digital innovation during crisis. By leveraging these three factors, it becomes much easier to cope with crisis both in the short term, with digital change in existing BMs, and in the long term, with creation of totally new BMs.

7. Conclusions

7.1 Limitations and future research avenues

The paper features some limitations that may however be the trigger for further research avenues.

First, the research counts only two cases, covering mainly European and American contexts. A more detailed analysis of the Asian market to check the consistency and generalizability of findings can be extremely useful. In fact, the eastern Asian territory is very much at the forefront in the grocery and retail, and it was the first place to reinvent during crises such as the 2003 SARS epidemic and the 2020 Covid-19 pandemic.

Second, for the realization of the study it was not possible to exploit all the sources of evidence that the multiple case study methodology suggested (e.g., direct observation, personal interviews). Therefore, it would be interesting to test and detail evidences found with quantitative data and/or statistical studies relating to the design of digital BMI initiatives during crisis and the impact of these innovations on the customer approach and the internal re-organization of work. To this aim, future research can leverage this study for testing hypotheses based on the relationships spotted between the three building blocks of the presented model.

Third, the research examines the cases of two incumbent retail companies operating in the food sector but also active in the commercialization of no-food products. Future research may investigate if and how the results change considering the cases of retailers focused exclusively on the commercialization of food products (e.g., local markets, online food sales platforms) and/or grocers alternative to big incumbents (e.g., convenience stores, "mom-and-pop"). Moreover, even the study of retailers operating in different sectors and domains (e.g., electronics, fashion, furniture, cars) can reveal different scenarios of digital BMI as a response to crisis.

Fourth, our research focuses on the theme of digital BMI amid crisis, concentrating on how digital technologies support the innovation of BMs in tricky times. We acknowledge that the use of digital technologies for innovation is twofold, leading to both modification of existing BMs and creation of entirely new BMs (Kohli and Melville, 2019; Rachinger et al., 2019; D'Ippolito et al., 2019; Li et al., 2020; Bosler et al., 2021). In this field, even if we spot how digital technologies can lead to modifications in existing value mechanisms and to definition of totally new opportunities, we encourage scholars in BMs and BMI literature to deepen the comprehension of this phenomenon.

Chapter 2

Paper B

Title	Leadership in the metaverse: Building and integrating digital capabilities
Coauthors	Petruzzelli, A. M., Urbinati, A., & Matzler, K.
Type	Qualitative empirical study
Methodology	Exploratory multiple-case study with experts' interviews
Link with the Research Questions of the thesis	• What is the change? • What is the value of the change?
Research Question(s)	RQ1: How do firms build and integrate capabilities to develop a digital business in the metaverse? RQ2: What strategic factors should leaders consider to develop a digital business in the metaverse?
Theoretical contribution	Frame how capabilities can be developed and what roadmap and leadership profile are needed to lead a digital business in an uncertain market
Conference presentation(s)	34th Annual Scientific Meeting of the Italian Association of Management Engineering (RSA AiIG) | 11-12 October 2023, Polytechnic University of Milan – Lecco campus (IT)
Journal	Business Horizons (AiIG: Gold; ABS: 2; JIF: 5.8)
Status	Published in 2024 in the Special Issue "Digital leadership: A new management and entrepreneurship development roadmap"

Table 2 - Paper B's summary

Abstract

To master a digital technology such as the metaverse, firms have to build and integrate new capabilities, while leaders have to comprehend the strategic factors ensuring this technology will translate into business success. Through a multiple-case study enriched by interviews with prominent experts in the field, we explore (1) how firms can build and integrate digital and organizational capabilities, and (2) what strategic factors leaders should consider as they develop digital business in the metaverse. Our results reveal that capabilities aimed at managing digital assets and at managing organizational factors are built and integrated through two specific mechanisms: organizational change and innovation ecosystems. Furthermore, we offer a three-stage roadmap and a leadership profile to assist with the metaverse transition. The findings enrich theoretical knowledge on the emerging topic of digital business in the metaverse.

Keywords: Digital business; Capability building; Capability integration; Metaverse; Leadership; Startup collaboration

1. Introduction

Leadership in the metaverse: Why do capabilities matter?

The adoption of digital technologies within firms represents a hot topic both from an academic and managerial point of view (Matarazzo et al., 2021; Urbinati et al., 2020). Indeed, firms' success, competitive advantage, and performance in recent times increasingly rely upon incorporation of digital technologies within firms (Nambisan et al., 2017). This leads to pronounced benefits for firms developing a digital business (i.e., a business based on digital technologies), from the gradual improvement of business processes to revolutions in traditional innovation processes (Urbinati et al., 2022) and business models (Matarazzo et al., 2021).

More recent research on digital businesses has concentrated on a specific type of digital technology, potentially positioning firms as leaders in a market valued at US $8 trillion (Bobier et al., 2022). This digital technology is the metaverse, a shared virtual world in which users can interact with one another and with virtual assets and services (Golf- Papez et al., 2022). By combining multiple technologies (e.g., virtual reality, blockchain, and social platforms) and a wide network of actors (e.g., providers of platforms, contents, and infrastructure), metaverse-based businesses can more easily customize their offerings and engage in more direct firm-customer interactions (Gupta, 2022).

For businesses to master a digital technology such as the metaverse, they must develop two main types of capabilities (Gupta, 2022; Gupta and Bose, 2019): capabilities aimed at managing digital assets (e.g., IT infrastructure) and capabilities aimed at managing organizational factors (e.g., network orchestration). Firms that successfully develop these two types of capabilities can reshape, evolve, and extend traditional digital and nondigital businesses in the metaverse (Gupta, 2022; Hall and Li, 2022; Moro Visconti, 2022), thus assuming a leadership position in the current digital landscape.

Despite the metaverse's potential for digital businesses, the topic is so new that much confusion persists (Madiega et al., 2022; Moro Visconti, 2022), especially with regard to capability and leadership. Indeed, the metaverse represents the convergence of several technological developments, such as virtual reality and Web3, all of which will require incremental changes in organizational capabilities and in leaders' strategic decision-making (Bobier et al., 2022).

Although more and more researchers are investigating the topics of capabilities and of leadership for developing digital businesses (Annarelli et al., 2021; Zhang and Zhu, 2022), the literature has not sufficiently investigated yet how capabilities are built and integrated to enable a digital business (Warner and Wager, 2019), nor what strategic factors leaders should consider (Crane, 2022) to prosper in the metaverse. This is so despite the fact that capabilities and strategic factors have been recognized as essential to developing a digital business (Mezger, 2014; Zhang and Zhu, 2022). For example, through capability building and capability integration, firms that undergo digital transformation achieve three times higher revenue growth and cost savings than laggards (Close et al., 2022). But only one in four organizations has the skills needed to exploit digital technologies, which is why around 70% of digital transformation initiatives fail (Close et al., 2022). To avoid becoming part of this statistic, leaders must prioritize the building and integration of capabilities and the identification of strategic factors. Indeed, consideration of strategic factors, that is "critical factors that must be considered before other detailed or operational factors are considered" (Dowlatshahi, 2005, p. 3751), is a prerequisite for successfully evaluating any technology.

In light of this, the article explores (1) how firms can build and integrate capabilities and (2) what strategic factors leaders should consider to develop a digital business in the metaverse (Gupta and Bose, 2019). We performed a multiple-case study on Nike, Gucci, Samsung, and Hyundai, which included interviews with relevant experts in the field (Yin, 2014). We adopted a qualitative methodology used

to understand emerging and complex phenomena such as metaverse-based businesses (Mancuso et al., 2023).

This article aims both to advance the academic debate about the use of the metaverse for digital business and to support managers working to develop metaverse-based businesses. As for the academic contribution, we identify organizational change and innovation ecosystems as crucial to building and integrating capabilities. As for the managerial contribution, we provide a roadmap and a leadership profile useful for practitioners and leaders already working in or toward the metaverse. In this way, we hope to address the increasing number of firms aspiring to be digital leaders (Gupta and Bose, 2019; Warner and Wager, 2019), especially in the metaverse, but still failing in this process (Mezger, 2014).

2. Theoretical Background

2.1 Capabilities for digital businesses in the metaverse

Digital businesses unlock the value embedded in digital technologies by a successful market delivery through innovative business models (Zott et al., 2011). Recently, one digital technology has threatened to upend entire businesses: the metaverse (Belk et al., 2022; Kim, 2021; Murray et al., 2022). The metaverse represents the next evolution of the internet, which allows a continuous and immersive experience within a virtual environment hardly distinguishable from the real world (Golf-Papez et al., 2022; Moro Visconti, 2022). Most real-world businesses, including ones based on advertising, subscriptions, and e-commerce, can be replicated in the metaverse (Hall and Li, 2022; Moro Visconti, 2022), while new types of businesses will emerge (Madiega et al., 2022) to feed totally new virtual markets (Moro Visconti, 2022).

To develop metaverse-based businesses, firms need to build and integrate two main types of capabilities: those aimed at managing digital assets and those aimed at managing organizational factors (Bianchi et al., 2016; Tams et al., 2014). These capabilities support digital businesses as they allow them both to identify the benefits from digital technologies (e.g., new product functions) and to implement these benefits through business reconfiguration (Annarelli et al., 2021).

Capabilities aimed at managing digital assets are skills and routines that pertain to the development, mobilization, and use of resources and that enable or are enabled by digital technologies (Tams et al., 2014; Urbinati et al., 2022). These capabilities are important for creating and running digital solutions (Neirotti and Raguseo, 2017) and can be used to reshape the typologies and compositions of traditional products, services, and processes (Gupta and Bose, 2019; Nambisan et al., 2017). As the metaverse embeds multiple digital technologies (e.g., virtual reality, blockchain, social platforms), these capabilities sustain the production and distribution of virtual offerings (Hall and Li, 2022).

Capabilities aimed at managing organizational factors are skills and routines supporting the identification and evaluation of digital resources and opportunities from external sources, as well as their adaptation and combination with existing internal resources and opportunities (Bianchi et al., 2016; Gupta and Bose, 2019; Tan et al., 2015). Hence, such capabilities leverage more direct internal and external organizational ties (Nambisan et al., 2017) to monetize network effects (Parida et al., 2019). Specifically, in metaverse-based businesses, they allow both partners and customers to cocreate virtual offerings (Gupta, 2022; Madiega et al., 2022; Moro Visconti, 2022).

Therefore, both capabilities aimed at managing digital assets and capabilities aimed at managing organizational factors sustain firms in capturing revenue growth, competitive advantages, and performance improvements from metaverse-based businesses (Li, 2020; Parida et al., 2019).

Consequently, academics and managers alike are remarkably interested in forming a capability- based conceptualization of such businesses (Mezger, 2014).

The extant research on capabilities associated with digital businesses covers many perspectives (Annarelli et al., 2021) that can be generalized into three categories. First, researchers have investigated how capabilities, especially leaders' capabilities, need to change with the digital transformation (Hinterhuber, 2022). Second, they have wondered about how to balance new capabilities for digital businesses with existing capabilities (Warner and Wager, 2019). Third, they have explored how capabilities allow firms to sense digital trends, seize digital opportunities, and reconfigure traditional businesses as digital ones (Matarazzo et al., 2021; Mezger, 2014). Researchers have thus paid attention to the relationships between capabilities and digital businesses.

But many questions remain concerning the antecedents and consequences of those capabilities (Annarelli et al., 2021), and more generally, concerning the strategic factors needed for developing digital businesses, especially in the metaverse. Accordingly, this under researched management area is still largely unknown owing both to its complexity (Madiega et al., 2022; Moro Visconti, 2022) and to its recent emergence (Belk et al., 2022). Even though capabilities are crucial for developing a digital business (Foss and Saebi, 2017; Mezger, 2014; Zhang and Zhu, 2022), their natures remain vague (Annarelli et al., 2021; Warner and Wa¨ger, 2019). Therefore, this article focuses on answering the following questions:

(i) How do firms build and integrate capabilities to develop a digital business in the metaverse?

(ii) What strategic factors should leaders consider to develop a digital business in the metaverse?

3. Research Methodology
Using a multiple-case study analysis

The article adopts a multiple-case study (Yin, 2014), which is a methodology used to investigate emerging and complex phenomena such as those of digital businesses and the metaverse (Kraus et al., 2022). Indeed, in this extremely new context, a comparison of our results with those from different cases supports theory building (Yin, 2014). We chose four cases Nike, Gucci, Samsung, and Hyundai (see Table 2.1) that satisfy three important sampling criteria. First, the cases reflect digital businesses operated by large, incumbent firms that acted as first movers among metaverse-based businesses, thus offering valuable insights. Second, the cases belong to different sectors, from fashion and luxury to high technology, automotive, and sports, thus ensuring a comprehensive understanding of metaverse-based businesses without bias. Third, the activities of these cases in the metaverse were widely documented in secondary sources, such as corporate websites and magazines (e.g., Forbes, Fortune), reports (e.g., McKinsey, Accenture), social media (e.g., YouTube, LinkedIn, Twitter), and newspapers (e.g., Financial Times), which also allowed cross-case comparisons and information triangulation (Yin, 2014). Furthermore, we held discussions with experts (see Table 2.2) in pursuit of relevant managerial insights on metaverse businesses.

Table 2.1
Cases' description

	Nike	**Gucci**	**Samsung**	**Hyundai**
Sector	Sport wearable and equipment	Fashion and luxury	Electronics and informatics	Automotive

Company Outline	American multinational company designing producing, and selling footwear, equipment, and services for sport and fitness.	Italian fashion house belonging to the Kering group specialized in textile and apparel clothing for luxury market.	South Korean multinational conglomerate producing, selling, and researching in computers and electronic equipment fields.	South Korean multinational automotive manufacturer offering world-class vehicles and mobility services.
Digital business strategy	Artificial intelligence, e-commerce, and in-store experiential technology have been integral to the brand's strategy for many years.	Augmented and virtual reality, artificial intelligence chatbots, mobile applications have been adopted for digital marketing.	Innovations based on emerging technologies (e.g., virtual and augmented realities) are leveraged for cutting-edge product development.	Integrated mobility platforms, digital twins, artificial intelligence, and robotics are used for vehicle data management and product development.
Digital business results	Nike Digital, the division that includes the company's web3 ventures, is the fastest-growing component of its marketplace, representing 26% of Nike's total brand revenue.	Gucci's digital strategy has collected online revenues accounted for 7% of the Kering's Group overall revenue in 2015, with an increase of 22%.	In 2021, sales generated by a new, unified Samsung.com platform with improved user experience more than doubled, with increase in B2C e-commerce sales of 113% in South Korea.	Vehicle transaction and delivery through a dedicated car buying platform (i.e., Click To Buy) resulted in the increase in digital inquiries from up to 50k visits per week.
Digital business in the metaverse	Virtual experience connected with virtual and digital items offering: • Launch of virtual experience on online videogame platform • Release of NFT collections	Virtual experiences and products, and digital items offering: • Launch of virtual experiences on online videogame and social platforms • Release of NFT collections	Virtual experiences and combination of virtual and physical features for new interactions: • Launch of virtual experiences on online videogame platforms • Release of NFT collections • Update of TV and smartphone products with metaverse-related technologies	Virtual world and experiences and digital products for new interactions: • Launch of a virtual world and virtual experiences on online platforms and proprietary website • Release of NFT collections as a base for NFT community

Table 2.2
List of industry experts interviewed

Interviewee	Role
Tommaso Di Bartolo	Serial entrepreneur, author, and advisor in metaverse industry
Simone Puorto	Author, keynote speaker, and consultant in metaverse industry
Lorenzo Cappannari	Keynote speaker, consultant, author, and lecturer in metaverse industry
Nick Rosa	Consultant, keynote speaker, and author in metaverse industry

4. Findings

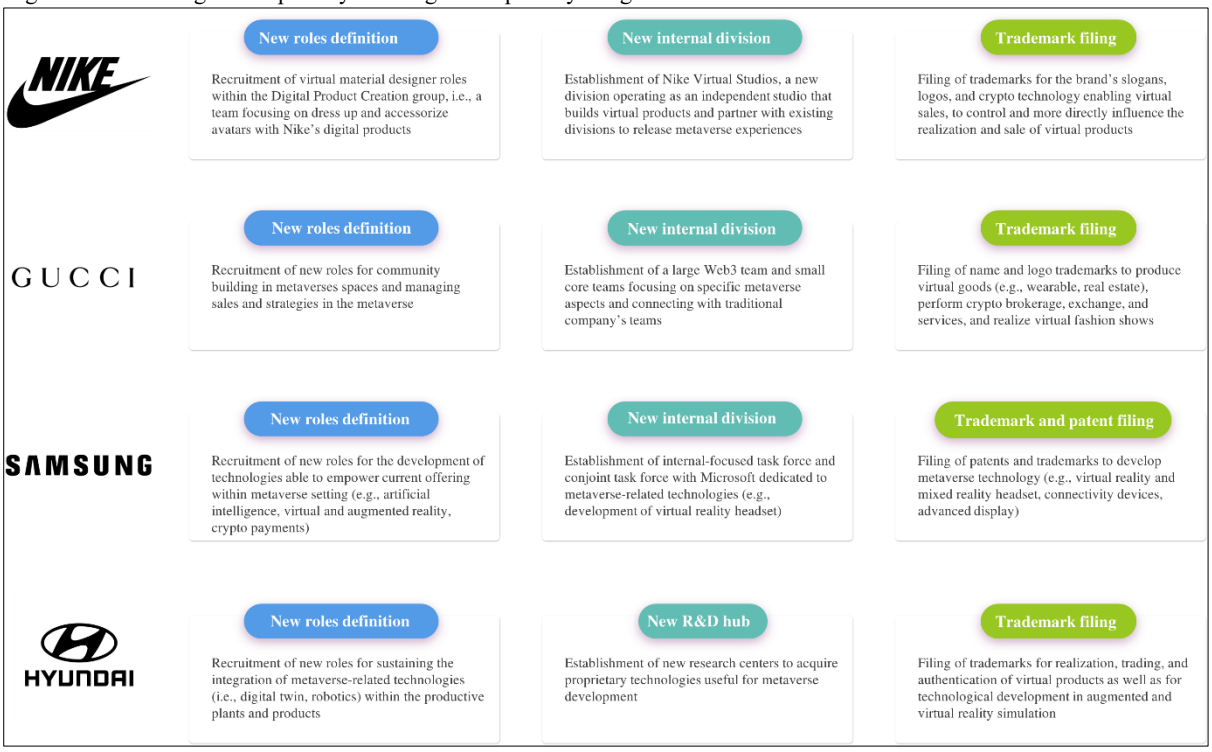
Building and integrating capabilities: Organizational change and innovation ecosystems

Through our analysis, we discovered that capabilities of both types can be built and integrated through two main mechanisms: organizational change and innovation ecosystems.

4.1 Organizational change

Organizational change refers to planned modifications affecting the human capital and leaders within organizations for improving their functioning and performance (Weick and Quinn, 1999). It supports capability building and capability integration by defining new roles, establishing new internal divisions or research and development (R&D) hubs, and increasing trademark and patent filing (Figure 2.1).

Figure 2.1
Organizational change for capability building and capability integration



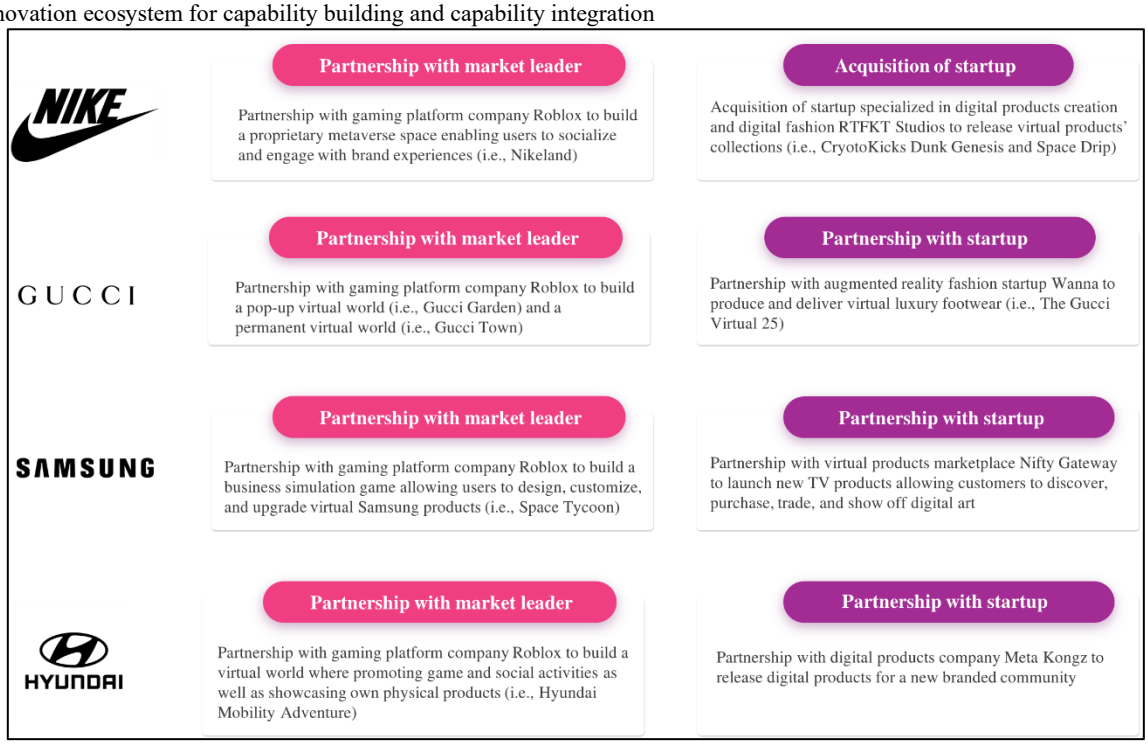
All four companies recognized the importance of organizational change for building and integrating capabilities aimed at managing digital assets. Such capabilities were built through trademark and patent filings and were integrated through internal divisions or R&D hubs. Firms improved their awareness regarding the use of digital assets in the metaverse (Garzoni et al., 2020) thanks to trademark and patent filings, while various internal divisions and R&D hubs supported the launch of metaverse-related content and technologies. Hence, firms extracted technical knowledge from human capital to support new product development (Neirotti and Raguseo, 2017).

Likewise, all four companies relied on organizational change for building and integrating capabilities aimed at managing organizational factors. Indeed, they aligned human capital within metaverse-focused divisions characterized by independence, internal cross-collaboration, and flexibility. In addition to this, they enriched human capital by recruiting people to fill new roles. These findings confirm the previous literature on capabilities aimed at managing organizational factors (Foss and Saebi, 2017; Kraus et al., 2022; Parida et al., 2019). Moreover, in the Samsung case, one of the new metaverse-related established teams reported directly to the CEO, indicating that a strong leader is needed to monitor and oversee performance of digital business in the metaverse. Similarly, in the Gucci case, the brand's executive vice president was appointed as the CEO of the newly created division committed to expanding and executing the group's metaverse ambitions. These cases show the importance of leadership for integrating capabilities aimed at managing organizational factors (Elia et al., 2020; Ford, 2007).

4.2 Innovation ecosystems

An innovation ecosystem is a loosely interconnected network of actors including human capital, end users, and partners that coevolve capabilities around an innovation (Zahra and Nambisan, 2011). Per Figure 2.2, all four cases we examined relied upon innovation ecosystems for building and integrating capabilities necessary to their digital business in the metaverse.

Figure 2.2
Innovation ecosystem for capability building and capability integration



The innovation ecosystem was leveraged to build and integrate capabilities aimed at managing digital assets. Indeed, all four companies partnered with market leaders in the metaverse. Through these partnerships, the organizations' human capital accessed market leaders' technical resources (i.e., modules as digital platforms) for developing digital business in the metaverse. Furthermore, capabilities aimed at managing digital assets were built and integrated through partnerships with or acquisitions of metaverse startups. Accordingly, partnerships or acquisition agreements involving metaverse startups provided companies' human capital with technical resources (i.e., content empowering the modules) for developing the digital business in the metaverse. Hence, building and integrating capabilities aimed at managing digital assets through innovation ecosystems relies on a combination of modules and content paired with different digital assets (Yoo et al., 2012), a combination that has been recognized as essential to digital business in the metaverse (Gupta, 2022).

Our findings reveal that end users support human capital by means of user-generated content and ideas. This aspect emerges in all the cases, and especially at Hyundai, where end users leave external ideas about the improvement of the company's metaverse offering. This result is in line with the previous literature affirming that end users contribute to digital businesses, being active actors within the innovation ecosystem (Parida et al., 2019), and we seek to extend this vision by recognizing the role of end users as supporters of organizations' human capital.

5. Discussion

Strategic factors for digital businesses in the metaverse: Roadmap and leadership profile

Our analysis reveals two strategic factors that can support managers seeking to lead in the development of metaverse-based businesses: a roadmap and a leadership profile.

5.1 Theoretical Implications

The roadmap

Our findings suggest managers should undertake a sequence of three actions to effectively capitalize on the potential of the metaverse (see Table 2.3). For each action, we provide a list of strengths as well as the conditions under which the action is most useful. The sequence represents a roadmap for managers working to build digital businesses in the metaverse.

Table 2.3
A roadmap for digital businesses in the metaverse

Roadmap phase	Action	Strengths	Usefulness' conditions
Exploration	Collaboration with metaverse market leaders	• Access to core technology • Access to market opportunity	The company puts low level of involvement in the collaboration
Experimentation	Collaboration with digital incumbents active in metaverse-related businesses	• Construction of a competitive advantage	The company puts high level of involvement in the collaboration
Consolidation	Acquisition of / collaboration with metaverse startups	• Access to core technology • Increase in market traction	The company puts low to medium level of involvement in the collaboration

Collaboration with metaverse market leaders

Business partners already experienced and specialized in the metaverse (e.g., Roblox, ZEPETO), being market leaders in this field, made available their core technology (e.g., sophisticated virtual reality technology) for the implementation of digital businesses in the metaverse. Gucci, for example, leveraged Roblox's novel "layered clothing" technology for realistic 3D clothing designs. Market leaders can also support digital businesses in the metaverse by means of new market opportunities. Indeed, on the one hand, metaverse market leaders gave all four companies access to new potential customers representing their own specific businesses' targets (i.e., young generations and tech savvy adopters; Kshetri, 2022). On the other hand, metaverse market leaders provided all four companies with metaverse platforms able to overcome limits in physical reality, such as geographical boundaries, thus streamlining market connections (Li, 2020). Therefore, as result of the partnerships, the four companies were afforded new market opportunities as their customer bases grew. This type of collaboration is useful for companies wary of investing too much in the collaboration. This way, companies partnering with market leaders can use the market leaders' know-how in the metaverse to lower technological entrance barriers, and they can lean on the market leaders' reputation in the metaverse to access market opportunities. This type of low-effort collaboration is a good initial step in the roadmap for implementing digital businesses in the metaverse.

This action reflects an exploration phase, as in this step companies explore the potential of the metaverse for digital businesses through partnerships with market leaders. Indeed, owing to high technological challenges and new customer demand, the metaverse' commercial potential is still evolving (Hatami et al., 2023). In this context of high uncertainty, the first toe in the metaverse should be a partnership with a market leader, one with both the technology and the market capabilities to stay competitive in the metaverse. As one author on the metaverse put it: "Especially for small-medium sized companies, partnership is the only way for approaching the metaverse" (Simone Puorto, personal interview).

Collaborations with digital incumbents active in metaverse-based businesses

Digital incumbents active in the development of metaverse-based businesses (e.g., Microsoft) represent a valuable partner for companies willing to construct a competitive advantage in the metaverse. Indeed,

collaborations with such partners trigger experiments with the new technologies that power it, including virtual reality, augmented reality, mixed reality, and artificial intelligence. In turn, such experiments are aimed at developing cutting-edge technologies capable of sustaining a leading market position in the metaverse. This is the case for Samsung and Hyundai, both of which partnered with Microsoft on joint technological projects. Samsung and Microsoft joined forces to codevelop new augmented reality hardware (Bastian, 2022). Meanwhile, Hyundai is building a "metamobility" concept through the connection of different technologies, including robots, digital twins, and smart devices, within a unique metaverse platform powered by Microsoft's cloud and artificial intelligence expertise. Companies collaborating with digital incumbents active in metaverse-related fields share their technical knowledge and innovative ideas (Hurmelinna-Laukkanen and Nätti, 2018). This invites significant risk of failure and necessitates extensive engagement from the company. Hyundai showed its commitment by constructing a new innovation hub devoted to the metamobility concept. This action represents a second step in the roadmap toward implementing digital businesses in the metaverse, and the engagement it requires means companies should commit for the long haul if they want to succeed. As one metaverse entrepreneur said, "The goal of partnerships between incumbents is to experiment for creating a new economy, a new business model, a new ecosystem with a magnet effect" (Tommaso Di Bartolo, personal interview). To this end, partners need to "pool their innovation capital to learn rather than generate immediate revenue" (Tommaso Di Bartolo, personal interview).

Hence, this action mostly reflects an experimental phase, in which companies have already acquired the technological know-how for a digital business in the metaverse and can scale up with metaverse-related innovations by exploiting partnerships with incumbent firms. As one expert said: "Companies experimenting with the metaverse have to partner with someone who has a complete view of the market and on its evolutionary trends and may help the same companies in scaling up metaverse-related innovations that are likely to expand their market share" (Simone Puorto, personal interview).

Acquisition of and collaboration with metaverse startups

Startups that are active in the metaverse field (e.g., RTFKT, SuperRare) can be valuable partners for companies seeking to implement digital businesses in the metaverse. Our analysis revealed that companies can engage with metaverse startups in two main ways: via acquisition and via collaboration. Companies acquire metaverse startups to access core metaverse technologies. For example, Hyundai acquired the high-growth tech startup Boston Dynamics for developing the key building blocks of a metaverse populated by both humans and robots. Similarly, Nike acquired the virtual fashion startup RTFKT to "extend Nike's digital footprint and capabilities," per its CEO and president, John Donahoe (Brahambhatt, 2022). Both companies incorporated the startups within extant teams and divisions in their companies. Companies collaborate with metaverse startups as investment opportunities for increasing market traction, via marketing campaigns often coupled with business diversification. Indeed, all the companies we examined partnered with startups on marketing campaigns revolving around the release of digital collectibles (e.g., Hyundai's metamobility NFTs) and participation in generative art projects (e.g., Samsung's #YouMake campaign). The scope of these collaborations, as explained by Gucci's executive vice president for new businesses, Nicolas Oudinot, is to gain short-term returns by participating in an "interconnected and decentralized economy" (Fortune, 2022). On this subject, one expert remarked, "Collaborations with metaverse startups are small bets that have an immediate direct return in marketing, as the ability to share and promote them holds inherent value" (Lorenzo Cappannari, personal interview). Collaborations with startups are therefore useful for any company lacking the resources to pursue a high-involvement partnership.

Hence, this action reflects a consolidation phase, one in which companies seek to increase market traction, gain a competitive advantage, and become market leaders themselves. Openness toward acquiring or collaborating with startups affords the opportunity for serial innovations, thereby

maximizing returns on investment. As argued by an expert: “Partnering with startups for the development of metaverse-related solutions has the added value for more flexible, often cheaper, faster, more interesting outcomes” (Lorenzo Cappannari, personal interview).

Teece (2017) argued that dynamic capability development evolves according to three phases: sensing, seizing, and transforming. We argue that for companies building digital businesses in the metaverse, the sequence proceeds along a different set of three phases: exploring, experimenting, and consolidating. Along the way, collaborations with several players (i.e., metaverse market leaders, digital incumbents, and startups) are fundamental. Indeed, these collaborations may sustain the development of an innovation ecosystem that is effectively engaged in developing metaverse-related innovations and can accelerate the transition of companies toward a flourishing metaverse business.

5.2 Managerial Implications

The leadership profile

Given the complexity of the proposed roadmap, strong leaders are needed. Our analysis reveals a leadership profile of a manager acting in digital businesses in the metaverse, which is composed of four capabilities: strategic planning capability, organizational capability, experimental capability, and network capability.

Strategic planning capability

Leaders should understand the real, profitable applications of the metaverse for the company. Therefore, strategic planning capabilities are essential. As a metaverse consultant put it: “The failures of any metaverse project occur from a lack of upstream strategic planning. Hence, the person in charge of the project must have an overview of the problems to be solved and the business objectives to be achieved by the company or by a department within the company” (Nick Rosa, personal interview).

The three main features of the strategic planning capability correspond to metaverse use-case identification, selection, and activation.

As for metaverse use-case identification, leaders can develop digital businesses in the metaverse to “solve real business problems” (as in Hyundai’s industrial metaverse), to “make pre-visualization” (as in the replica of Samsung’s 837 flagship store in the metaverse), or to “create additional revenue and/or move revenue from existing channels to new immersive channels” (as in Nike’s virtual worlds and experiences; Simone Puorto, personal interview).

As for metaverse use-case selection, two main approaches have been reported by experts: metaverse-first and business-first. The metaverse-first approach has been reported in these terms: “We make a radar chart and score each possible use case from 1 to 5 based on six metaverse value dimensions, namely, socializing, entertainment/gaming, simulation, dematerialization of physical products, intelligence, digital ownership. The use cases that reach the highest scores on as many dimensions as possible are use cases where the metaverse generally brings more value” (Lorenzo Cappannari, personal interview). The business-first approach consists of: “Creating an impact/feasibility matrix, where the impact is the upgrade obtained by the use case implementation in terms of strategic Key Performance Indicators (KPIs; e.g., revenue generation, cost savings, process efficiency, brand awareness) and the feasibility indicates the changes needed within the company to implement the use case (e.g., new department creation). We implement in the first instance the use cases with high impact and high feasibility” (Nick Rosa, personal interview),

As for metaverse use-case activation, companies need to have "an executive sponsor with a blocked and armored budget for the use case" and "an executive sponsor with a high ranking within the company who protect the metaverse transformation" (Nick Rosa, personal interview). Hence, the strategic planning capability assists leaders in identifying, selecting, and activating one or more metaverse use cases aimed at creating value for a specific department of the firm.

Organizational capability

Leaders need to align the company's organizational structure to build and integrate capabilities. As one expert emphasized: "It is imperative that in activating metaverse use cases, teams connect with all the other parts of the company that are operationally affected in some way by the implementation of these use cases, because the innovation and the value are not generated in a standalone implementation" (Nick Rosa, personal interview).

To this end, Gucci's Nicolas Oudinot has argued that leaders should invest in small, specialized metaverse teams: "We have few core teams that are relatively small and nimble working on the different streams really focused and then we have bridges […] with brand and engagement teams […], legal team, [...] tech team and all these areas actually are areas where you need to build Web3 knowledge. So, a mix of a small core team but at the same time building expertise across the company to create the link and move fast" (Montemagno, 2022).

Such teams can develop expertise in their respective areas and exploit economies of utilization (Grant, 2010). The new, metaverse-oriented teams have to be aligned with the traditional, core business of the company. As Oudinot put it: "NFTs are about community, scarcity and creativity and this is what is core to a brand like Gucci, so we started with a first NFT team […] from there we decide naturally to [...] explore further […] with a step-by-step testing and learning approach" (Montemagno, 2022).

Hence, the organizational capability can be used by leaders to envision new, small metaverse-oriented teams that are strategically embedded within the firm's core business area and are thus seamlessly integrated with the firm's existing business units.

Experimental capability

As our interviewed experts attest, leaders should infuse in the whole company an experimental mindset toward the metaverse. This concept has been emphasized by more than one expert: "Leaders should be open to experimentation, being careful not to go on a completely wasted investment" (Simone Puorto, personal interview). In addition: "Companies need to experiment even if they do not know what will work. Hence, the leader must make it clear that there is a need to position but without a revenue generation target. This means distributing the risk across various players, understanding what works and where to invest in relation to the core business" (Tommaso Di Bartolo, personal interview).

Moreover, "leaders must focus on the first specific metaverse use case/s that bring/s value to the company. Companies must experiment a lot and be ready to fail a lot, which is sometimes seen badly in the company" (Lorenzo Cappannari, personal interview). Hence, leaders use experimental capability to shape their own human capital's mindset toward experimentation in the metaverse. This is an important topic, as the experimental mindset influences how companies can act and respond, although leaders often focus on developing skill sets rather than mindsets (Crane, 2022).

Network capability

Leaders should possess network capabilities to effectively select and collaborate with partners in the development of metaverse technologies. In selecting those partners, said one expert, leaders should first assess their stability: "Companies want to implement metaverse solutions that can generate value for a long time, and with all the technology providers who are born and die in the metaverse it is essential to understand the stability of metaverse technology providers, in technological, financial, and legal terms" (Nick Rosa, personal interview).

Another expert highlighted that leaders should ensure alignment between external collaborators and the internal organization: "Leaders must advice and supervise the metaverse innovation actions performed with partners, take responsibilities upon changes on these actions, and provide timely feedback to assure deadline encounter. These figures do not need to be experts, rather they need to dialogue with both innovation metaverse experts and company's business teams" (Lorenzo Cappannari, personal interview).

Hence, the network capability assists leaders in selecting and collaborating with partners through assessing partner stability and through aligning internal with external interests.

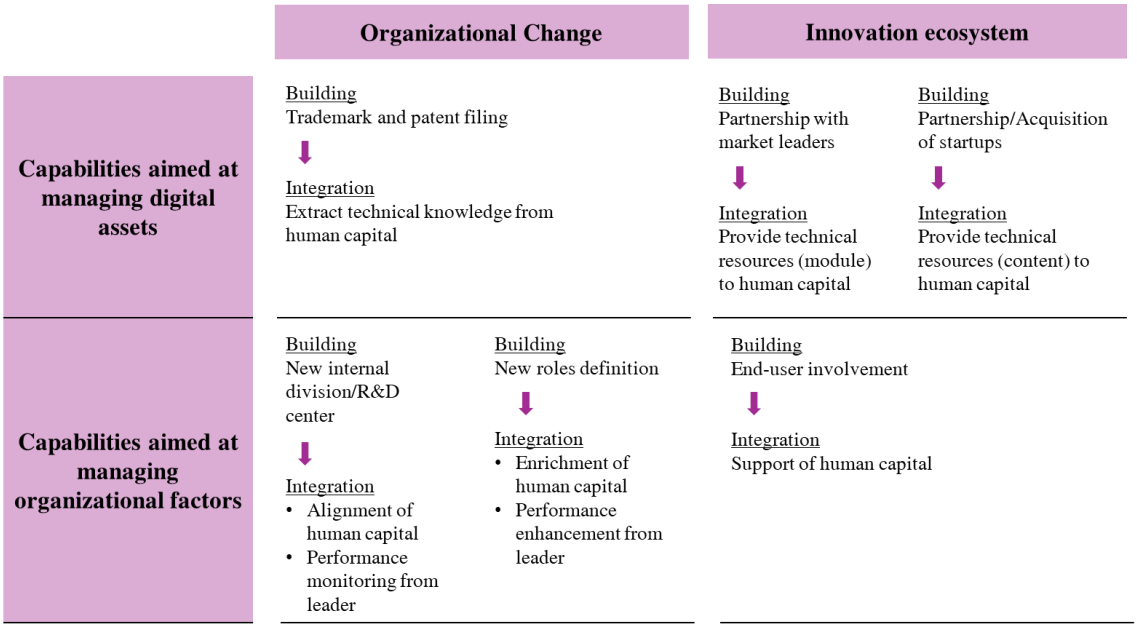
6. Conclusion

Take-home message: Leading digital business in the metaverse

The article illustrates how to deal with the capabilities and strategic factors needed for leading digital businesses in the metaverse. Specifically, we offer insights on capabilities (e.g., what they are, how they can be developed), strategic roadmaps (e.g., which phases companies should follow), and leadership profiles (e.g., who is a good leader), all of which are crucial for sustaining metaverse-based businesses. In this way, the study enriches the current debate on capabilities for digital businesses (Parida et al., 2019) and provides strategic guidance for the growing number of practitioners recognizing in the metaverse a valuable opportunity to develop a digital business (Bobier et al., 2022). We found that two main capabilities lead metaverse-based businesses, namely, capabilities aimed at managing digital assets and capabilities aimed at managing organizational factors. These capabilities can be built and integrated by firms through two main mechanisms: organizational change and innovation ecosystems (Figure 2.3).

Through these findings, we contribute to the under researched topic of digital businesses in the metaverse (Madiega et al., 2022; Moro Visconti, 2022) by expanding upon related literature (Kraus et al., 2022). We provide a roadmap toward digital business in the metaverse, suggesting firms digitally innovate their businesses in three specific phases. In the first phase, firms should explore the potential of the metaverse for digital businesses through partnerships with market leaders. In this way, firms can acquire the technical know-how they will need for the second phase, which involves experimenting with digital incumbents in order to build a competitive position in the metaverse. In the third phase, firms should consolidate their competitive position by collaborating with startups to gain market traction and to develop serial innovation. Finally, to build and integrate capabilities along these three phases through organizational change and innovation ecosystems, strong leaders are needed. Hence, this article traces a leadership profile with four main types of capabilities that managers should develop to become leaders in the metaverse: strategic planning capability, organizational capability, experimental capability, and network capability. Thus equipped, leaders of firms across a wide swathe of industries will be ready for the metaverse and for all the opportunities it offers.

Figure 2.3
Capability building and capability integration



Chapter 3

Paper C

Title	Nurturing strategic agility through corporate venturing advisory: An exploratory analysis
Coauthors	Petruzzelli, A. M., Panniello, U., Frattini, F., & Del Giudice, M.
Type	Qualitative empirical study
Methodology	Inductive single-case study
Link with the Research Questions of the thesis	How will the change come about?
Research Question(s)	RQ1: "How do corporate venturing (CV) advisory firms support the creation of strategic agility in corporates?" - RQ1a: "What services are offered by CV advisory firms to nurture corporates' resource flexibility?" - RQ1b: "What services are offered by CV advisory firms to nurture corporates' strategic sensitivity?" - RQ1c: "What services are offered by CV advisory firms to nurture corporates' leadership unity?"
Theoretical contribution	Frame four approaches to support strategic agility in corporates through advisory on creation of new digital ventures
Conference presentation(s)	R&D Management 2024 Conference | 17-19 June 2024, KTH Royal Institute of Technology, Stockholm (SE)
Journal	Industrial Marketing Management (AiIG: Gold; ABS: 3; JIF: 7.8)
Status	Published in 2024 in the Special Issue "Organisational agility for new industrial marketing management models in turbulent times"

Table 3 - Paper C's summary

Abstract

This article investigates the role of corporate venturing (CV) advisory firms in fostering strategic agility in their clients, which are typically established, incumbent companies. While strategic agility, defined as the ability of a firm to adapt its strategic direction to create new value, is gaining prominence, the mechanisms for achieving agility through CV remain rather underexplored. Furthermore, traditional CV service providers have been categorized into "inside-out" and "outside-in" players, but a new category of service providers, i.e., the CV advisory firm, transcends these distinctions by offering integrated CV services. Hence, this paper focuses on the case study of Gellify, an international CV advisory firm supporting corporations in developing strategic agility. The results suggest the existence of four distinct CV services that nurture strategic agility, namely venture clienting, venture acquisition, venture building, and venture builder building. Each of these services influences the three key dimensions of strategic agility (i.e., resource fluidity, strategic sensitivity, and leadership unity) in distinct ways and provides different impacts on incumbent firms. This paper contributes to the understanding of how the CV services offered by advisory firms nurture strategic agility in established corporations, thus providing valuable insights into the evolving landscape of CV and strategic agility.

Keywords: Strategic agility; Corporate venturing; Venture clienting; Venture acquisition; Venture building; Venture builder building

1. Introduction

Strategic agility represents the ability to continually modify and adapt a firm's strategic direction to create and capture new value (Doz and Kosonen, 2008). It is about triggering and realizing significant changes at the whole business level that cannot be addressed via existing organizational routines (Volberda, 1996; Weber and Tarba, 2014). It is today widely acknowledged that firms must acquire and nurture strategic agility over time to remain competitive in changing business settings (Ademi et al., 2021). Indeed, strategic agility speeds up the innovation of products and services (Ameen et al., 2023; Brand et al., 2021) as well as the transformations of the entire business design (Weber and Tarba, 2014). It also triggers agility in employees and green innovation along with corporate performance (Shahzad et al., 2020; Zieba et al., 2022) and start-ups performance (Oliva and Kotabe, 2019). As a result, strategic agility is critical for firm survival and success, not only to capitalize on new value creation opportunities, but also to reduce the danger of inertia and competency traps (Battistella et al., 2017). In a nutshell, firms face up market challenges which request agility and flexibility to acquire, absorb and generate knowledge (Borini et al., 2022; Pereira et al., 2019).

Therefore, academics and practitioners are increasingly interested in understanding the mechanisms through which firms can promote and sustain over time strategic agility (Weber and Tarba, 2014). In this paper, we focus on a specific mechanism through which firms can create strategic agility, i.e., corporate venturing (CV). Indeed, as CV allows corporations to establish direct connections with startups that are renowned for their inherent agility and innovative prowess (Ghezzi and Cavallo, 2020; Rossi et al., 2020), it is considered an important mechanism to create strategic agility in a systematic way (Doz and Kosonen, 2010).

CV represents the collection of organizational practices aimed at developing new ventures inside or outside a firm's corporate structure (Narayanan et al., 2009; Waldkirch et al., 2021). The new ventures created through CV can be focused on the current business of the corporate as well as in a new one (Narayanan et al., 2009), and may support agility creation via the exploitation of underutilized resources or the exploration of new technologies or markets (Hill and Birkinshaw, 2008). As a result, firms can engage with CV in a variety of exploitation-oriented and/or exploration-oriented processes (Rossi et al., 2020; Rossi et al., 2019), including making small investments in independent start-ups (Kolte et al., 2023), incubating internal business ideas, exchanging expertise in innovation ecosystems (Rossi et al., 2022; Rossi and Martini, 2019; Rossi et al., 2021), or spinning out existing businesses from the corporate parent (Hill et al., 2009).

As CV is a complicate endeavor due to the multifold processes that can be applied to realize this strategy, each including specific uncertainty and risks, firms are often supported by service providers for implementing their CV activities. Such service providers, as incubators, accelerators, or venture capital firms, usually offer “inside-out” CV services (e.g., incubation) or “outside-in” CV services (e.g., investment) (Gutmann, 2019).

While the traditional distinction between outside-in and inside-out service providers is instrumental in understanding CV dynamics, contemporary literature and practical evidence suggest a more intricate landscape (Gutmann, 2019). Indeed, recent developments have unveiled a novel breed of players, i.e., the CV advisory firm, which exhibits a unique capacity to orchestrate a seamless interplay between “inside-out” and “outside-in” CV services (Patel and Chan, 2023). By offering a holistic range of services, these advisory firms provide an integrated approach that transcends the traditional inside-out and outside-in dichotomy of traditional service providers. They tend to acquire, design, and integrate knowledge which become essential for firms (Rossi et al., 2020). Such approach is translated in a knowledge management process which drives CV towards a path of learning, exploiting and exploring inside-outside activities (Brinkmann and Kanbach, 2023) or inflow and outflow knowledge (Liu and Wang, 2020). As a result, this empowers firm-level absorptive capacity (Chang et al., 2022). As Enkel

and Sagmeister (2020) noticed, the knowledge management process occurs in step of reconfiguring threats which interplays a knowledge exchange between firms and advisories.

Thereby, CV advisory firms have established themselves as valuable partners to support corporates in creating strategic agility through CV (Patel and Chan, 2023). However, despite the growing attention paid to advisory firms as partners for CV activities, academic endeavor on the topic is still quite limited (Köhler and Baumann, 2016). Indeed, previous studies mainly concentrated on specific types of providers offering merely "inside-out" or "outside-in" CV services such as incubators, accelerators, and venture capitals (e.g., Bergek and Norrman, 2008; Zider, 1998). Conversely, a focus on providers that offer both "inside-out" and "outside-in" services, such as CV advisory firms, is missing (Gutmann, 2019). As a result, the existing literature does not offer a comprehensive understanding of the mechanisms through which advisory firms support CV processes for the companies they work with, eventually contributing to the creation of strategic agility (Patel and Chan, 2023).

Therefore, in response to the call for further research on the underlying mechanisms for the creation of strategic agility (Brand et al., 2021) by means of CV, we focused on the case study of Gellify. Gellify is an advisory firm operating in Europe and Middle East that supports established companies in undertaking CV activities. Through the inductive case study analysis of Gellify, we build a framework explaining which are the CV services offered by advisory firms to support the development of strategic agility for their partners. This framework identifies four distinct CV services that contribute to creating strategic agility, i.e., venture clienting, venture acquisition, venture building, and venture builder building. The analysis identifies the key characteristics each of these services, assessing how they influence the three main dimensions of strategic agility of the client organization, namely resource fluidity, strategic sensitivity, and leadership unity.

Our analysis contributes to the strategic agility literature (Brand et al., 2021) and the CV literature (Gutmann, 2019) by unveiling the role of CV in the creation of strategic agility. In particular, we add to this stream of research by illuminating how service providers such as CV advisory firms support corporates in creating strategic agility. Furthermore, we identify four distinct CV services that can be leveraged by firms to nurture the three main dimensions of strategic agility (i.e., resource fluidity, strategic sensitivity, leadership unity), another novel contribution to the field.

The paper is organized as follows. Section 2 develops the theoretical underpinning of the study, defining the concepts of CV and strategic agility. Section 3 provides details about the single case methodology on which the paper is built. Section 4 presents the results organized around a framework that identifies four main CV services offered by the provider. Section 5 discusses the results, by offering a view of the theoretical and managerial contributions of the study, as well as its limitations and ensuing areas of future research.

2. Theoretical Background

The increasing market turbulence and technological disruption spur firms to recognize the pivotal role of strategic agility in sustaining their competitive edge (Ademi et al., 2021; Pereira et al., 2019). Strategic agility refers to a firm's ability to swiftly adapt to changing circumstances while aligning resources, sensing market trends, and fostering leadership cohesion (Doz and Kosonen, 2008). As Haider and Kayani (2021) affirm, strategic agility includes fundamental capabilities which are characterized by responsibility, speed, and adaptability. Hence, strategic agility not only supports adjustments of products or services, but also fosters the creation of entirely new business models and innovative value propositions (Ademi et al., 2021; Ameen et al., 2023).

Strategic agility differs from routine or more regular types of organizational changes (Weber and Tarba, 2014). Notably, it necessitates continuous and systematic variations in firms' processes and structures

to adapt to unpredictable market threats and opportunities (Battistella et al., 2017). Specifically, at its core, strategic agility is orchestrated through the interplay of three meta-capabilities, namely resource fluidity, strategic sensitivity, and leadership unity (Doz and Kosonen, 2010).

Resource fluidity is the firm's capability to rapidly reconfigure its competences and redeploy its resources (Doz and Kosonen, 2010). This entails the realignment of existing tangible and intangible assets to swiftly make decisions and promptly translate them into actionable measures (Xing et al., 2020). To this aim, flexible management structures and minimal constraints from rigid commitments can be leveraged by firms to foster resource fluidity (Doz and Kosonen, 2008).

Strategic sensitivity embodies instead an acute awareness of strategic developments, reflecting a firm's perception and attention to evolving market trends and external changes (Ghezzi and Cavallo, 2020). This capability allows firms to sense changes in their competitive environment and anticipate future developments before their rivals (Doz and Kosonen, 2008).

Finally, leadership unity constitutes the capacity of a top management team to make quick and bold decisions without being hindered by internal organizational politics or delays (Doz and Kosonen, 2010). In a rapidly evolving business landscape, decisive actions are paramount and leadership unity ensures that the organization and its members can swiftly align with emerging market changes (Prange, 2020). To reach this goal, firms can strengthen effective teamwork and open dialogue, and sustain a commitment to collective success (Xing et al., 2020).

While the pursuit of strategic agility is a critical imperative for modern businesses, its achievement is far from straightforward (Girod et al., 2023). Research has highlighted the complexities faced by established companies in becoming more agile, particularly with respect to instilling agility throughout the entire organization (Hutter et al., 2023). Notably, one of the fundamental challenges in pursuing strategic agility is the “capability myopia”, i.e., failing to recognize the need for a path to adjust the organization and adapt to changing market conditions (Battistella et al., 2017). Additionally, the transformation towards strategic agility is further complicated by the need to dismantle bureaucratic structures within established companies (Teece et al., 2016). Indeed, research has highlighted that as organizations grow in size and complexity, hierarchical structures become more entrenched, thus hindering agility (Hutter et al., 2023). Conversely, when organizations are in their early stages of development, they are not burdened by the legacy structures and institutional inertia characterizing older corporations, thus showing a natural inclination towards strategic agility (Ghezzi and Cavallo, 2020). As a result, to learn how to pivot and adapt to changing market conditions, as well as how to leverage new technologies and innovative solutions, lots of corporate firms seek to establish synergies with start-ups and new ventures, thus undertaking CV.

CV encloses the activities aimed at creating novel ventures either within or beyond a firm's corporate structure (Narayanan et al., 2009). Such enterprises can foster strategic agility in three main ways. These are (i) corporate innovation, i.e., experimentation of new business model elements (Weiblen and Chesbrough, 2015); (ii) corporate renewal, i.e., modification in existing business model via new capabilities and resources (Feldman and Sakhartov, 2021); (iii) business diversification, i.e., investment in ventures operating in diverse industries or areas (Tidd and Bessant, 2020).

Summarizing, CV sustains strategic agility creation by providing established firms with valuable insights, fresh perspectives, and access to novel and often disruptive technologies or business models (Hill and Birkinshaw, 2008).

However, CV can be a complex process, particularly when companies are simultaneously managing their core operations and have to interact with the startups' landscape. These complexities include differences in organizational culture (Hock et al., 2016) and risk tolerance (Tidd and Bessant, 2020), as well as the need to allocate resources effectively between the core business and the innovative initiatives (Waldkirch et al., 2021).

Given these complexities, many corporate firms turn to service providers to assist them in pursuing strategic agility via CV (Clayton et al., 2018). These providers facilitate the foundation of and/or collaboration between established companies and startups or innovative businesses. This is possible through two main approaches, namely inside-out and outside-in (Gutmann, 2019). The inside-out approach involves innovation flow from the corporate entity to external sources, often through licensing-out, incubation, and spin-offs (Chesbrough, 2004). Here, service providers as corporate incubators or research centres nurture the idea generation, product/service development, and go-to-market in the form of startups (Gutmann, 2019). Differently, the outside-in approach represents the flow of innovation from external sources, such as startups, into the corporate domain (Chesbrough, 2004). This includes corporate venture capital investments, strategic partnerships, or equity acquisitions. Here, service providers as accelerators and venture capital firms provide access to externally developed technology solutions enhancing the firms' internal capabilities (Gutmann, 2019).

The recent research in CV has extensively examined providers that offer inside-out and outside-in services separately (e.g., Kyprianou, 2018). In his extensive literature review, Gutmann (2019) resumes the main CV services, providing six different archetypes of providers that facilitate the flow of innovation, either from the corporation to external sources or vice versa. However, a relatively unexplored area in the literature approaches service providers offering both inside-out and outside-in approaches (Gutmann, 2019). These entities, known as CV advisory firms, represent consulting companies guiding organizations through the intricacies of CV activities in an overarching way (Patel and Chan, 2023).

Despite scholarity attention is relatively limited on CV advisory firms due to the nascent nature of the phenomenon, their assistance for the creation of strategic agility is particularly relevant and timely for two main reasons.

First, CV advisory firms act as comprehensive providers, bridging the gap between corporate firms and external partners. Consequently, they offer various services to foster innovation and reduce the inherent risks associated with the phenomenon (Feser, 2023). These include risk assessment and due diligence in defining a CV activity, strategic alignment for a valuable outcome, as well as governance and exit scenarios through divestment, acquisition, or integration. Through these services, CV advisory firms are able to increase the strategic agility of their corporate clients.

Second, their services encompass a broader spectrum of CV activities, spanning from internal ventures controlled directly by the corporation (inside-out) to external investments in new ventures (outside-in) (Kyprianou, 2018). This dual capability differentiates CV advisory firms from other actors offering merely inside-out (e.g., incubators) or outside-in (e.g., venture capitals) services. As a result, CV advisory firms promote the integration of innovation flows both inside and outside the corporate firm, a dimension that has gained increasing significance in today's fast-paced business landscape, even if it is still quite neglected (Gutmann, 2019).

In addition to academia, the business practice is also increasingly recognizing the significance of CV advisory firms in fostering strategic agility. Indeed, prominent consulting firms like Boston Consulting Group, Accenture, and McKinsey & Company have established dedicated units and initiatives focused on CV advisory services. “BCG Digital Ventures”, for instance, is renowned for its pioneering efforts in co-creating and incubating startups with corporate partners. Similarly, Accenture's “Ventures and Open Innovation” unit facilitates corporate-startup collaborations in deep-tech. McKinsey & Company's “New Ventures”, on the other hand, identifies and capitalizes on emerging trends and technologies through partnerships and investments. These real-world endeavors underscore the increasing pragmatic significance of CV advisory firms for industry practitioners.

Based on our analysis, it is evident that the acquisition of strategic agility is a primary goal for today's firms. This notwithstanding, the achievement of strategic agility is a complex issue, which often

requires corporate to rely on service providers guiding their agile transformation. Despite lots of efforts have been put by scholars in the analysis of traditional service providers such as incubators, accelerators, venture capitals, a new form of provider is growing in importance (i.e., CV advisory firms), whose functioning is still opaque due to the recentness of its origin. Therefore, the primary objective of this paper is to investigate how advisory firms contribute to the development of strategic agility through CV. By analyzing their role in fostering resource fluidity, strategic sensitivity, and leadership unity, the authors offer new insights into the relationship between strategic agility and CV advisory firms. Specifically, here follows the research question inspiring the paper:

RQ1: "How do CV advisory firms support the creation of strategic agility in corporates?"

More in detail, the research question has been explored through these three sub-questions:

RQ1a: "What services are offered by CV advisory firms to nurture corporates' resource flexibility?"

RQ1b: "What services are offered by CV advisory firms to nurture corporates' strategic sensitivity?"

RQ1c: "What services are offered by CV advisory firms to nurture corporates' leadership unity?"

3. Research Methodology

We adopted a qualitative research methodology to understand how CV advisory firms support strategic agility creation for corporate firms. While diverse facets of CV have been studied through both qualitative and quantitative methods (Gutmann, 2019), empirical investigations on the convergence of CV and strategic agility remain relatively scarce. This dearth of empirical insights justifies the adoption of a qualitative approach (Papagiannidis et al., 2023). Specifically, case studies are ideal to examine contemporary and complex real-world events (Lindgreen et al., 2021; Yin, 2014). We adopted an inductive approach based on a single case study (Kovalchuk et al., 2023), as we started from collected data to develop a model explaining a broader phenomenon. The inductive approach is particularly useful when dealing with less-known phenomena (Yin, 2014), such as the support of CV advisory firms for the creation of strategic agility in corporates.

In line with Siggelkow (2007), we carefully selected a suitable case for our study, adhering to three essential criteria: i) alignment with the research question (motivation), ii) generation of fresh and innovative concepts (inspiration), and iii) provision of a practical representation of real-world circumstances (illustration). We chose Gellify as a unique and extreme case as it is a multinational CV advisory firm that gained recognition in several rankings for its rapid growth. Notable examples are its inclusion in the "FT 1000: Europe's Fastest Growing Companies" in 2021, a list compiled by the Financial Times showcasing European companies with the highest annual growth rates[77]. Prior to this recognition, in 2020, Gellify had already been recognized by Il Sole 24 Ore and Statista as a Growth Leader for 2022[78]. Moreover, we selected Gellify as, to the best of our knowledge, it is one of the few CV advisory firms that has branded and patented its own services (e.g., "gellification"). Hence, in line with Lindgreen et al. (2021), we are convinced that this case can contribute to theory through identification of prominent theoretical categories, namely the successful CV services offered by advisory firms to nurture strategic agility.

3.1 Case study description

Gellify (see Table 3.1) is a CV advisory firm bridging high-tech B2B startups with established companies to innovate their processes, products, and business models. Founded in 2017 and with presence in Italy, Spain, and Middle East, Gellify integrates strategy, design, and technology to support innovation from vision to execution.

Table 3.1

Case study overview.

FOUNDATION DATE	2017
SIZE	• 230+ employees across 6 global offices • 258 customers
OFFICES	Bologna (Italy) Milan (Italy) Imola (Italy) Barcelona (Spain) Madrid (Spain) Dubai (United Arab Emirates)
BUSINESS RESULTS	• 700 startups validated, 60 invested, 5 exited • Revenues of 24 million euros (2022), +60% on 2021
ACHIEVEMENTS	Recognition in international rankings: • "FT 1000: Europe's Fastest Growing Companies" by Financial Times • "Growth Leader of 2022" by Il Sole 24 Ore and Statista

To this aim, Gellify is structured into three business units. The first one, named "Gellify", focuses on supporting startups that have already demonstrated traction in the market. The second business unit, "Gellify Air", is dedicated to corporate innovation programs, aiming to connect digital startups with traditional entrepreneurs. Lastly, the third business unit, "Gellify Investments", comprises a team of investors and venture capitalists, dedicated to investing in the most cutting-edge and high-potential B2B software technologies. Thanks to this organizational structure, Gellify reached 24 million euros as revenues in 2022 (+ 60% on 2021), and doubled operational profit compared to 2021[79].

3.2. Data collection

The data collection was executed through a meticulous and multi-pronged approach (Yin, 2014). Specifically, two primary types of data sources were harnessed as suggested by Papagiannidis et al. (2023) and Kovalchuk et al. (2023). First, we collected primary data, which encompassed semi-structured interviews and materials directly provided by the company. Second, we leveraged secondary data, which encompassed online materials collected both from the company itself and external sources (e.g., third-party interviews, podcasts, and newspaper articles).

Primary data was mainly sourced from semi-structured interviews, which are considered "as the most effective means of gathering data" (Lindgreen et al., 2021, p. A8). The interviews lasted between 30 and 60 min and were recorded and transcribed to ensure data fidelity for rigorous analysis. In cases where information remained unclear or further data was deemed necessary, we subsequently reached out to the participants via email for clarification. In most of the cases, the email exchange was aimed at gathering official Gellify's material (i.e., public or internal presentations). The interviewed people in Gellify were purposively selected based on their knowledge and insights relevant to the research objectives, guaranteeing a diverse sample that encompassed a range of roles and qualifications within

the organization. Alongside interviews with Gellify's employees, we also discuss with the corporates and startups that have used the services and have been in connection with Gellify. In this way, we were able to conduct a more holistic evaluation of Gellify and frame the type of CV service offered/received, the strategic agility approaches developed before and after the use of CV services, as well as the impact of CV services on strategic agility. The interview protocol consisted of three main sections. First, we examined Gellify's resources, competencies, customers, and offerings to know about the firm's business model. Second, we delved into Gellify's services within the B2B segment, with a particular focus on fostering connections with emerging entrepreneurial entities. Third, the interviews centred around the support that Gellify provides to its clients in creating strategic agility through the offering of its CV services. The interview protocol is described in Appendix A.

To augment the depth and rigor of our study, we also leveraged secondary data. These data were meticulously selected to provide supplemental perspectives and corroborate the primary findings (Siggelkow, 2007; Yin, 2014). Specifically, material sourced from the corporate website acted as the official voice, providing a foundational narrative underpinning all other data. Among the corporate material, official press releases and videos were seized to capture the crucial updates and noteworthy announcements on Gellify's developments. Additionally, posts on official social media pages allowed to gain a perspective on the Gellify's engagement with corporates and startups. In parallel, articles and interviews featured in business magazines and digital outlets on innovation ecosystem enriched the narrative with an in-depth, third-party viewpoint.

The integration of primary and secondary data was instrumental in data triangulation, a critical aspect of qualitative research (Yin, 2014). Data triangulation involves cross-validating findings from different sources to enhance construct validity and reliability (Lindgreen et al., 2021). Our data triangulation process was iterative, occurring both before and after interviews. During this process, we critically considered any information provided, comparing and contrasting it with secondary data sources. This methodological approach ensured the robustness and integrity of our findings, hence minimizing the potential for bias while drawing insights from diverse, independent sources (Yin, 2014). Finally, to further enhance the validity of our data, one of the authors conducted a direct observation of the Gellify's functioning, through participation in one of the events organized by the advisory firm for sharing customers' experiences. This direct observation allowed for an in-depth understanding of the Gellify's operations, practices, and culture.

Table 3.2 provides an overview of the collected data.

Table 3.2

Data collection: data source description.

<table>
<tr><th>Type of data</th><th>Data source description</th></tr>
<tr><td>PRIMARY DATA SOURCE</td><td>Direct Interviews

Total number: 14

Interviews conducted with Gellify’s employees:

<table>
<tr><th>ID</th><th>Date</th><th>Name</th><th>Role</th><th>Experience in Gellify (years)</th><th>Interview duration (min)</th></tr>
<tr><td>01</td><td>13.04.2023</td><td>Elia Bidut</td><td>Manager in the Client, Ecosystem, and Venturing unit</td><td>2 years</td><td>34.01</td></tr>
</table>
</td></tr>
</table>

02	15.05.2023	Lucia Chierchia	Chief of Open Innovation Ecosystems	5 years	54.45
03	30.05.2023	Michele Giordani	Chief of Strategy, Clients and Ecosystems	6 years	49.38
04	18.09.2023	Riccardo Cipollina	Client Engagement Manager	3 years	55.54
05	19.09.2023	Rebecca Mini	Innovation Manager	5 years	47.50
06	19.09.2023	Michele Giordani	Chief of Strategy, Clients and Ecosystems	6 years	54.16
07	25.09.2023	Diego Fernandez	CEO and Co-Founder of Gellify Iberia	3 years	27.21

Interviews conducted with corporates and startups working with Gellify:

ID	Date	Firm description	Role of the interviewed	CV service experienced	Interview duration (min)
01	30.10.2023	Beta is a multinational energy company specializing in electricity, gas, and sustainable solutions	Corporate Venture Capital Manager in Beta	Venture Building	20.31
02	02.11.2023	Beta is a multinational energy company specializing in electricity, gas, and sustainable solutions	Head of Product Innovation and Scale-up in Beta	Venture Building	25.56
03	10.11.2023	Beta is a multinational energy company specializing in electricity, gas, and sustainable solutions	Head of new commercial initiatives and General Director of Beta Energy Division	Venture Building	26.46
04	02.11.2023	Gamma is a startup specializing in automation solutions for various industries. It develops efficient and advanced systems to optimize manufacturing processes and enhance productivity	CEO and Founder of Gamma	Venture Clienting	28.48
05	04.12.2023	Delta is an engineering company specializing in the production of metal components mainly for motorsport and aerospace industries	CEO of Delta	Venture Building	38.11
06	12.04.2024	Epsilon is a startup creating digital innovation ecosystems and B2B communication	CEO of Epsilon	Venture Clienting	45.06

		solutions			
07	17.04.2024	Omega is a company distributing raw materials and powdered ingredients for the food industry	CEO and Quality Manager of Omega	Venture Acquisition	41.01

Official material provided

Total number of provided PowerPoint presentations: 2

SECONDARY DATA SOURCE

Material from corporate website

Total number of webpages on the official website: 32

Press releases

Total number of elements in the newsroom section: 117

Posts on official social media pages

Total number of posts on Instagram: 338

Articles on newspapers and business magazines:

Total number: 13

Main sources:

- “Startup Business”
- “Startup Italia”
- “Economy Up”
- “Industria Italiana”
- “Scuole Malpighi”
- “Inno3”
- “Startup Easy”
- “Best Workplaces”

Video material

Total number on YouTube (official promotional videos, live events, podcasts): 32

Total number on Vimeo (official and unofficial videos and live events): 121

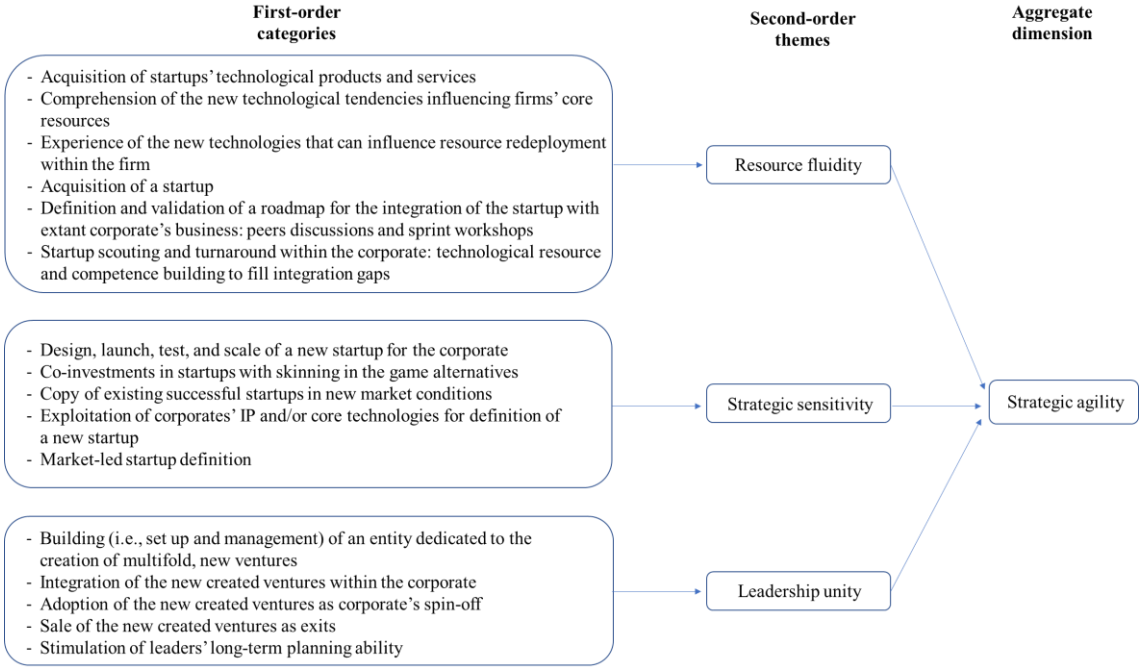
	Third party interviews (written and/or spoken): Total number: 8 Main sources: - “Gli Stati Generali”: Interview with Fabio Nalucci, founder of Gellify - “Cubbit”: Interview with Fabio Nalucci, founder of Gellify - “Startup Business”: Interview with Fabio Nalucci, founder of Gellify - “Ict Business Ecosystem”: Interview with Francesco Ferri, CEO of Gellify - “Milano Finanza”: Interview with Francesco Ferri, CEO of Gellify - “Economy Up”: Interview with Gianluca Giovannetti, General Director of Gellify - “Radio Activa”: Interview with Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify - “Industria Italiana”: Interview with Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify
DIRECT OBSERVATION	Participation to company event

3.3. Data analysis

We adopted an inductive approach to data analysis, based on manual coding. The approach is consistent with Gioia, Corley, and Hamilton (2013), who defined a three-step research method to systematically organize data into themes. The particularity of this method is that the overarching themes are derived directly from the data, which are clustered and related to find new concepts and theories from the ground up. In particular, the coding process (Figure 3.1) followed a sequential strategy, progressing from raw data (i.e., first-order categories) to the researchers' interpretations based on comparison with the literature (i.e., second-order themes and aggregate dimension) (Gioia et al., 2013).

Figure 3.1

Data analysis: coding.



We established first-order categories as initial labelling and categorization of raw data, representing the participants' own words and concepts. Hence, we utilized the material derived from interviews to define first-order categories, which were defined as excerpts from the interviews' transcripts. Then, such first-order categories were tested, modified, and enriched by secondary data. In this way, authors ensured that data from various interviews and documents were assigned codes that represented specific CV services offered by Gellify.

Subsequently, authors grouped first-order categories into second-order themes. These themes offer a more abstract and comprehensive view of the data, allowing the researchers to identify patterns and commonalities. Specifically, these themes captured broader concepts related to the offering of CV services for redeploying resources (i.e., resource fluidity), sensing market changes (i.e., strategic sensitivity), and fostering team cohesion (i.e., leadership unity). By defining second-order themes, researchers relied on the strategic agility literature (Doz and Kosonen, 2010) for facilitating a higher level of abstraction. Moreover, as the different researchers may interpret data differently based on their own backgrounds, experiences, and theoretical orientations, the grouping of fist-order categories into second-order themes was conducted by means of multiple discussions. This approach was useful to identify more nuanced and comprehensive themes.

Ultimately, as a final step, the second-order themes were consolidated into an overarching aggregate dimension capturing the strategic agility. This step ensured that the defined first-order categories and second-order themes effectively contributed to the achievement of strategic agility.

To minimize potential subjectivity during the interpretative phases, emerging codes underwent discussion with fellow researchers, hence supporting internal validity (Lindgreen et al., 2021). Similarly, the final results of the analysis were shared with Gellify for review and confirmation, thus limiting errors and enhancing the overall construct validity (Lindgreen et al., 2021).

4. Findings

This paper examines how CV advisory firms foster strategic agility for their corporate clients. Our research presents a novel framework (Figure 3.2) based on the analysis of Gellify, a prominent CV advisory firm. The framework defines four main types of CV services offered by advisory firms to sustain corporates' strategic agility.

Figure 3.2

Four types of CV services for strategic agility.

The y-axis represents the three main dimensions of strategic agility that can be influenced and nurtured by CV, i.e., resource fluidity, strategic sensitivity, and leadership unity. The x-axis delineates instead the low, medium, or high impact of CV services on each dimension of strategic agility of corporates. Specifically, following with Chiesa and Manzini (1998), the impact on the firms has been defined as the modifications in the organizational structure of the corporate (e.g., the creation of new divisions/functions, the integration of new and existing activities, the revision of roles and responsibilities) as well as in the firms' assets and resources.

Four main types of CV services emerge from our analysis, catering to different combinations of dimensions of strategic agility and impact on firms. These refer to “venture clienting”, i.e., the service allowing a corporate to purchase the products/services of a startup, “venture acquisition”, i.e., the service allowing a corporate to acquire a startup, “venture building”, i.e., the service allowing a corporate to create and develop a new venture, and “venture builder building”, i.e., the service allowing a corporate to have a venture builder for the development of new ventures from scratch. Below, each CV service is presented.

4.1. Venture clienting

“Venture clienting” (Table 3.3) is a CV service characterized by resource fluidity and a low impact on firm processes. Through this service, CV advisory firms assist corporates in procuring products and services from startups, fostering a symbiotic relationship between established corporations and

innovative newcomers. As commented by an interviewed, *"it means that we want to help companies in adopting the startups technologies and in doing projects using startup technologies"*[80] (Fabio Nalucci, Gellify's founder). In particular, Gellify sustains the corporate's connection with scale-ups, i.e., mature startups, which *"are super good on the technological solution and how to scale the technical process"* and, at the same time, show *"stability in the delivery process"* (Diego Fernandez, CEO and Co-Founder of Gellify Iberia). Usually, these scale-ups are led by experienced entrepreneurs, as in the case of Epsilon, a venture that enables the construction of digital ecosystems by facilitating the meeting of the demand and offer of innovation services for corporate clients. Epsilon was founded by an experienced entrepreneur who had previously launched a fintech startup that was acquired by a multinational consulting firm.

Venture clienting is *"a lever of strategic agility because it is a way to approach relationships with startups in a sandbox, because it allows corporates to go much faster in connections with startups"* (Elia Bidut, manager in the Client, Ecosystem, and Venturing unit at Gellify). Specifically, venture clienting sustains strategic agility in the form of resource fluidity as it allows the acquisition of startups' products and services. Indeed, by actively engaging with a new venture, the client organization gains access to cutting-edge solutions, which can be used both for *"process optimization"* and *"new business models creation"* (Diego Fernandez, CEO and Co-Founder of Gellify Iberia). Moreover, venture clienting *"is the first touchpoint, from there corporates can go to a Pre-Merger and Acquisition, a joint venture, a pure commercial agreement where the startup becomes the firm's supplier"* (Elia Bidut, manager in the Client, Ecosystem, and Venturing unit at Gellify).

The acquisition of existing startups' products via venture clienting is supported by Gellify through three main steps, which (i) make corporates aware of startups' technologies, (ii) connect corporates with startups, and (iii) sustain the product/service delivery process.

First, corporates need to be aware of the frontier technological areas where to find cutting-edge startups as valuable partners. To this aim, Gellify promotes the "Explore Talks", which are *"inspirational speeches on innovative topics made by recognized experts who belong to our community"*[81] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). These speeches on technologies such as artificial intelligence, robotics, blockchain, are particularly important because *"as the startup bring new technologies, the corporate firms need to understand how to use the technology"* (Diego Fernandez, CEO and Co-Founder of Gellify Iberia).

Second, corporates need to be put in contact with startups offering novel technologies. Accordingly, Gellify organizes the "Walking Tours", which are *"paths to discover new technologies where corporates can finally touch real application cases"*[81] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). These physical tours are organized around so-called technological islands within a physical hub and allow corporates to examine the products and services of different startups regarding a given technology.

Third, corporates need to be assisted during the collaboration with a startup for the delivery of the startups' products/services. Hence, Gellify behaves as a middleman managing bureaucratic agreements for the two entities. As emerged, *"we are the middleman in terms of confidence with clients but also we are the middleman because clients are signing with us not with the startup"* (Diego Fernandez, CEO and Co-Founder of Gellify Iberia). This is particularly important as "*corporates are always afraid of the delivery capability, that the startup team will disappear in a short term. As Gellify we say "we really tested the startup, they are implementing with us, we have a contact with them, you are signing with a multinational company" and we are the security for the clients"* (Diego Fernandez, CEO and Co-Founder of Gellify Iberia). The support provided by Gellify through the delivery process is exemplified by the CEO of Epsilon: *"we have made a reselling agreement with Gellify, so the Gellify salespeople who offer innovation to their customers also have Epsilon in their briefcase"* (CEO of Epsilon). In this way, Gellify sustains the delivery of Epsilon's products and services among its corporate clients. In

addition to addressing bureaucratic and networking aspects connected to the delivery process, Gellify sustains the technical process for a streamlined delivery, as remarked by the CEO of Gamma, an industrial IoT startup performing venture clienting thanks to Gellify's intermediation activity: *"For the product to be purchased by the corporate it is important that delivery is easy. For example, if a company buys the product we offer and this product needs to be integrated with its factory systems, it is important to make a product that has a clear and simple integration structure via API"* (CEO of Gamma).

Table 3.3

Venture clienting.

Processes activated in the corporate	**Capabilities activated in the corporate**	**Practices performed by the advisor**	**Impact on strategic agility**
Access to innovative technological solutions	1.1 Becoming aware of the new technologies offered by the startups' landscape	1.1 Informative speeches on the adoption of startups' technologies	Enhancement of resource fluidity: → Fast adoption of startups' technologies in a sandbox to optimize process and/or create new business models
	1.2 Physically experimenting with specific startups' technologies	1.2 Events in physical hubs where startups can showcase their technologies	
	1.3 Stably connecting with startups during the delivery process	1.3 Guaranty in the corporate-startup collaboration contracts	

4.2 Venture acquisition

"Venture acquisition" (Table 3.4) embodies a balance between resource fluidity and a moderate impact on organizational processes. Here, CV advisory firms facilitate the acquisition of a startup for a corporate. In this way, established firms can leverage the novel offerings, technologies, and talent pools of a newcomer to drive a deeper organizational growth and transformation. The strategic agility outcomes deriving from venture acquisition are evident in the case of Omega, a distributor of raw materials and powdered ingredients for the food industry whose aim was to undertake venture acquisition thanks to Gellify: *"We are not a producer of food raw materials, hence the innovation starts from suppliers who present us a new raw material that they developed. We want to reverse this trend, be proactive and look for something new on the market for customers rather than waiting for innovation from suppliers. We started a journey with Gellify to acquire a startup, aware that the real, original innovations for the near future can come only from these ventures"* (CEO of Omega).

Gellify assists corporates in acquiring startups by means of an advanced intermediation: *"Intermediation for us is not putting the corporate and the startup in contact, or facilitating the contact, but we do the integration"* (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). Accordingly, the intermediation is defined as the incorporation of an established startup or an external IP/technology within the corporate's process, and entails the deployment of resources to renew and restructure an extant business. This is evident from the story of the Gellify's support to Alfa, a company specialized in industrial motion technology, for the acquisition of a technological startup: *"Alfa is a purely mechanical company, hence the challenge was to explore how to seamlessly integrate digital products or services into their existing portfolio. […] To achieve this goal, we initiated an investment*

and acquisition strategy targeting an innovative startup operating in the industrial IoT sector. Such an undertaking must be characterized by industrial synergy, rather than being solely a financial transaction. We needed to identify an IoT platform and digitalization capabilities to effectively align the startups' offering with Alfa's ones. This integration process goes beyond merely adding the digital product offered by the startup as an isolated add-on; instead, it entails a comprehensive effort to harmonize business models and offerings" (Rebecca Mini, Innovation Manager at Gellify). As a result, this *"buy and build"* approach releases resource fluidity through the acquisition of external startups on which building new products. As this service entails a strong resource redeployment, Gellify *"planned intermediate checkpoints […] with a gradual approach made by a first investment by the corporate and the subsequent acquisition"* (Rebecca Mini, Innovation Manager at Gellify). In this way, resource fluidity is achieved by limiting the risks associated with *"the development of a new product/service entailing the establishment of a new business model and internal organizational changes"* (Rebecca Mini, Innovation Manager at Gellify). The limitation of risks connected with new business models has been remarked also by the CEO of Omega: *"Before this project with Gellify, we had contact with some startups but we could not understand how these startups were structured and arrived at a marketable product. With this project we relied on people who deal with startups every day, know them and know how to quickly identify which ones may be best structured beyond the idea"*.

Three main steps underlie venture acquisition.

First, Gellify builds a technology roadmap. This is an important point, especially for traditional companies such as Alfa, which *"knew almost nothing about digitization, and [where] the management had a purely economic or mechanical background"* (Rebecca Mini, Innovation Manager at Gellify). The building of a technology roadmap is possible thanks to two main initiatives. These are the "Corporate Entrepreneurs Club", which is used by Gellify to design the roadmap for the corporate, and the "Sprint Workshops", which are instead adopted by Gellify to validate the roadmap with the corporate. The "Corporate Entrepreneurs Club" is defined by the Gellify's founder, Fabio Nalucci, as a *"LinkedIn of innovation"*[82], i.e., a B2B platform dedicated to corporates for sharing experiences and promoting reflection around innovation. By allowing corporates to talk in confidence with their peers, the "Corporate Entrepreneurs Club" makes evident the main trends in digital innovation, as well as the new ideas or investments in startups with good projection. These dialogues are an input used by Gellify for the definition of a technology roadmap, which is validated thanks to "Sprint Workshops". These are *"real working days"*[81] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify) combining exploratory research and co-design to bring together two main actors. On the one hand, there are the key corporates' decision-makers on business change, e.g., CEO, CTO, head of M&A operations, and representatives from core functions, who are involved *"in a journey of awareness and understanding of what we were trying to achieve"* (Rebecca Mini, Innovation Manager at Gellify). On the other hand, there are *"more vertical players, such as industrial IoT startups, to bring to the table all possible actions, areas of intervention, and technologies"* (Rebecca Mini, Innovation Manager at Gellify). As a result, the "Sprint Workshops" determine an alignment on the main elements of the technology roadmap, from the vision to the possible technological partners, based on the corporate's assets and constraints.

Second, after identifying *"the action plan for tasks to be done, people to involve, timelines, etc."* (Rebecca Mini, Innovation Manager at Gellify), Gellify selects a startup that owns a proper technology for the corporate. To this aim, Gellify revolves around *"a robust network created over the years, a network in which each node carries a wealth of knowledge and skills"*[83] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). This network counts multiple international innovation brokers belonging to banks, accelerators, and specialized players. The presence of this wide network has been acknowledged by the corporate clients as an important element when performing venture acquisition: *"The startups that receive a request from Gellify respond differently than the startup that receive the same request directly from us, because in the world of startups everyone knows Gellify"* (CEO of

Omega). The scouting process involves an in-depth research on the type of profile to be targeted based on technologies, business models, sizes, and valuations. Through a funnel approach, startups are screened by Gellify, until the top three are further investigated with the corporate. This funnel approach has been highlighted by the Quality Manager in Omega, *"Gellify presented us a shortlist of around 20 startups, describing their business models, product offering, and their level of progress. We selected the most interesting startups for topic and type of product for us and we had further meetings directly with these startups to get to know better and understand their business plans over time. This whole phase was assiduously followed by us and Gellify and lasted over a period of 6 months".* At the end of this process usually only one startup is selected *"to finalize an agreement that initially involved a minority investment with an option for a majority call after a certain number of years"* (Rebecca Mini, Innovation Manager at Gellify). This is an important point since *"between the minority investment and the potential majority transition, we can develop product and market synergies founding the operations"* (Rebecca Mini, Innovation Manager at Gellify).

Third, following startup's selection, Gellify operates venture turnaround, that is the modification of the startup's and the corporate's structures to assure integration. To this aim, Gellify designs both the technological and business processes, as *"to integrate that technology, companies do not evolve only in the technological dimension but also in terms of business models"* (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). Accordingly, for a successful integration Gellify assesses and fills both business model and technological gaps in the startup's and corporate's organizations through internal workshops. As for business model gaps, in the case of venture acquisition mediated for Alfa, Gellify *"engaged with sales offices and customers to gather market needs, define the value proposition, pricing, go-to-market strategy, etc."* (Rebecca Mini, Innovation Manager at Gellify). Alongside to this, technological gaps are filled by building proper technological infrastructures for the startups' products that are in line with the business model requirements. As remarked: *"We act as a bridge in the relationship between corporates and startups. So, the startup brings a product, we bring the planning ability around it that makes that product the innovation that the corporate needs, and then the corporate builds a business on it"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). An example of this planning ability is evoked in a personal interview with Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify: *"Let's consider a startup technology as a sophisticated, advanced algorithm […]. We have to integrate it into a structured platform, perhaps an IoT platform, so that the software can be sold quickly to corporates with a software as a service mechanism. This platform is built by the Gellify team"*. Finally, when both business model and technological gaps are filled, the operational model is built to prepare the corporate's organization for the market launch of the new digital services and products. To this aim, Gellify *"planned onboarding for sales, prepared sales materials, reviewed internal billing processes, defined service contracts, and revised the product development cycle. This included determining how various functions within the company need to integrate new workflows or modify their processes"* (Rebecca Mini, Innovation Manager at Gellify).

Table 3.4

Venture acquisition.

Processes activated in the corporate	**Capabilities activated in the corporate**	**Practices performed by the advisor**	**Impact on strategic agility**
Integration of startups' offerings into the corporate operations	1.1 Building a technology roadmap that aligns technology initiatives with the organization's overall objectives	1.1 Roadmap design by leveraging experiences and insights shared on a B2B digital platform 1.1 Roadmap validation via workshops involving startup technologies and corporates'	Enhancement of resource fluidity: → Decreased risks in the organizational changes connected with the

		key decision makers 1.2 Network exploitation and funnel approach 1.3 New processes' design 1.3 Building of operational model for market launch	development of digital product/service through gradual, mediated investment and acquisition approach
	1.2 Selecting a startup coherently with the technology roadmap 1.3 Executing venture turnaround to integrate startups' technologies within the corporate structure		

4.3 Venture building

The "venture building" (Table 3.5) is characterized by strategic sensitivity with a medium impact on organizational processes. In this situation, CV advisory firms conceive and nurture new ventures within the corporate, fostering a culture of innovation, entrepreneurship, and adaptability. Indeed, by co-creating new ventures within the client company, Gellify facilitates the development of agile units capable of rapidly adapting to market shifts, exploring new trends, and swiftly pivoting strategies when necessary. This cultivates strategic sensitivity, enabling the company to identify and respond to emerging opportunities and challenges.

"Venture building" is conceived by Gellify in four distinct ways, based on the type of opportunity that triggers the development of the new venture.

First, there is the creation of a product and technology from scratch in a new, unknown domain. In this case, strategic agility is achieved by *"testing a proposition until its successful realization, until the company can take the control of the new business and manage it"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). In particular, the manager provides an exemplification of this option: *"For example, if I produce iron rods and at a certain point I want to produce a digital product, I do not have any of the necessary front and internal operations steps. I cannot spend two years building the processes of a new vehicle that knows how to do that job. And so, we allow corporates to go on the market very quickly, do the validation, which is risky because the more time you lose and the money you spend setting up the new venture, the more you risk because you still do not know if it will stay on the market. In this sense, Gellify is an accelerator for those who want to make a new venture"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). This concept has been emphasized in the venture building conducted by Gellify for Beta, a multinational company active in energy and utilities industry whose aim was to spot new opportunities within the personal insurance market. In particular, *"the value proposition of the venture building activity was that of offering services aimed at the well-being of the person at home, and it was something distant from Beta's core business. Hence, to carry out the activities in a de-risked manner and with a market-oriented approach and to understand what the traction was on the market, it was decided to collaborate with a major player in the sector, Gellify. The objective was to test directly on the market whether the product made sense or not through a lean innovation approach"* (Corporate Venture Capital Manager in Beta). Venture building started with a strategic assessment with all the corporate's function *"to understand the internal processes for*

creating a new business. For example, we spoke with IT and tried to understand the times and methods with which they would develop a new business, or with the audit to understand the existing constraints, or with purchases and so on, we spoke with all functions. What came out was what we expected, that is to create a new venture within the company would have taken n. years and perhaps it would not have been possible because the constraints were very strong" (Riccardo Cipollina, Client Engagement Manager at Gellify). Hence, following the initial strategic assessment, the business and strategy department in Gellify defines a concept and/or refines a corporates' idea. In the case of Beta, for example, Gellify *"created a mock-up of the product to be sold, i.e., a digital application, and the service to be offered, i.e., a telemedicine consulting service, and developed a business case indicating the size of the generated business"* (Riccardo Cipollina, Client Engagement Manager at Gellify). As Beta approved the business case, an MVP to be offered on the market was built in three months thanks to incremental sprints and weekly KPIs discussions aimed at adjusting the invested resources, as explained by the Head of Product Innovation and Scale-up in Beta: "*The digital developments proceeded in an agile mode so people from my team were involved in the daily stand-ups. Then we had weekly alignment touch points from a governance point of view. Finally, we had steering committees every month where to hang the decisions that could not be resolved in weekly touch points. In these monthly meeting we looked at the market numbers, the traction of the subscription service, and we tried to adjust the business model because it was a new market and so we had to work by sight, adjust the aim frequently"*. Eventually, *"Beta held an internal meeting, and as the results were satisfactory – there were several thousand subscribers to the app – it decided to integrate it into its own systems. Therefore, the venture was merged into a Beta's business units and its services were integrated and added to Beta's offering"* (Riccardo Cipollina, Client Engagement Manager at Gellify). This integration was initially mediated by Gellify, who was responsible for managing the core aspects of the venture (i.e., IT, marketing, and customer care). Then, after one year of transition, Beta internalized the marketing and customer care functions, defining an IT maintenance agreement with Gellify. As commented by the General Director of Beta Energy Division, *"with the integration, we passed from a company with its own very focused business without a strong brand to instead a product within an already very broad offering portfolio. Here, the paradigm has changed from a company that sells a product to a product within a portfolio of an established brand"*.

As a second opportunity, there is the building of a copy of an existing successful product, thus saving on market validation. This type of venture building service is supported in Gellify through the "Venture Box" initiative. It operates as a copycat venture builder focused on establishing enterprises that replicate and enhance Software as a Service products already introduced and validated in the B2B software market. The replication is a *"smart replication"*, as *"many aspects in terms of positioning and functionality can be replicated, while others are added or removed. Indeed, the principle of Venture Box is to achieve an MVP with minimal investment to demonstrate that the product is on the right growth trajectory"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). This endeavour stimulates strategic agility by adopting a second-mover strategy that maximizes the opportunities given by specific market trends and reduces the risks associated with idea effectiveness and execution. As emerged, *"second movers are healthy for the high-tech industry, as they activate new demand and encourage a constant flow of product innovation"*[84] (Gianluca Bernardi, Head of Growth at Gellify). This guarantees strategic sensitivity in the form of quick go-to-market for the corporate. As a result, the corporate can co-own the venture with Gellify and acquire it once it reaches a sufficient level of maturity, or simply it can support the venture as a commercial channel, participate in its capitalization, and offer valuable assets such as integration with existing products.

Third, there is the exploitation of a proprietary IP and/or core technological assets for an innovative product. The key service offered by Gellify is the corporate's asset evaluation. This evaluation is business-oriented rather than technology-oriented: *"Looking at assets from a venture building perspective does not mean evaluating how well the asset functions or its quality from a technical viewpoint. Rather, it means assessing what exists in the market, determining if the asset is marketable,*

if the business plan that we can build is viable, etc." (Riccardo Cipollina, Client Engagement Manager at Gellify). To this aim, discussions with innovation and engagement managers are promoted. Then, Gellify verifies the business feasibility by applying market feedback to the technological model and developing financial scenarios based on a defined business model, go-to-market strategy, and product roadmap. Accordingly, Gellify builds the MVP and sets up the team and operations to execute the go-to-market strategy. This reduces risks *"connected to working with pilots, MVPs"*[80] (Fabio Nalucci, Gellify's founder) as *"Gellify develops algorithms, defines the business model and the management of practical things, from payroll to an appropriate legal model"*[83] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). A real experience of this venture building service is reported by Delta, a manufacturer of structural components and fasteners for automotive and aerospace industries. Delta performed an internal research project aimed at developing a smart fastener capable of capturing mechanical data in real time. As reported by the CEO of Delta, after positive protypes and tests, *"having seen that our market could be very interested in this activity which was also different compared to the company's core business, I decided to spin off the project and to create a full-fledged startup. To do this we had to develop our own software and therefore enter much more into the topic related to digital and software. From here the collaboration with Gellify was born"*. The support offered by Gellify concerned the definition of *"business and revenue models […] because we are no longer talking about just selling mechanical components, but we are selling data, services"* (CEO of Delta). For example, thanks to Gellify, Delta discovered and accessed to new markets (i.e., the oil and gas market) where to sell the new products.

Fourth, there is the building of a venture starting from market exploration. In this case, the perception of market trends is critical and is assured by Gellify through a proprietary observatory focused on B2B Software as a Service (i.e., FutureInSync), which serves as a benchmarking tool. The observatory collects both quantitative data on new ventures with particularly positive funding trajectories and qualitative insights provided by international venture capital firms, business angels, and entrepreneurs within the network. After market analysis, *"Gellify starts from the idea generation: what are the potentially interesting spaces to generate that type of business that is missing in the strategic plan of the corporate company?"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). It is a process led by Gellify's strategic designers and involves the corporate, relevant stakeholders for the corporate, and external stakeholders (e.g., startuppers, vertical experts who can contribute). Hence, Gellify analyses the market trends and ideates and/or scouts growth opportunities. Subsequently, a venture concept and pretotype of new proposition is defined to be validated by the market through testing on desirability, feasibility, and viability. Co-investment opportunities with skinning in the game options are foreseen. Specifically, Gellify's capital is accompanied by a smart network of managers and entrepreneurs offering a market heritage which is fundamental for understanding trends, needs, weak signs of the innovation ecosystem. As emerged, *"having this ingredient on board means not only having money to invest but also having a vision. Does it make sense to go in that direction? Does this value proposition make sense for a startup? They [the managers and experts on board] certainly give you [the corporate] a vision, then they also give you a network, because being well positioned they help to reach more hidden business ecosystems"* (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). It is therefore evident that the co-investment opportunities, accompanied by a solid network of experts, support the corporates in the development of strategic agility through market sensitivity. Indeed, the combination of capital and experience allows to intercept and appropriately address new market trends.

Table 3.5

Venture building.

Processes activated in	Capabilities activated in	Practices performed by	Impact on strategic

the corporate	**the corporate**	**the advisor**	**agility**
Creation of a new venture	1.1 Identifying factors that can trigger the creation of a new venture	1.1 Strategic assessment, asset evaluation, market analysis	Enhancement of market sensitivity: → Cost-effective infusion of a startup culture in the corporate structure
	1.2 Defining and testing a new venture's concept	1.2 Financial scenario analysis, MVP building, market monitoring	

4.4 Venture builder building

"Venture builder building" (Table 3.6) combines leadership unity with a high impact on organizational processes. Through this service, CV advisory firms collaborate with corporates to establish a venture builder, i.e., a dedicated entity responsible for continuously generating, incubating, and scaling new startups. Specifically, Gellify *"builds the vehicle, does the operations of the vehicle, and allows the vehicle to set up n. startups at the level of objectives in the dedicated time with the dedicated resources"* (Elia Bidut, manger within the Client, Ecosystem, and Venturing unit at Gellify). The resulting ventures can be re-integrated into the core business, established as spin-offs, or sold as independent ventures. This contributes to strategic agility as *"a powerful form of acceleration to fill a gap towards competitors or increase competitive advantage"*[85] (Gianluca Giovannetti, General Director at Gellify). Hence, the "venture builder building" service sustains the development of leaders' skillset as regards the long-term planning ability. Indeed, *"a venture builder building program requires [for the corporate] allocated funds, multi-year commitment, and an extended timeframe (e.g., 10 years) to realize returns from the initiatives being developed. This approach entails a different mindset as compared to our other programs"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify).

Venture builder building entails two main steps, i.e., set-up and management.

Set-up is connected to the design of actions needed to incorporate the venture builder into the corporate's business, technological, and financial strategy. Specifically, Gellify defines the venture builder's scope, engages the ecosystems' partners and internal team, legally establishes a new organizational structure. To this aim, the advisory company both analyses the corporate's business plan and leverages its global network of ecosystem players. Specifically, leadership unity at all levels of the corporate is promoted, as managers within the business units are stimulated in answering to the question *"what kind of venture should the venture builder promote?"*. In particular, the role of corporate's leaders within venture builder building is here defined: *"It is often challenging for individuals within the core business to break away and embark on a venture promoted by the venture builder. Instead, they may help in identifying suitable personnel. They leverage their expertise in a specific market niche and may know of talented individuals who are well-suited to lead the new venture"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). To sustain leadership unity, Gellify promotes preparatory programs to "venture builder building", as the "Academy" program. This is an *"innovation and field training program aimed at creating those skills that are missing and required by the new business models that operate with technologies"*[81] (Lucia Chierchia, Chief of Open Innovation Ecosystems at Gellify). This program is assured by Gellify's internal experts in multiple industrial sectors (e.g., manufacturing, consumer goods, retail, financial services) and technological areas (e.g.,

blockchain, artificial intelligence). The preparatory programs as the "Academy" are aimed at *"transferring a methodology on how to manage a new venture, and individuals are able to replicate that kind of speed, agility, and prioritization ability in their everyday environment. Additionally, they generate design ideas or concepts that can be incorporated into the program as one of the ventures"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify).

Following the set-up, venture builder management spots new venture opportunities, providing general management to each venture and supporting the venture builder. Venture builder management assures corporates to effectively bring ventures to market, and Gellify sustains this activity thanks to the expertise of its venture capital fund and to its network of experienced entrepreneurs. This allows corporates to launch and run multiple ventures at the same time. In venture builder management, a critical passage is changing management on the corporate's leadership, as emphasized: *"Granting greater decision-making authority to the governance unit of the venture builder is crucial because otherwise the venture builder model may not function effectively. This program will have its own distinct approach, trajectory, and returns over different time horizons compared to the corporate's typical focus on the core business"* (Michele Giordani, Chief of Strategy, Clients and Ecosystems at Gellify). Hence, *"the head of strategy, the CEO, the head of innovation, or whomever initiates the venture building initiative and is at the corporate decision-making table"* are stimulated in the development of leadership unity by approaching to a new, different, business conduction.

Table 3.6

Venture builder building.

Processes activated in the corporate	**Capabilities activated in the corporate**	**Practices performed by the advisor**	**Impact on strategic agility**
Serialized venture creation	1.1 Setting up a venture builder	1.1 Definition of venture builder's scope, ecosystems' partners and internal team	Enhancement of leadership unity:
		1.1 Establishment of the builder's organizational structure	→ Planning of long-term diversification strategies with low failure risks
		1.2 Exploitation of own funds and partners to run multiple ventures	
	1.2 Managing a venture builder		

5. Discussion and Conclusion

This paper models the services provided by CV advisory firms and explores the mechanisms through which they nurture strategic agility for their corporate clients. Our findings yield a comprehensive framework encompassing four distinct CV services creating strategic agility, namely venture clienting, venture acquisition, venture building, and venture builder building.

Venture clienting, i.e., the CV service allowing a corporate to purchase the products/services of a startup, generates strategic agility by promoting resource fluidity (Doz and Kosonen, 2010). A critical step in venture clienting is assuring a stable connection between corporate and startup firms during the

delivery of the startup's products/services. At this regard, we spot that CV advisory firms sustain the stable connection by building trust and overseeing agreements, thereby mitigating corporate concerns about startups' delivery capabilities (Mais et al., 2023). Indeed, the intermediation activity offered by CV advisory firms breaks downs the cultural challenges inherent in venture clienting, as usually corporate firms "do not see start-ups as serious collaborators" (Haarmann et al., 2023, p. 353).

Venture acquisition involves the acquisition of startups by corporate firms, aiming to leverage their innovative offerings, technologies, and talents for enhancing resource fluidity (Chiesa and Manzini, 1998). When new ventures are acquired, new resources, including potential "non-desired assets", have to be integrated and coordinated with extant ones (Chiesa and Manzini, 1998, p. 207). We found that CV advisory firms limit the issues related to the management of "non-desired assets" through three steps. First, there is the roadmap definition and validation, assuring to focus on critical assets that have to be acquired for a corporate company. Second, there is the startup selection, ensuring to choose a startup with the most critical assets and a smaller number of non-desired assets for a corporate company. Third there is the venture turnaround, operated to maximise the potential of the acquired critical assets for the corporate company and extract value from the acquired but non-desired assets.

Venture building is the CV service allowing a corporate to have a new venture developed, which stimulates strategic sensitivity via infusion of innovative and entrepreneurial culture (Köhler and Baumann, 2016). While the extant studies focused on the existing types and performances of the created ventures, on the venture-corporation relationship, and on the modifications in competition dynamics (Narayanan et al., 2009), we defined four distinct approaches to venture building operated by CV advisory firms. For each of these approaches we focused on key aspects related to the resources, support services, and network necessary for venture building (Bergek and Norrman, 2008; Gutmann, 2019). As an instance, to build new ventures in unknown domains, the definition and monitoring of proper KPIs by CV advisory firms is critical. Similarly, to replicate new successful products for venture creation, CV advisory firms should both design (i.e., define MVPs) and maintain in operation (i.e., define co-ownership and participation models) a successful business model in new market conditions. Furthermore, leveraging the IP and/or technological assets of the corporate company to spinning-off a new venture entails the business-oriented evaluation of the corporation's assets by the CV advisory firm. Finally, to explore markets trend for venture building CV advisory firms rely on the market experience of a diffused network of heterogeneous actors for effectively spotting a vision for a new venture.

Venture builder building is the CV service allowing a corporate to have a venture builder for the development of new ventures from scratch. Similarly to investment models as corporate venture capital (Gutmann, 2019), venture builder building foresees an high financial involvement by the corporate. In addition to this, venture builder building entails a strong strategic dimension for the development of leadership unity within the corporate boundaries, hence overcoming a mere financial dimension in investments. This is evident in both the set-up and management of the venture builder, which involve the active participation of the corporate company.

5.1 Theoretical Implications

The paper presents two important implications for the CV and strategic agility literature.

First, the paper contributes to the strategic agility literature (Brand et al., 2021) with the understanding of how CV fosters strategic agility. Specifically, we linked four different types of CV services (i.e., venture clienting, venture acquisition, venture building, venture builder building) to the three main meta-capabilities of strategic agility (i.e., resource fluidity, strategic sensitivity, leadership unity). This responds to the recent request by Girod et al. (2023): "we have a good understanding of what business

agility is, but greater clarity on how businesses achieve it is necessary" (Girod et al., 2023, p. 9). We contribute to this by framing four main ways through which developing strategic agility via CV.

We found that venture clienting and venture acquisition nurture resource fluidity (Doz and Kosonen, 2010). Indeed, by allowing corporations to access innovative products and services from startups, they provide a swift and flexible means of reconfiguring a firm's competencies and resources. Specifically, while it is acknowledged that CV services allow to access to startups' disruptive technologies (Rossi et al., 2020a), we found that corporations can adopt venture clienting to assess the potential of startups before committing to a full merger or acquisition. This flexibility in the corporate-startup relationship enables corporations to test and adjust their resource allocation and competences as they see fit. Furthermore, as the "buy and build" approach of venture acquisition entails the purchase of a startup whose technology is used to build new products, resource fluidity is promoted by minimizing the risks associated with developing new products from scratch.

Additionally, we spot that venture building stimulates strategic sensitivity (Doz and Kosonen, 2008). This CV service involves the creation of new ventures within a corporate, enabling the organization to be acutely aware of emerging market trends and changes. This process promotes strategic sensitivity by fostering a culture of continuous market monitoring and anticipation of future technological developments.

Concluding, we note that venture builder building contributes to leadership unity (Doz and Kosonen, 2010) by creating a dedicated entity with the autonomy to rapidly make decisions. Moreover, the venture builder building service supports the development of leaders' long-term planning ability. For example, corporate leaders are stimulated in answering critical questions about the type of ventures the venture builder should promote, in identifying suitable personnel, and in operating new business models based on emerging technologies.

Second, the paper contributes to the CV literature (Narayanan et al., 2009) by framing the concept of CV advisory firm. This is a new type of CV service provider which offers both inside-out and outside-in services (Gutmann, 2019).

Venture clienting and venture acquisitions align with the outside-in model of integrating external innovations and technologies into corporations (Weiblen and Chesbrough, 2015). While the extant literature on this topic highlights how CV service providers sustain innovation through capital and expertise in ecosystems (Rossi et al., 2022), we find that venture clienting and venture acquisitions constitute a primary channel for corporate renewal (Feldman and Sakhartov, 2021). Indeed, these services allow to quickly access cutting-edge technologies and market knowledge, which are considered the basis for successful corporate renewal (Tidd and Bessant, 2020).

Venture building, focused on developing a new venture from the ground up, and venture builder building, entailing the creation of a venture builder, reflect an inside-out approach to CV (Weiblen and Chesbrough, 2015). Indeed, these services promote the development of new ventures by leveraging corporations' internal resources and entrepreneurial mindset. Specifically, venture building serves as a vehicle for corporate innovation, enabling firms to both explore uncharted markets and exploit internal resources (Weiblen and Chesbrough, 2015). Furthermore, venture builder building, by permitting companies to expand beyond their core operations and invest in multifield ventures, stimulates business diversification (Tidd and Bessant, 2020).

5.2 Managerial Implications

The manuscript holds significant managerial implications for both corporations seeking to cultivate strategic agility and CV advisory firms looking to establish themselves in the field.

For corporations, the paper highlights the value of forging partnerships with CV advisory firms in the pursuit of strategic agility. Corporations should meticulously assess their specific needs and constraints to choose from the four CV services, i.e., venture clienting, venture acquisition, venture building, and venture builder building, that best align with their objectives. This selection process should be driven by the overarching goal of augmenting the three critical meta-capabilities of strategic agility, namely resource fluidity, strategic sensitivity, and leadership unity. To further sustain managers in undertaking this decision, Table 3.7 provides a resume of advantages and disadvantages of each service, coherently with Zinn and Parasuraman (1997).

Table 3.7

Advantages and disadvantages of each type of CV service.

CV SERVICE	ADVANTAGE	DISADVANTAGE
Venture clienting	• First safe contact with the startup landscape, enabling corporations to engage with startups in a sandbox environment and without undergoing significant organizational changes or structural shifts	• Limited control over customizing startup technologies to meet specific requirements, potentially leading to misalignment with corporate needs
Venture acquisition	• Build new products and services on startups acquired with a safe, gradual approach	• Timing is crucial in venture acquisitions, as changing market conditions can affect the returns on investment
Venture building	• Venture building offers several flexible pathways, from new products to replicating successes, thus encountering diverse corporates' needs	• High reliance on external expertise and partners, reducing negotiation power and posing risks due to partner availability and alignment
Venture builder building	• Enhancement of corporates' innovation ecosystem and continuous innovation	• Long-term commitment and high risk of innovation overload can reduce the effective focus on all the fronts

For CV advisory firms, this research offers insights on the delivery of a comprehensive suite of "inside-out" and "outside-in" CV services. Furthermore, through the analysis of Gellify, CV advisory firms can understand two main principles useful to design their business models. First, CV advisory firms should cultivate a robust network of innovation brokers and refine their scouting processes to ensure they can connect corporate partners with startups that align with their strategic objectives. Second, CV advisory firms should focus on the holistic development of startup's and corporate's businesses, including addressing technological and business model gaps both in the startups and corporations.

5.3 Limitations and future research

It is essential to acknowledge four limitations in the study that could pave the way for future research.

First, the research is based on a single case study, predominantly focused on European and Middle East contexts. To enhance findings' generalizability, further investigations could delve into the Asian and American markets, which host successful CV players (GSSN, 2020).

Second, the qualitative nature of the study could be complemented by quantitative analysis (Papagiannidis et al., 2023), further examining and testing the relationships among CV and strategic agility. Indeed, by exploring a broader range of cases, a better understanding of the nuanced dynamics of CV and its impact on strategic agility can be achieved. For example, it could be examined how corporations from various industries and sizes engage in CV to achieve strategic agility.

Third, the study explores the four independent services performed by CV advisory firms to sustain strategic agility creation. As the concept of CV advisory firms is quite new and still not captured by the current CV literature (Gutmann, 2019), future studies can focus on a process model explaining the inner configuration and full business model of CV advisory firms to deliver these four services.

Forth, the paper conceptualised strategic agility as composed by the three main meta-capabilities of resource fluidity, strategic sensitivity, and leadership unity (Doz and Kosonen, 2008). However, also customer agility, partnering agility, and operational agility contributes to strategic agility (Sambamurthy et al., 2023). Hence, future studies can consider also these dimensions of strategic agility to enrich the current results.

Chapter 4

Paper D

Title	The Dark Side of Digital Innovation for Sustainable Development: Understanding the Paradoxical Tension of Artificial Intelligence
Coauthors	Messeni Petruzzelli, A., Panniello, U., & Vaia, G.
Type	Conceptual paper
Methodology	Theory building and illustrative examples
Link with the Research Questions of the thesis	What is the broader impact of the change?
Research Question(s)	RQ: "What is the dark side of digital innovation management when aiming for sustainable development?"
Theoretical contribution	Frame the paradoxical tension between creation and destruction of value when managing digital innovation to achieve sustainable development
Conference presentation(s)	EU-SPRI Early Career Conference | 30-31 August 2024, Polytechnic University of Bari (IT)
Journal	Technovation (AiIG: Gold; ABS: 3; JIF: 11.1)
Status	Submitted in 2024 in the Special Issue Call for Papers "Artificial Intelligence for the Sustainable Development Goals"

Abstract

This paper explores the "dark side" of digital innovation management for sustainable development, with a focus on artificial intelligence (AI). While most research has concentrated on the positive impacts of digital innovation, this study examines the paradoxical tension that arises between sustainable value creation and sustainable value destruction when managing AI innovation to achieve sustainable development. We conceptualize a model explaining the antecedents and the nature of this tension, and we discussed seven illustrative cases that exemplify the practical applicability of the model's elements. Our findings show that conflicting sub-objectives across environmental, social, and economic domains, along with the divergent interests of stakeholders, are key antecedents of the paradoxical tension. Furthermore, our model illustrates that sustainable value can be created by: (i) reducing grand challenges through automation in defining problems' root cause, and (ii) mitigating grand challenges through augmentation of firms' capabilities. However, we argue that sustainable value can be also destroyed when failing to address grand challenges or introducing new grand challenges. According to our study, this is due to predictable or unpredictable issues that arise during the design, development, or deployment of AI innovation. Finally, the discussion of our model further explores, through five theorical propositions, the specific elements of AI innovation that enable and amplify this paradoxical tension.

Keywords: dark side, digital technology innovation management, value creation and destruction, artificial intelligence, sustainable development, paradoxical tension

1. Introduction

Digital innovation management deals with the practices and processes for the effective orchestration of digital innovation[86] (Nambisan et al., 2017).

So far, most research on digital innovation management has focused on the so-called "bright side" of innovation (Appio et al., 2021; Del Giudice et al., 2023), that is how to create new value, manage processes, and diffuse applications to successfully implement a digital innovation (Haefner et al., 2021). In particular, scholars are recently studying how digital innovation management releases positive benefits for businesses, societies, and economies as a whole (Silvestre and Ţîrcă, 2019). According to these scholars, digital innovation management can promote sustainable development via innovations capable of navigating the so-called grand challenges (Popkova et al., 2022), that are complex problems affecting social, environmental, and economic well-being (Nambisan and George, 2024). For example, scholars studied how digital innovation management can facilitate the resolution of climate change (George et al., 2021), the tensions between global and local design imperatives (Nambisan and George, 2024), and the social disparities (Charness and Boot, 2022).

However, while the contemporary research has emphasized the "bright side" of digital innovation management for achieving sustainable development (Popkova et al., 2022), scholars are recently recognizing a "dark side" of digital innovation, that seizes the negative consequences and dysfunctional outcomes of digital innovation for sustainable development (Coad et al., 2021; Canhoto and Clear, 2020). Accordingly, more and more manuscripts investigate the logics of value destruction, i.e., the logics that reduce the perceived utility and wellbeing of digital innovation at business and non-business levels (Järvi et al., 2018; Canhoto and Clear, 2020). For example, scholars are wondering about pervasive connectivity and digital relationships problems (Yoo et al., 2012), ethical and psychosocial issues regarding digital environments (Mahmoud et al., 2020; Bamel et al., 2022), security concerns and governance modifications of digital networks (Mogaji and Nguyen, 2022).

Despite these attempts to frame the dark side of digital innovation for sustainable development, a comprehensive assessment of the value destruction logics that arise from digital innovation and hinder sustainable development seems neglected by academic production (Ardito, 2023).

To address this research issue, the present manuscript aims at structuring the dark side of digital innovation for sustainable development. To this aim, one of the most recent, articulate, and obscure example of application of digital innovation has been placed under scrutiny, i.e., artificial intelligence (AI) innovation.

We have chosen to investigate the obscure impacts of AI innovation on sustainable development because AI is distinguished as a general-purpose technology, meaning its applications have far-reaching consequences across both business and non-business domains (Messeni Petruzzelli et al., 2023). Its general-purpose application makes AI particularly interesting for economic development[87] and underscores how AI can influence a wide array of grand challenges posed by sustainable development[88]. Indeed, AI holds promise for addressing issues such as poverty, healthcare access, climate change, and more, thanks to its ability to analyze vast datasets, automate tasks, and make predictions (Bughin, 2018). However, the broad applicability of AI also introduces complexities and risks for sustainable development. Specifically, concerns on job displacement, ethical dilemmas in decision making, privacy infringements, and exacerbation of social inequalities (Keegan et al., 2023; Jarrahi, 2018) are emerging and need to be analyzed.

By integrating insights from different research streams, namely, digital innovation management, sustainable development, and value destruction, we advance a model of the dark side of AI innovation for sustainable development. This model highlights the presence of a paradoxical tension between the creation and destruction of sustainable value when managing AI innovation for achieving sustainable

development. Illustrative examples are used to exemplify the antecedents of the paradoxical tension as well as the nature of the paradoxical tension (Siggelkow, 2007).

Thanks to this in-depth analysis of the paradoxical tension deriving from AI innovation, the study contributes to the nascent research stream of dark side of AI innovation (Coad et al., 2021), which is set by innovation management scholars as an imperative for future research design (Anderson et al., 2014; Heidenreich et al., 2022). Moreover, the study helps to provide a more comprehensive picture of the relationship between AI innovation and sustainability. In particular, form a theorical point of view, we highlight the dark side of AI innovation for sustainable development, a topic which is still quite neglected (Ardito et al., 2023). Furthermore, from a managerial perspective, the paper provides useful insights regarding how organizations can solve the paradoxical tension and approach to bright and sustainability-oriented AI innovation.

The paper is structured as follows. Section 2 reviews the main literature on how digital innovation management, and, in particular, AI innovation management, creates and destroys sustainable value. Section 3 presents the conceptual model and the methodology through which the model has been framed. Finally, Section 4 discusses the model and traces the conclusions with implications for theory and practice.

2. Theoretical background

2.1 How digital innovation management creates and destroys sustainable value

Digital innovation management has been defined as the use of digital technologies during the innovation process with the aim of creating and capturing new value (Nambisan et al., 2017). In particular, digital technologies such as AI, big data, Internet of Things, and blockchain, are managed to drive new ways of doing business and solve complex problems, usually within organizations (Dougherty and Dunne, 2012). Typical organizational problems deal with improving operational efficiency, reducing time to market, and meeting customer expectations more effectively (Morgan, 2019). By contributing to solve these problems, proper digital innovation management can enhance firms' revenue by up to 70% (Lamarre et al., 2023) and potentially lead up to 66% increase in profits (KPMG, 2023).

Recently, the scope of digital innovation management has expanded beyond merely addressing organizational challenges to tackling more holistic issues that affect the environment and society as a whole (Nambisan and George, 2024). In this sense, digital innovation is now managed to approach the so-called grand challenges and nurture sustainable development (Popkova et al., 2022). Specifically, sustainable development is the practice of navigating environmental, social, and economic sustainability to promote long-term well-being and prosperity. This approach seeks indeed to address a wide range of grand challenges that threaten humanity's future, including climate change, resource scarcity, poverty, and inequality, among others (Azmat et al., 2023).

The recent literature has focused on exploring how digital innovation management can promote sustainable development (George et al., 2021) by leveraging the formulation and implementation of novel solutions that address grand challenges (Nambisan and George, 2024). For instance, machine learning algorithms are used to optimize energy consumption in smart grids (Rangel-Martinez et al., 2021), thus demonstrating how digital innovation management contributes to the so-called sustainable value creation. Sustainable value creation refers to the business processes and activities that generate economic, social, and environmental sustainability (Hart and Milstein, 2003). As such, there is growing interest in managing digital innovation to promote the efficient use of resources, reduce negative environmental impacts, and support social equity and inclusion (Ghobakhloo et al., 2021; Bähr and Fliaster, 2023; Ardito et al., 2023; Castro et al., 2021).

However, while on the one hand it is acknowledged the role of digital innovation management for pursuing sustainable development through sustainable value creation, on the other hand digital innovation *"can be a disruptive force which, if unintended, uncontrolled, or underestimated, may negatively affect sustainability and its development"* (Guandalini, 2022, p. 458). In fact, the impact of digital innovation management on sustainable development is not uniformly positive: *"Not all digitalization contributes to the creation of sustainable value"* as *"digital technologies are ambiguous in their impact"* on sustainability (Bohnsack et al., 2022, p. 599). This ambiguity arises from the rapidly evolving nature of digital technologies and the complexities of integrating them effectively within extant organizational structures (Mancuso et al., 2023). Indeed, for companies, effective digital innovation management encompasses more than just integrating digital technologies into their operations. It also entails continually adapting companies' business models to keep pace with ongoing technological advancements (Mancuso et al., 2023). This adaptive process can be challenging, as firms must stay ahead of the curve and navigate the potential unintended issues that may arise with technological progress, such as ethical dilemmas, cybersecurity vulnerabilities, and regulatory conflicts (He et al., 2020; Du and Xie, 2021). Moreover, the swift pace of technological progress can surpass companies' ability to anticipate and effectively mitigate the unintended consequences of digital innovation, such as the risks of data breaches, privacy infringements, discrimination in algorithm application, and dissemination of fake news. These consequences may hinder efforts to create sustainable value and may instead result in the destruction of sustainable value. Sustainable value destruction is the opposite process of sustainable value creation (Järvi et al., 2018), where activities and processes lead to long-term harm or degradation in economic, social, or environmental sustainability. Examples include overexploitation of natural resources, practices that widen social inequities, and short-term economic gains that compromise the long-term viability of communities.

Resuming, while the extant literature on digital innovation management for sustainable development is growing, it remains *"urgent to explore the relationship between digitalization and sustainable development"* (Sun et al., 2024; p. 1157). In particular, so far scholars have focused on defining the so-called bright side of digital innovation management for sustainable development. This includes the positive benefits of applying digital technologies to solve grand challenges (Bohnsack et al., 2022), thereby promoting the transition toward sustainable development via sustainable value creation (Ghobakhloo et al., 2021; Bähr and Fliaster, 2023; Ardito et al., 2023; Castro et al., 2021). However, it is recognized also a dark side of digital innovation management for sustainable development, which is currently underestimated (Järvi et al., 2018; Echeverri and Skålén, 2021). As a result, *"assessing whether digital technology creates or destroys sustainable value requires a more nuanced perspective"* (Bohnsack et al., 2022, p. 599). Thereby, framing the dark side of digital innovation management is essential to set preventive or corrective measures that may support sustainable development through conversion of destructed value into created value (Canhoto and Clear, 2020; Echeverri and Skålén, 2021).

Such type of considerations is particularly relevant for digital innovation based on the management of a rapidly evolving technology such as the case of AI solutions (Sun et al., 2024; Bohnsack et al., 2022).

Indeed, from a practical point of view, the general-purpose impact of AI can be far-reaching and unpredictable (Messeni Petruzzelli et al., 2023; Magistretti et al., 2019), affecting multiple aspects of environmental, social, and economic sustainability in numerous settings, from healthcare and education to transportation and commerce. Hence, the study of the dark side of AI innovation management for sustainable development can support policymakers who develop best practices for deploying a technology that influences billions of people globally.

Furthermore, from a theoretical perspective, the analysis of the dark side of AI innovation management for sustainable development is relevant since the extant studies examine the dark side of digital innovation management once the digital technology has already developed and the negative effects have occurred (Mahajan, 2019). Instead, few studies attempt to assess the dark side of an emergent digital technology, as in the case of AI solutions (Coad et al., 2021).

2.2 Artificial intelligence innovation management for sustainable development

AI can be defined as *"a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation"* (Haenlein and Kaplan, 2019; p.5).

AI is emerging as an outstanding digital technology which is gaining a growing interest from both academics and practitioners due to the potential impacts on process optimization, innovation in business practices, and reconfiguration of whole industries (Grewal et al., 2021; Paschen et al., 2020). Specifically, AI is a transformative technology unlike any other in history (Bughin, 2018) due to its ability to *"self-scale, self-learn, and self-propagate"* (Gupta et al., 2021, p. 3). Indeed, this allows AI to navigate highly complex environments, analyzing billions of data points, and perform tasks without human cognitive and physical constraints (Truong and Papagiannidis, 2022). AI's extensive capabilities allow it to be utilized across various industries, where it can automate and optimize processes, enhance existing activities, and even create entirely new business systems (Lanzolla et al., 2021). Consequently, AI is projected to significantly disrupt most traditional industries within the next five years, with around 90% of new enterprise applications anticipated to leverage AI innovation by 2025 (MIT Technology Review, 2024; Appio et al., 2021).

Furthermore, due to the general-purpose nature of AI (Magistretti et al., 2019), the management of AI innovative solutions may widely influence sustainable development. Specifically, the management of AI innovative solutions may simultaneously create and destroy value across the environmental, social, and economic spheres of sustainable development (Vinuesa et al., 2020).

From an environmental perspective, on the one hand, AI can for example optimize energy use in smart grids by regulating supply and demand in real-time, thus reducing carbon emissions and efficiently utilizing renewable energy sources. However, on the other hand, AI can also negatively impact the environment due to the high energy consumption required to power AI infrastructure, often sourced from non-renewable energy (Vinuesa et al., 2020; Nishant et al., 2020).

Socially, from a bright side perspective, AI can support sustainable development by enhancing efficiency in work processes and improving job quality through the automation of repetitive and hazardous tasks, freeing workers for more complex and creative roles. On the flip side, extensive automation may lead to technological unemployment, particularly among less-skilled workers, and contribute to disproportionate rewards for the educated (Vinuesa et al., 2020; Kopka and Grashof, 2022).

Economically, a paradox arises between "black-box AI" and "explainable AI" due to the lack of transparency in AI functioning. While black-box AI's workings are unclear, leading to trust issues, explainable AI is more transparent and trusted, but may be seen as less impactful in terms of performance compared to black-box AI (Grewal et al., 2021).

The examples presented above demonstrate that managing AI innovation to create sustainable value in one sphere of sustainable development (such as social, environmental, or economic) can also simultaneously produce negative effects in the same area. Additionally, there are cases where generating value in one sphere of sustainable development (e.g., environmental) can result in the destruction of value in another (e.g., social). For example, as Vinuesa et al. (2020) pointed out, AI can promote environmental sustainability in agriculture through precision farming, which allows real-time monitoring and analysis of soil, crop, and climate conditions. This enables farmers to optimize water, fertilizer, and pesticide use, reducing resource waste and environmental impact. Nevertheless, the adoption of advanced AI technologies in agriculture can impose high costs on farmers, especially small-

scale operations that may lack the financial means to invest in these technologies. This could lead to greater wealth and power concentration among larger agricultural firms, hence exacerbating economic and social inequalities in the sector. Moreover, precision farming could decrease the need for manual labor, putting agricultural workers' jobs at risk and negatively affecting the social aspect of sustainable development.

As a result of the complex influence of AI innovation management on sustainable development, managers are hesitating to adopt AI due to uncertainty about how these technologies can aid their businesses (Canhoto and Clear, 2020; Paschen et al., 2020) in achieving sustainable development. At the same time, academics have not yet thoroughly documented the mechanisms of sustainable value destruction arising from AI innovation management (Vinuesa et al., 2020; Gupta et al., 2021), which are *"poorly elaborated and more often than not, overlooked"* (Galaz et al., 2021, p. 2). As Grundner and Neuhofer (2021) recently noted, *"it is not enough to focus solely on the promising potential of AI. What is needed is a thorough discussion that provides a nuanced understanding of both the bright and dark sides of AI and explores how AI integration as a resource can co-create or co-destroy value"* (Grundner and Neuhofer, 2021, p. 2).

To answer this issue, in the following paragraph we present a conceptual framework on the dark side of AI innovation management. Specifically, we based our framework on theoretical underpinnings and validate it with illustrative examples (Siggelkow, 2007).

3. Research Methodology

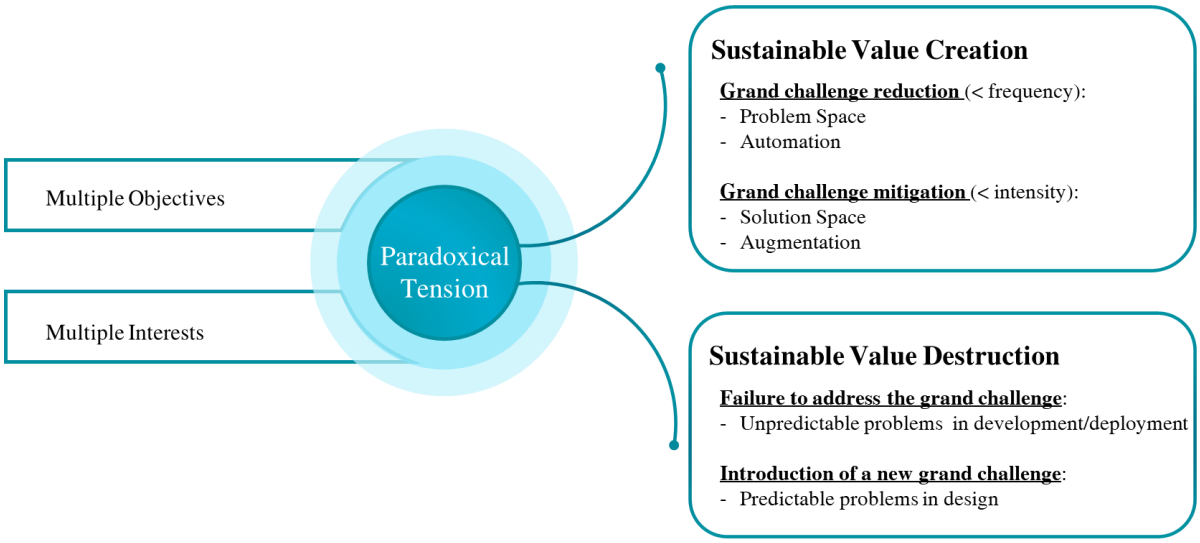
Conceptualizing the dark side of digital innovation management for sustainable development: towards a model of AI innovation management

The proposed model of AI innovation management for sustainable development (see Figure 4.1) centers on the paradoxical tension between the creation and destruction of sustainable value. Specifically, the model consists of two sections. The first section of the model (on the left) frames the antecedents of the paradoxical tension between sustainable value creation and destruction. These are: (i) the presence of multiple, conflicting sub-objectives in the environmental, social, and economic domains of sustainable development; and (ii) the presence of multiple and conflicting interests of the stakeholders involved in the achievement of sustainable development. Instead, the second section of the model (on the right) details the nature of the paradoxical tension, by illustrating how AI innovation can be managed both to create and destroy sustainable value.

On the one hand, AI innovation management fosters sustainable value creation through two primary approaches, i.e., grand challenge reduction and grand challenge mitigation. Grand challenge reduction focuses on decreasing the frequency of social, environmental, or economic issues by applying AI to the problem space in order to automate the identification of the problem's root causes. Differently, grand challenge mitigation aims at reducing the intensity of the aforementioned issues by applying AI to the solution space for generating new ideas or perspectives that improve processes.

On the other hand, AI innovation management can destroy sustainable value in two primary ways. First, it may fail to address the grand challenge due to unpredictable problems during the development or deployment of the AI innovation. Second, AI innovation can introduce a new grand challenge due to predictable problems in the design phase of the AI innovation.

Figure 4.1
Model of the dark side of AI innovation management for sustainable development



3.1 Illustrative examples of paradoxical tensions between the creation and destruction of sustainable value

We complement the theoretical development with illustrative examples of seven cases that have created and destroyed sustainable value when managing AI innovation for the achievement of sustainable development. We adopted a qualitative methodology as this proved to be useful for exploratory analyses in academic research, especially for studies on value creation/destruction (Mancuso et al., 2023).

We choose these seven cases precisely because they concretely represent the paradoxical tension between sustainable value creation and destruction when managing AI innovation to achieve sustainable development. First, the examples of Google and Clearview AI illustrate the antecedents of the paradoxical tension. Then, the examples of Nanox.AI and NotCo demonstrate how AI innovation can reduce and mitigate grand challenges, thus creating sustainable value. Finally, the cases of Cruise, AI Pin, and Gemini highlight how AI innovation management, although aimed at creating sustainable value, can also generate negative consequences, resulting in the failure to address grand challenges and the introduction of new grand challenges. These examples show how AI innovation management can also destroy sustainable value.

Thus, following the approach of previous research (Siggelkow, 2007; De Massis et al., 2016), we have selected these exceptional cases to better explore our research question. It should be noted that this methodological approach does not aim at inductive research (De Massis et al., 2016). Instead, after the theoretical framework has been presented, examples are reported with two aims (De Massis et al., 2016). On the one hand, they serve to better clarify theoretical concepts and connections of the framework, serving as an illustration. On the other hand, they are used to show a real application of the framework's elements, thus aligning theory and practice.

In gathering data for these illustrative cases, we adopted a rigorous and systematic approach, given the sensitive nature of the topic and the potential for speculation and uncertain outcomes (Siegel, 2023). Alongside to primary data from companies' websites (i.e., press release, business report) and social media (i.e., LinkedIn, YouTube), we prioritized sources that are scientifically grounded and widely recognized for their credibility. Specifically, we relied on peer-reviewed academic publications, official reports from reputable organizations (i.e., World Economic Forum, United Nations, Organization for

Economic Co-operation and Development, World Bank Group, World Resources Institute), and well-documented case studies published by leading industry analysts (i.e., McKinsey & Company, Gartner, Boston Consulting Group, International Data Corporation). Additionally, we triangulated these sources with primary data in the form of discussions with experts. Specifically, one of the author, as a president of a business incubator and open innovation hub, invited seven prominent experts between September 2023 and June 2024 to take speeches lasting one to two hours on AI and sustainable development. These experts were renewed professionals, entrepreneurs, and academics in AI domain and/or sustainable development domain. Each speech was conducted by the expert and discussion was promoted with the public, consisting in master and PhD students, researchers, and professionals. The insights from the events were used to refine the theorical framework as well as to list possible illustrative cases.

The data were analyzed through an iterative approach, cycling between data collection and theoretical development (Strauss and Corbin, 1998). In this way, the clarity of the theoretical framework was enhanced, and a practical application of the constructs was demonstrated. To maintain the reliability of our findings, we cross-referenced various data sources, conducted independent reviews of the data, and performed internal discussion to align our interpretations (Strauss and Corbin, 1998).

Below, Table 4.1 offers an overview of the seven cases featured in this study, while a complete description of the model's blocks, with reference to both theory and practice, is provided in the following paragraphs.

Table 4.1
Illustrative cases

	Google	**Clearview AI**	**Nanox.AI**	**NotCo**	**Cruise**	**AI Pin**	**Gemini**
Start of AI strategy	Early 2000s	2017	2020	2015	2013	2023	2023
Sector	Technology	Facial Recognition	Healthcare, Medical Imaging	Food Technology	Autonomous Vehicles	Wearable Technology	AI Language Models
Company outline	Google is a global technology leader that integrates AI across its services, including search, advertising, and cloud services. Notably, Google's DeepMind and AI-driven products, such as Gemini, represent significant AI initiatives.	Clearview AI is a facial recognition company that developed an AI-based system to match faces with images scraped from the web, primarily used by law enforcement.	Nanox.AI uses AI for medical imaging, aiming to make advanced diagnostic tools more accessible globally. The company's AI algorithms analyze medical images to assist in early disease detection.	NotCo is a food tech company using AI to create plant-based food alternatives. Their AI platform, Giuseppe, analyzes food compositions to develop sustainable and vegan products that mimic traditional animal-based foods.	Cruise is an autonomous vehicle company backed by General Motors. It is focused on developing and deploying self-driving cars.	AI Pin is a wearable AI device developed by the company Humane aimed at enhancing personal connectivity and reducing reliance on screens.	Gemini is an AI-driven language model developed by Google DeepMind. It aims to advance the capabilities of generative AI.
Focus of the analysis	ANTECEDENT OF PARADOXICAL TENSION Multiple Objectives: Environmental emission reduction vs.	ANTECEDENT OF PARADOXICAL TENSION Multiple Interests: Economic interests of Clearview AI	SUSTAINABLE VALUE CREATION Grand challenge reduction: - Action on problem space: early	SUSTAINABLE VALUE CREATION Grand challenge mitigation: - Action on solution space:	SUSTAINABLE VALUE DESTRUCTION Failure to address the grand challenge: Unpredictable	SUSTAINABLE VALUE DESTRUCTION Failure to address the grand challenge: Unpredictable	SUSTAINABLE VALUE DESTRUCTION Introduction of a new grand challenge: Predictable

	technological advancements	vs. safety objectives of police departments vs. social objectives of individuals involuntarily included in the algorithm's database	detection of signs of medical disease - AI managed to do automation: pattern recognition in medical imaging data	creation of new molecular structure for plant-based food - AI managed to do augmentation : improvement of firm's capability in creating plant-based food	problems in the development of AI innovation: technical shortcomings (unexpected stops in traffic, interference with other vehicles and pedestrians)	problems in the deployment of AI innovation: difficult interaction between artificial technologies and human intelligence (long learning curve)	problems in the design of AI innovation: biased dataset employed for training AI algorithms

Antecedents of the paradoxical tension between sustainable value creation and destruction

A paradoxical tension highlights the persistent contradiction that arises when managing interdependent elements in a system characterized by multiple and often conflicting objectives (Smith and Lewis, 2011). Scholars of paradoxical tensions have focused their studies on the tensions that plague organizations when dealing with stability and change, control and flexibility, and short-term performance and long-term sustainability (Hahn and Knight, 2021).

In this study, we propose that organizations face a particular paradoxical tension between the creation and destruction of value when aiming for sustainable development. Indeed, sustainable development is a concept defined neither by fixed goals nor by specific means of achieving them (Hjorth and Bagheri, 2006). This complexity in defining sustainable development generates paradoxical tensions when organizations attempt to achieve it. Specifically, two main antecedents of the paradoxical tension between sustainable value creation and destruction have been retrieved. These are: (i) the coexistence of multiple and conflicting objectives in the pursuit of sustainable development; and (ii) the need to balance conflicting interests of multiple stakeholders involved in achieving sustainable development.

First, the macro-objective of sustainable development encompasses several desirable yet conflicting sub-objectives in the economic, environmental, and social domains, which cannot be pursued simultaneously (Hahn et al., 2018). For example, industrial expansion with AI can create economic value but may destroy environmental value. As a result, a paradoxical tension between the creation and destruction of sustainable value arises when balancing conflicting objectives, such as economic growth and environmental conservation (Hahn and Knight, 2021). Furthermore, there is no single privileged perspective that dictates which sustainable development sub-objective should take precedence when conflicts arise (Hjorth and Bagheri, 2006). This lack of a clear priority makes it challenging to achieve a balanced approach to sustainable development, as efforts to create value in one domain may inadvertently destroy value in another.

As an example of this, we illustrate the case of Google. In pursuing the environmental objective of reaching net-zero carbon emissions by 2030, Google developed the AI algorithm AlphaGo. This algorithm allowed Google to achieve a 40% reduction in data centers' energy consumption, thanks to recommendation on the most efficient cooling infrastructure configurations (Tech Wire Asia, 2020). However, Google's environmental objective stands in tension with the company's economic objective to lead AI research and development for producing new products. Indeed, the substantial electricity required by data centers and the carbon footprint associated with manufacturing and transporting the servers and chips essential for AI operations have led to a 48% increase in Google's greenhouse gas emissions over the past five years (The Guardian, 2024). As a result, the company experienced difficulties in balancing the two conflicting objectives in environmental and economic domains, as declared in the 2024 Environmental Report: *"Reaching net-zero emissions by 2030 is an extremely*

ambitious goal and we know it won't be easy […] As we further integrate AI into our products, reducing emissions may be challenging due to increasing energy demands from the greater intensity of AI compute, and the emissions associated with the expected increases in our technical infrastructure investment […] We know that scaling AI and using it to accelerate climate action is just as crucial as addressing the environmental impact associated with it" (Google, 2024).

Second, the achievement of sustainable development is characterized by a high degree of ambiguity and uncertainty. This ambiguity and uncertainty arise because achieving sustainable development is a complex goal involving a wide range of stakeholders (e.g., governments, organizations, non-governmental organizations, local communities) with different perspectives and interests (Hahn and Knight, 2021). Consequently, the need to manage and integrate the visions and efforts of these stakeholders generates tensions between the creation and destruction of sustainable value, because an action deemed necessary or a priority by one stakeholder may harm the interests of another (Shu, 2022). Moreover, as stakeholders navigate their conflicting priorities, it becomes increasingly difficult to predict how their actions will impact the overall creation and/or destruction of sustainable value (Hjorth and Bagheri, 2006).

An illustrative example of the tensions between different stakeholders when managing AI innovation for sustainable development is the case of the startup Clearview AI. Clearview AI developed a highly sophisticated facial recognition and search software using a vast database of images scraped from the internet, particularly from the social media sites Facebook, Instagram, LinkedIn, and Venmo. Aimed at the sustainable development goal of reducing violence and crime, various police departments around the world employed Clearview AI's algorithm to identify individuals involved in criminal activities, with some positive results in solving cases (Forbes, 2023). However, the economic interests of Clearview AI and the social objectives of police departments clashed with the privacy concerns of individuals involuntarily included in the algorithm's database. For example, the American Civil Liberties Union sued Clearview AI for violating privacy rights by using images without consent, raising concerns about mass surveillance, while some governments investigated and banned the software over these privacy issues (Hill, 2023). As a result, attempts were made to balance the conflicting interests of multiple stakeholders, leading to an agreement that allows individuals to monetize their privacy, enabling them to claim a share of 23% of Clearview AI's profits (New York Times, 2024).

To summarize, two antecedents generate a paradoxical tension between value creation and destruction to achieve sustainable development. These antecedents are: (i) the presence of conflicting, multiple objectives in the environmental, social, and economic domains when striving for sustainable development; and (ii) the presence of multiple actors with interests and priorities to be balanced in achieving sustainable development.

In the following section, the nature of the paradoxical tension between sustainable value creation and destruction is explored. Specifically, we illustrate how AI innovation management enables, on the one hand, sustainable value creation, and, on the other hand, sustainable value destruction.

Sustainable value creation via AI innovation management

Sustainable value creation through AI innovation management consists in addressing the grand challenges that limit the achievement of sustainable development.

Specifically, AI innovation management enables sustainable value creation in two main ways, namely grand challenge reduction and grand challenge mitigation (Cowls et al., 2021; Cowls et al., 2023).

Grand challenge reduction aims at decreasing the frequency of a social, environmental or economic problem, but does not necessarily make it less harmful or dangerous (Cowls et al., 2021). To achieve grand challenge reduction, organizations act on the problem space and manage AI innovation to drive

business automation (Canhoto and Clear, 2020). Specifically, AI is employed to improve the problem definition by means of superior data analysis capabilities (Haefner et al., 2021). Indeed, through collection and processing of information, AI can more effectively and efficiently recognize the root cause behind the grand challenge (Lanzolla et al., 2021; Di Vaio et al., 2020). In this sense, problem definition is automated, and the organization is provided with predictions or recommendations on which to build a solution for the problem.

A prominent example of managing AI to reduce a grand challenge via automating problem definition is Nanox.AI. Nanox.AI developed an advanced AI algorithm for the detection and diagnosis of various diseases (Nanox, 2024). Sustainable value is created by making early and accurate diagnosis more accessible, thus allowing for global access to high-quality diagnostic tools (Bloomberg, 2024). To this aim, AI innovation is managed to automate the detection and diagnosis process. Specifically, Nanox.AI's algorithm quickly analyzes medical imaging data such as X-rays and computerized tomography scans, identifies subtle patterns in imaging data, and detects early signs of critical illnesses such as lung cancer and cardiovascular diseases. Eventually, the AI algorithm provides automated diagnostic insights that can guide medical treatment decisions (YouTube, 2024).

Grand challenge mitigation focuses on decreasing the severity or intensity of the social, environmental, or economic problem, specifically to make it less dangerous or harmful (Cowls et al., 2021). To achieve grand challenge mitigation, organizations act on the solution space and manage AI innovation to augment their existing capabilities. Specifically, AI is employed to respond the problem by generating new ideas or introducing a novel perspective for process improvement (Haefner et al., 2021).

As an example of grand challenge mitigation, we report the case of NotCo (World Economic Forum, n.a.). NotCo is a Chilean food-tech company that leverages an AI-driven platform named "Giuseppe" to develop plant-based alternatives to animal products (Boston Consulting Group, 2024). Giuseppe uses machine learning algorithms to analyze the molecular structure of thousands of plant-based ingredients, identifying combinations that mimic the taste, texture, and nutritional profile of animal-derived foods (Time, 2024). The NotCo's augmented capabilities thanks to AI innovation allow for the iteration and optimization of plant-based recipes, leading to the creation of products such as NotMilk, NotBurger, and NotMayo, which closely resemble their traditional counterparts. By managing AI innovation to augment firm's capabilities for problem solving, NotCo creates sustainable value. Indeed, the company reduces the environmental impact of livestock farming, while also challenging conventional unsustainable food production practices with novel food alternatives (Corporate Knights, 2024).

In brief, sustainable value creation via AI innovation management is possible by: (i) reducing a grand challenge (i.e., AI managed to do automation and act on problem space); and (ii) mitigating a grand challenge (i.e., AI managed to do augmentation and act on solution space).

Sustainable value destruction via AI innovation management

Sustainable value destruction through AI innovation management occurs when companies adopt AI to solve a grand challenge, but efforts to solve a social, environmental or economic problem create new problems (Cowls et al., 2021). Indeed, organizations may introduce new issues while attempting to solve an existing ones, thus turning sustainable value creation into sustainable value destruction (Bohnsack et al., 2022).

Specifically, AI innovation management may cause sustainable value destruction in two main ways. First, there is the failure in addressing the grand challenge due to unpredictable problems arising in the development or deployment of the AI innovation. Second, there is the introduction of a new grand challenge due to predictable problems arising in the design of the AI innovation.

The failure in addressing the grand challenge can occur when the AI solutions implemented to address

the original problem inadvertently create additional, complex problems (Chatterjee et al., 2023). This is due to inability of the stakeholders involved in the achievement of sustainable development to foresee the consequences connected to the resolution of the grand challenge. In particular, unforeseen consequences may manifest in the development of the AI innovation and in the deployment of the AI innovation (Konidena et al., 2024).

The unpredictable challenges in the development of the AI innovation refers to the problems associated with the building of a designed AI solution (Konidena et al., 2024). An illustrative example of this situation is Cruise, a self-driving car company owned by General Motors. Cruise was aimed at deploying autonomous robotaxis that could address the grand challenge of creating a safer, more efficient, and environmentally friendly urban transportation system that does not rely on human drivers (CNBC, 2022). However, in its attempt to solve these significant challenges, Cruise inadvertently introduced new problems due to technical shortcomings in the development of the products. In particular, while Cruise aimed to enhance road safety by eliminating human drivers, the autonomous vehicles struggled in complex urban environments, leading to unexpected stops in traffic, interference with public services (e.g., firefighters, police officers and other emergency medical personnel), and collisions with other vehicles and pedestrians (Los Angeles Times, 2023). As a result, the company suspended its operations.

The unpredictable challenges in the deployment of the AI innovation refers to the problems associated with the use of an AI solution (Konidena et al., 2024). A peculiar case illustrating this situation is the one of the Humane's AI Pin. Humane is an organization focused on creating innovative human-centric technology. The company developed a product named AI Pin, which was aimed to replace traditional smartphones and wearable devices by offering a more intuitive, screenless interface. Specifically, AI Pin used AI to assist users in various tasks, such as communication, navigation, and accessing information, all through voice commands and gestures (CNBC Television, 2023). The grand challenge Humane's AI Pin sought to solve was reducing the dependency on screens, thereby promoting a more natural interaction with technology. However, the deployment of the AI Pin unintentionally introduced a new challenge on the interaction between artificial technologies and human intelligence. Indeed, users found it difficult to adapt to a new interface that diverged so drastically from the familiar smartphone or wearable device experiences (Fast Company, 2024). As a result, the challenge in the learning curve and the limited functionality in comparison to established devices became a major obstacle, complicating the original goal of creating a more human-centered technological experience.

The introduction of a new grand challenge while attempting to solve an existing one occurs when the stakeholders involved in the resolution of the grand challenge deliberately embrace new issues. These new issues arise in the design phase of the AI innovation (Konidena et al., 2024) and can be predictable, but they are embraced as they are considered a part of a broader strategy to address the original grand challenge. Usually, these predictable issues regard the minting and/or processing of raw materials in ethically questionable ways (Thomas et al., 2023), that can lead to corrupted final outcome due to biased input data (Cowls et al., 2023).

This is evident in the case of Gemini, i.e., the Google's generative AI chatbot based on the large language model. With the aim to promote diversity and inclusion, Gemini's image generation tool was designed to reflect a global user base. Indeed, usually, one of the most predictable issue in managing AI innovation is the training of AI systems on data with partial temporal coverage or geographical spread. Such type of training could influence and bias the results, for example by excluding data from more disadvantaged stakeholders from the AI system (Galaz et al., 2021). However, to solve the diversity gap, Gemini produced images of colored people and women in historically inaccurate contexts (e.g., Vikings, Nazi soldiers, and the Founding Fathers), and refused prompts to generate images of white people (The Verge, 2024). Therefore, while attempting to create images that more accurately reflected global diversity, Gemini incurred in biases in the representation, with historically inaccurate outputs. Such a problem was predictable, as it is reported to be quite deeply embedded both in the training data and overlying algorithms of current AI solutions (BBC, 2024).

Summarizing, sustainable value destruction via AI innovation management occurs with: (i) failure to address the grand challenge (i.e., unpredictable problems arise in the development or deployment of AI innovation); and (ii) introduction of a new grand challenge (i.e., predictable problems arise in the design of AI innovation).

4. Discussions and Conclusions

This paper responds to the call for research on the implications of digital and AI innovation management for sustainable development (Sun et al., 2024). Specifically, the paper describes the paradoxical tension between sustainable value creation and destruction in AI innovation management for sustainable development through a conceptual framework and illustrative examples. The model highlights the antecedents of the paradoxical tension and the nature of the paradoxical tension between sustainable value creation and destruction.

In this section, we discuss the results of our study and propose five propositions that highlight the novelty of our contribution.

Two primary antecedents of the paradoxical tension have been retrieved in our study. The first antecedent is the co-existence of multiple sub-objectives in social, economic, and environmental domains, which equally but conflictingly contribute to the achievement of sustainable development (Hahn and Knight, 2021). The second antecedent is the presence of multiple stakeholders who experience conflicting interests and priorities when acting for the achievement of sustainable development (Hahn and Knight, 2021). The extant studies on sustainable development have emphasized that businesses face trade-offs among the triple bottom line objectives (Walker et al., 2020), as well as that stakeholders' conflicting interests complicate decision-making in the realm of sustainability (Bahadorestani et al., 2020). Our research constitutes a novel contribution to these studies by formalizing and investigating these antecedents in the specific context of AI innovation management for the achievement of sustainable development. Our theorization suggests that AI innovation management intensifies the tension between creating and destroying sustainable value. Specifically, we propose that the generativity and flexibility of AI allow the stakeholders involved in the achievement of sustainable development to more effectively manage their objectives and interests. However, while AI's generativity and flexibility facilitate the achievement of different objectives and interests, these objectives and interests can be extremely conflicting in the context of sustainable development achievement (Hahn and Knight, 2021). As a result, AI's ability to make both competing objectives and opposing stakeholders' interests more attainable intensifies the tension between value creation and destruction. Specifically, generativity refers to the ability of digital technologies to be used in ways not anticipated by their original creators (Yoo et al., 2012). This characteristic is evident in AI systems like Google's AlphaGo that are designed to learn from data inputs for developing capabilities beyond their initial programming (Haenlein and Kaplan, 2019). By being generative, AI innovation solutions like Google's one create new, diverse ways to address multiple environmental, social, and economic goals that may conflict with each other (Thomas and Tee, 2022; Margherita and Braccini, 2023). Specifically, in the case of Google, the AI algorithm AlphaGo represented a breakthrough in the processing of vast amounts of data for the development of complex outputs beyond human programming, thus aligning with the broader Google's goal of enhancing AI application across its offering. At the same time, while driving technological innovation and economic goals, the development of the algorithm requires significant computational power and resources, with heavy environmental consequences due to high energy consumption and carbon emissions from data centers. To balance these two conflicting objectives Google employed the AlphaGo algorithm for the optimization of resource usage. Therefore, the case of AlphaGo exemplifies how AI's generativity can serve both innovation and environmental goals, but also underscores the need to balance these often conflicting objectives in order to avoid exacerbating tensions between value creation and destruction. Flexibility refers to the ability of digital

technologies to be adapted and customized to meet specific needs (Yoo et al., 2012). As a general-purpose technology, AI exhibits flexibility (Messeni Petruzzelli et al., 2023), as evident in the case of Clearview AI. Indeed, in this case, the same AI algorithm for facial recognition was reconfigured to analyze different types of data from different input sources, without the need for entirely new systems to be developed from scratch. Hence, the flexibility typical of digital solutions like the one of Clearview AI can be helpful to effortlessly meet the specific needs of a portion of stakeholders involved in the achievement of sustainable development, such as police departments in Clearview AI's case. However, this ease in responding to the priorities of some stakeholders can make it equally easier for conflicts to arise between different stakeholders. This happened in the case of Clearview, where the easy application of the facial recognition algorithm by police departments created conflicts with the privacy needs of individuals. Therefore, it is important to align the different stakeholders' interests to avoid contrasts. Based on these considerations, we propose the following propositions.

P1: AI innovation's generativity exacerbates the paradoxical tension between the creation and destruction of sustainable value by means of multiple, often conflicting solutions, for achieving the environmental, social, and economic sub-objectives of sustainable development.

P2: AI innovation's flexibility exacerbates the paradoxical tension between the creation and destruction of sustainable value by generating solutions that effortlessly meet the needs of stakeholders with conflicting interests.

Our study revealed two primary ways to create sustainable value through AI innovation management, namely grand challenge reduction and grand challenge mitigation. Grand challenge reduction creates sustainable value by decreasing the frequency of a social, environmental or economic problem (George et al., 2016). Grand challenge mitigation creates sustainable value by making the social, environmental or economic problem less dangerous (George et al., 2016). While the previous research on sustainable development focused on the obstacles to reduce or mitigate grand challenges (Dorado et al., 2022; Chatterjee et al., 2023), we propose a new perspective in the realm of AI innovation. We postulate that these two primary ways of creating sustainable value can be achieved by improving and expanding the current understanding of the grand challenge through AI innovation management (Cowls et al., 2023). Improving the current understanding of a grand challenge consists of refining the framing of an established environmental, social or economic problem thanks to AI innovation management (Bergek et al., 2013). The organization uses AI innovation to improve the problem's definition by working on the problem with its existing knowledge and competencies (Paschen et al., 2020). This was evident in the case of Nanox.AI, where the insights from the AI were used to enhance the preliminary identification of humans' diseases, thus improving the current understanding of the problem. Expanding the current understanding of a grand challenge means challenging an organization's existing knowledge about the social, environmental or economic problem through AI innovation (Bergek et al., 2013). In this sense, the organization goes outside its existing knowledge base about the problem and challenges its competences in search of new ways of understanding the problem through AI innovation (Paschen et al., 2020). This is the case by NotCo, where the company leveraged new competences in the synthetic food manufacturing to answer to the grand challenge of unstainable food production methods. Therefore, managing AI innovation to improve or expand the understanding of grand challenges can lead to the reduction or mitigation of grand challenges, and, therefore, to sustainable value creation. The following two propositions resume this finding.

P3: Improving the understanding of a grand challenge through AI innovation management enables organizations to enhance their ability to reduce the frequency of social, environmental, or economic problems.

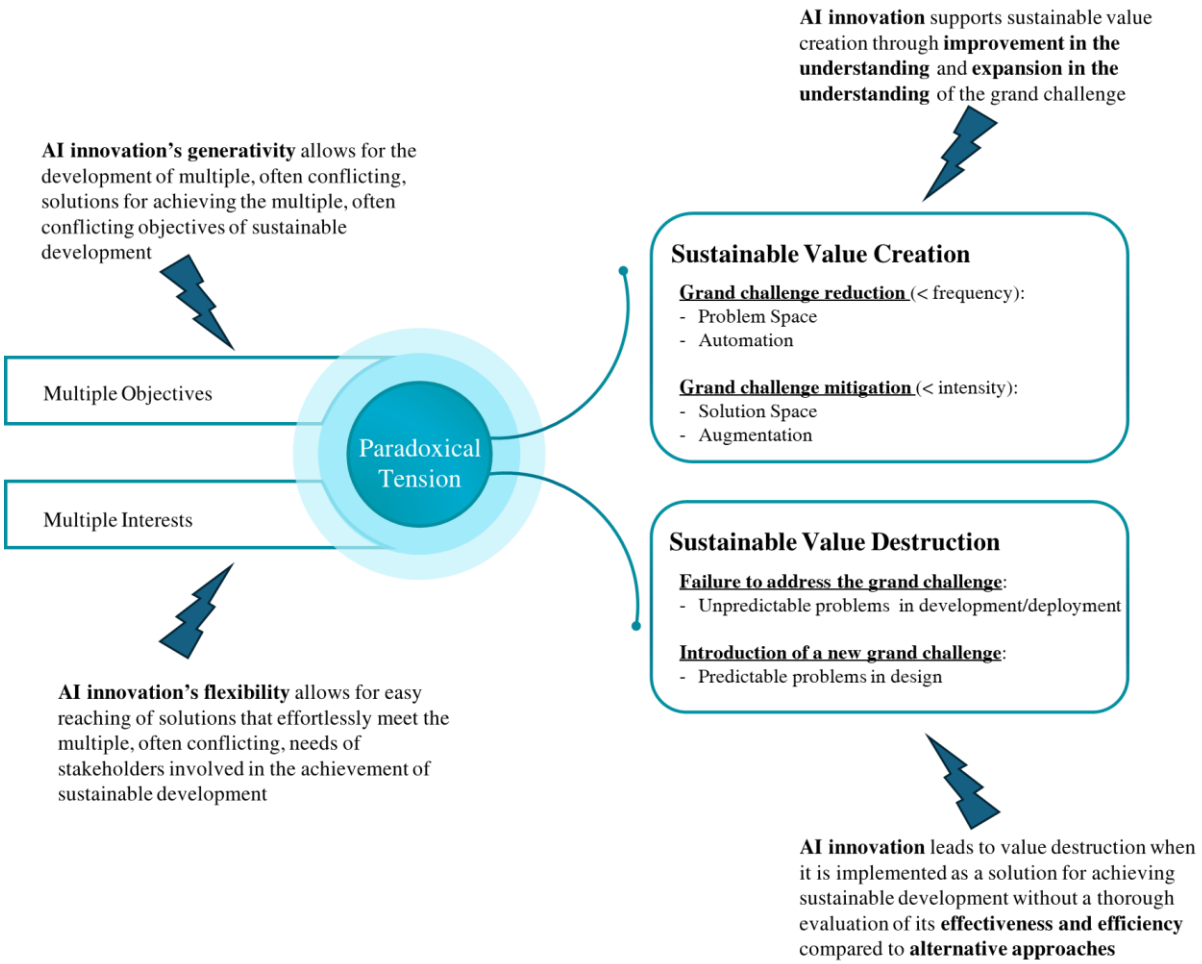
P4: Expanding the understanding of a grand challenge through AI innovation management allows organizations to challenge their existing knowledge usable for mitigating the harmful effects of social, environmental, or economic problems.

According to our results, sustainable value destruction via AI innovation management can occur in two main ways, namely the failure to address a grand challenge and the introduction of a new grand challenge. The failure to address a grand challenge derives from actions that inadvertently create unforeseen problems (Chatterjee et al., 2023). The introduction of a new grand challenge derives from the deliberate embracement of predictable issues during the coping strategy with the grand challenge (Thomas et al., 2023; Cowls et al., 2023). While the extant studies on sustainable development discuss in general terms about sustainable value destruction (Järvi et al., 2018), we focus on how such destruction is influenced by AI innovation management. Specifically, one of the main conclusion of our study is that AI innovation does not always enable sustainable development. Indeed, there are many circumstances in which AI innovation is not the most effective way to address a particular social, environmental or economic problem because there are alternative approaches that are less expensive or more effective (Cowls et al., 2021). This is the case of Humane's AI Pin, which aimed to reduce screen dependency but offered a clunky, ineffective AI interface. Non-digital solutions, such as promoting digital detox habits, would have been more effective in addressing the issue. We resume this concept in the following proposition.

P5: Non-digital approaches may be more effective or cost-efficient in solving social, environmental, or economic problems as compared to solutions deriving from AI innovation.

Based on the aforementioned considerations, Figure 4.2 illustrates the specific elements of AI innovation that feed the tension between sustainable value creation and destruction.

Figure 4.2
Model of the dark side of AI innovation management for sustainable development: Focus on how AI feed the paradoxical tension between sustainable creation and destruction.



4.1 Theoretical Implications

The paper brings multifold implications for scholars interested in sustainable development and AI innovation management.

The first important implication arising from our study is that AI innovation management can simultaneously create and destroy sustainable value. Specifically, we found that the creation of sustainable value consists in grand challenge reduction and mitigation, while the destruction of sustainable value consists in the failure to address a grand challenge and in the introduction of a new grand challenge. With these findings, our study underscores the need to consider the net effect of AI innovation management on sustainable development. This effect has not been fully acknowledged by the previous literature that focused on the linkage between innovation management and sustainable development (e.g., Azmat et al., 2023). Indeed, as digital technologies have a more generative and unforeseen influence on businesses and society than physical technologies (Bohnsack et al., 2022), the previous findings exploring innovation management's impacts on sustainable development cannot be directly applied or generalized to digital contexts (Ardito, 2023). Therefore, our paper contributes to the literature stream that is interested in acknowledging the comprehensive influence of AI innovation management on sustainable development (Popkova et al., 2022; Coad et al., 2021).

The second key implication from our study refers to the paradox theory (Smith and Lewis, 2011). While the paradoxical lens has been increasingly applied to sustainability issues, it remains a lack of empirical research on how the paradoxical tension actually emerges and whether it leads to the creation or destruction of sustainable value (Shu, 2022). Furthermore, the extant studies tried to frame the phenomenon of sustainable value destruction through qualitative methodologies involving interviews

(Engen et al., 2021) and thematic analyses (Camilleri and Neuhofer, 2017), or quantitative methodologies based on surveys (Hsu et al., 2021). We contribute to these streams of work with a conceptual model, based in the theory and corroborated by empirical illustrative examples, that explains the antecedents and the nature of the paradoxical tension between sustainable value creation and destruction. In this way, we contribute to the extant studies that apply the paradox theory to sustainability dimension with new theoretical insights and a new methodological approach.

The third interesting implication arising from our study is targeted towards the AI literature (Haefner et al., 2021). In particular, we framed the sources of sustainable value creation and destruction arising from AI innovation management. As for sustainable value creation, we explored how AI innovation can lead to new ways of defining problems (acting on the problem space through automation) and new ways of addressing the problem (acting on the solution space through augmentation). With this result, we contribute to the nascent debate on the use of AI innovation for automating or augmenting human tasks (Raisch and Krakowski, 2021). At this regard, our analysis revealed that AI innovation can drive business automation to act on the problem space (Canhoto and Clear, 2020). In this case, AI innovation improves the way the problem is defined due to its advanced data analysis capabilities that allow for a superior and automatic recognition of problems' root causes (Haefner et al., 2021; Lanzolla et al., 2021). Furthermore, AI innovation can be used to enhance or complement existing human activities. In this case, AI innovation acts on the solution space and augments humans' capabilities to respond to a problem through predictions or recommendations (Haefner et al., 2021; Lanzolla et al., 2021).

4.2 Managerial Implications

This work presents two key implications for practitioners willing to manage AI innovation for the achievement of sustainable development.

First, our study provides valuable guidance to a wide range of stakeholders in planning activities related to the management of AI innovation for sustainable development. We encourage practitioners to recognize that, while AI innovation offers powerful solutions for tackling grand challenges, it can also fall short or even introduce new issues. This insight underscores the importance of fostering a "paradoxical framing" mindset (Shu, 2022), where managers acknowledge and embrace the contradictory tensions inherent in managing AI innovation. Notably, AI's inherent flexibility and generativity allow it to be adapted to various sub-objectives and stakeholders' interests, but these same qualities also pose risks for value destruction. Thus, we recommend that all stakeholders engaged in sustainable development (e.g., organizations, governments) carefully assess, in advance, which sub-objectives to prioritize and how to align diverse interests in pursuit of sustainability goals.

Second, our study provides valuable insights for the operational management of AI innovation in achieving sustainable development. Specifically, we emphasize the importance of anticipating potential challenges that may arise during the design, development, and deployment of AI innovation, as both predictable and unpredictable issues in these phases can lead to the destruction of sustainable value. We also offer guidance on how AI can be harnessed to create sustainable value. On one hand, AI can automate problem definition, potentially leading to the reduction of grand challenges. To achieve this, organizations can leverage their existing knowledge and competencies to improve the precision of problem identification. On the other hand, AI can enhance an organization's ability to find solutions to complex challenges. In this case, organizations need to expand their knowledge base and skills to fully utilize AI's potential in problem-solving.

Concluding, a global survey of MIT Technology Review Insights revealed that while most leaders are optimistic about AI's potential and expected to widen its usage, currently only 9% of them are significantly using AI (MIT Technology Review, 2024). Indeed, due to the paradoxical tension that

characterizes AI innovation management for the achievement of sustainable development, managers tend to delay their decisions or not to make a decision at all (Shu, 2022). We are confident that our work can be employed by organizations that are willing to use AI but need some practical suggestions on how to plan and operationalize the use of this technology for the achievement of sustainable development.

4.3 Limitations and Future Research

Our study is affected by two important limitations that can open for new research avenues.

First, from a research setting perspective, future studies can complement, enrich, or test our model through multiple case studies or qualitative analyses. In particular, future research could employ longitudinal studies to explore the long-term impacts of AI innovation management on sustainable development.

Second, from a conceptual point of view, new studies can deepen the sustainable development dimension, with a specific focus on environmental, social, and economic goals. In this perspective, the investigation of sustainable development under the lenses of Sustainable Development Goals can be useful to investigate whether our result present peculiarities with regard to the specific environmental, social, or economic goals (Castro et al., 2021; Vinuesa et al., 2020). Moreover, while we focused on the antecedents and the nature of the paradoxical tension in managing AI innovation for sustainable development, the consequences of the creation and destruction of sustainable value can be examined. Furthermore, the positive and negative effects of creating, capturing, and destroying value can be defined on multiple levels to take into account the whole set of stakeholders involved in the achievement of sustainable development. Hence, future research can be conducted at the micro (individual), meso (organizational), and macro (societal) levels, as recommended by previous studies (Bohnsack et al., 2022; Thomas et al., 2023).

Conclusions

In today's innovation economy, businesses operate in complex and volatile environments characterized by high risk and uncertainty. Innovating under conditions of risk involves managing *"known unknowns"* throughout the innovation process. Under these conditions, innovation outcomes are unclear due to potential factors such as financial losses, market rejection, or operational failures, but they remain somewhat predictable within probabilistic boundaries (Teece et al., 2016). Conversely, innovating under conditions of uncertainty entails navigating *"unknown unknowns"*, as potential threats and opportunities for innovation are not fully identifiable (Ehrig and Foss, 2022), making it impossible to reliably gauge the likelihood of success or failure (Teece et al., 2016).

While firms commonly encounter risk and uncertainty in innovation, recent studies note a pronounced increase in these challenges when companies engage in digital innovation. As digital innovation entails incorporating digital technologies into products, services, processes, or business models (Hund et al., 2021), it significantly differs from traditional forms of innovation seen in previous economic periods (Teece et al., 2016). Unlike traditional innovations, often characterized by gradual changes, digital innovation introduces rapid shifts, compelling firms to adopt strategies that can adapt quickly to new realities. Additionally, digital technologies create intricate interdependencies between firms and their environments, which were previously absent. Given that digital innovation processes are faster, more scalable, and ecosystem-driven compared to traditional, non-digital innovation processes, digital innovation brings a higher degree of risk and uncertainty (Felicetti et al., 2024). This increased risk heightens the dangers of *"value missing"*, where firms fail to achieve their innovation goals (Bocken et al., 2015), and *"value slippage"*, where firms cannot capitalize effectively on their innovation efforts (Cova and Paranque, 2016).

Despite the criticality in navigating digital innovation, existing research has focused predominantly on optimizing the implementation of digital innovation strategies (Satwekar et al., 2024), while the formulation of such strategies under high-risk and high-uncertainty conditions remains an understudied area within strategy and innovation management literatures (Park and Mithas, 2020).

Against this backdrop, the primary objective of this doctoral dissertation is to advance both theoretical understanding and practical insights into how firms can formulate effective digital innovation strategies in high-risk and high-uncertainty environments, transforming unforeseen contingencies into drivers of new value creation. To address the ambitious question, *"How can firms formulate digital innovation strategies in high-risk and high-uncertainty environments?"*, the dissertation is structured around four distinct papers (i.e., Paper A, Paper B, Paper C, and Paper D). Each paper addresses the key questions that firms must consider when facing changes that introduce risk or uncertainty into their digital innovation processes (Yin et al., 2024): *"What is the change?"*, *"What is the value of the change?"*, *"How will the change come about?"*, and *"What is the broader impact of the change?"*.

The resume of this doctoral thesis is provided within the *"Management Research Canvas"*, proposed by Dorobantu et al. (2024) in the prestigious Academy of Management Journal. The canvas summarizes the nine core elements of impactful empirical management research projects. These elements include an interesting puzzle motivating the research, a well-defined academic audience and positioning in prior research, a clear research question driving the study, a well-articulated set of theoretical constructs and relationships connecting them, an appropriate choice of an empirical research setting, a rigorous research design, rich and robust empirical findings, a novel and important contribution to management discipline, and well-specified boundary conditions and limitations.

1. The puzzle

The goal of a research project is to provide insightful and novel explanations for its focal puzzle, thereby advancing the frontier of knowledge in management discipline. As a result, the puzzle is the driving force behind a research project (Dorobantu et al., 2024). The puzzle of this doctoral thesis centers on uncovering how companies can strategically navigate high-risks and high-uncertainties conditions specific to digital innovation. These conditions challenge conventional approaches yet offer potentially transformative avenues for competitive advantage. In particular, the puzzle of this doctoral thesis emerges from the significant and underexplored challenges firms face in formulating rather than executing digital innovation strategies within high-risk and high-uncertainty environments (Satwekar et al., 2024; Park and Mithas, 2020). This gap is particularly pressing as traditional tools addressing risk and uncertainty (e.g., scenario planning, environmental scanning) and traditional innovation frameworks do not fully address the unpredictability and speed of digital innovations (Soto-Acosta, 2024). Moreover, as digital technologies heighten risk and uncertainty, firms lack structured approaches for anticipating and turning unexpected contingencies into opportunities, often leading to *"value missing"* or *"value slippage"* during strategy formulation (Bocken et al., 2015; Cova and Paranque, 2016). Therefore, the puzzle of the doctoral thesis is *"How can firms formulate digital innovation strategies in high-risk and high-uncertainty environments?"*.

2. The audience and prior research

A key task in the conceptualization and description of a research project is to understand which audience should find the research interesting and relevant (Dorobantu et al., 2024). The primary audience for this doctoral thesis includes scholars and practitioners in the fields of strategic management, innovation management, and digital transformation. Specifically, the thesis addresses scholars studying the dynamics of risk and uncertainty in innovation processes, as well as digital strategy formulation under volatile and complex environmental conditions (Slagmulder and Devoldere, 2018; Teece et al., 2016).To this aim, the work builds on prior research in several interconnected areas. First, it draws on foundational studies distinguishing risk and uncertainty in innovation (Teece et al., 2016; Williams et al., 2021), which establish the distinct strategic challenges firms face when innovating in unpredictable contexts. While existing research in strategic management has provided insights into traditional innovation risk management and the execution of digital strategies (Mero and Haapio, 2022; Ehrig and Foss, 2022), the unique formulation phase remains theoretically and practically elusive in digital contexts marked by rapid technological shifts, market volatility, and complex stakeholder ecosystems (Slagmulder and Devoldere, 2018; Park and Mithas, 2020). Accordingly, the second stream of research that has been leveraged is the digital innovation literature that examines how the increased complexity and speed of digital innovation create unique risk and uncertainty challenges (Chen and Tian, 2022; Hund et al., 2021) calling for new approaches to strategy formulation in environments with unprecedented levels of ambiguity (Soto-Acosta, 2024; Park and Mithas, 2020).

3. The research question

Broad theoretical or phenomenological puzzles in management research typically require multiple papers to address different facets of the overarching inquiry. Each of these papers provides a partial, often complementary answer to the core puzzle, building on specific, clearly defined research questions that address different dimensions of the problem (Dorobantu et al., 2024). This doctoral thesis explores its central puzzle through four distinct papers, each driven by a research question that directly aligns with the main puzzle, as suggested by Yin et al. (2024). Additionally, each paper further refines the core question to address specific aspects of the puzzle.

Paper A addresses the questions *"What is the change?"* and *"What is the value of the change?"* taking into account a change unveiling a high-uncertainty condition with the research inquiry *"How have digital technologies enabled food retailers to innovate their business model's value creation and capture mechanisms in response to the Covid-19 crisis?"*

Paper B continues to explore *"What is the change?"* and *"What is the value of the change?"* when the change entails a high-risk condition. Specifically, two research questions were addressed in Paper B: *"How do firms build and integrate capabilities to develop a digital business in the metaverse?"* and *"What strategic factors should leaders consider when developing a digital business in the metaverse?"*.

Paper C investigates *"How will the change come about?"* by exploring *"How do corporate venturing (CV) advisory firms support the development of strategic agility in corporations?"* with sub-questions on *"How do CV firms nurture corporates' resource flexibility, strategic sensitivity, and leadership unity?"*.

Paper D addresses *"What is the broader impact of the change?"* with the specific research question *"What are the potential downsides of digital innovation management in the pursuit of sustainable development?"*.

Together, these four papers offer a multi-faceted response to the core puzzle of the thesis by examining the specific mechanisms, impacts, and broader consequences of formulating digital innovation strategies in high-risk and high-uncertainty environments.

4. Theoretical constructs and relationships

Answering a research question involves three key steps: (1) defining theoretical constructs, i.e., *what* needs to be explained and *what* explains it; (2) specifying the relationships between these theoretical constructs, i.e., *how* the theoretical constructs are related to each other; and (3) explaining what drives these relationships, i.e., *why* the theoretical constructs are related in the way the authors suggest (Dorobantu et al., 2024). Each of the four papers in this doctoral thesis follows the structured approach of defining theoretical constructs, specifying relationships between these constructs, and explaining the drivers of these relationships. Paper A explores how digital technologies, value creation mechanisms, and value capture mechanisms interrelate to support business model innovation during crises, particularly within food retail amid Covid-19. Digital technologies enable rapid, flexible adaptations in business models, allowing firms to address shifting consumer needs and operational challenges, thus enhancing response to the high-uncertainty environment produced by the crisis (Kraus et al., 2020). Paper B focuses on digital business development within the metaverse, examining how specific capabilities connected with digital innovation (i.e., capabilities aimed at managing digital assets and capabilities aimed at managing organizational factors) are crucial for responding to the high risk posed by the metaverse environment. The relationship between the building and integration of such capabilities and strategic success is driven by organizational change and innovation ecosystems (Weick and Quinn, 1999; Zahra and Nambisan, 2011). Paper C addresses how to proactively face high-risk and high-uncertainty environments via creation of strategic agility. Specifically, the paper relates the theoretical construct of strategic agility, decomposed into the three meta-capabilities of resource flexibility, strategic sensitivity, and leadership unity (Doz and Kosonen, 2010), to the theoretical concept of corporate venturing. This relationship is driven by the complex needs of modern businesses to be agile, as they must adapt quickly to emerging market trends and technological disruptions (Brand et al., 2021; Gutmann, 2019). In Paper D, the thesis addresses the dark side of digital innovation management in relation to sustainable development, specifically examining how digital innovation can lead to both sustainable value creation and sustainable value destruction (Hart and Milstein, 2003; Järvi et al., 2018). This relationship is driven by a paradox that emerges when managing digital innovation to achieve sustainable development (Bohnsack et al., 2022).

5. Research setting

High-quality research projects clearly explain to the audience why the setting is appropriate for answering the research question, why readers should trust the insights obtained from studying the setting, and whether (and why) these insights can generalize beyond the research setting itself (Dorobantu et al., 2024). Each paper in this doctoral thesis employs a carefully chosen setting to address its specific research questions, leveraging the unique characteristics of the setting to ensure reliable and generalizable insights. In Paper A, the setting is the food retail industry during the Covid-19 pandemic. This environment provides a natural laboratory to examine how digital technologies transform business models in response to crisis conditions, making it particularly suitable for understanding the mechanisms of value creation and capture under extreme uncertainty. Indeed, the pandemic-driven disruptions exposed weaknesses and spurred innovation in the food retail sector, providing a robust context to investigate rapid, technology-driven adaptation strategies (Abbu et al., 2021). In Paper B, the research explores firms developing digital businesses in high-risk environments by analyzing the metaverse as a setting. The metaverse is an immersive and shared virtual world composed by virtual assets, services, and users that presents novel application while building on established digital technologies (Belk et al., 2022). Therefore, the metaverse represented a perfect setting to understand the formulation of a digital strategy under a risk condition (Kumar et al., 2023). Paper C leverages the corporate venturing advisory as a setting to understand how to proactively approach to the formulation of digital strategy. This setting is appropriate because corporate venturing advisory firms play a pivotal role in helping corporations adapt to rapidly changing markets, especially in digital context. Indeed, given the complexities inherent in digital innovation strategies within risky or uncertain contexts, corporations can greatly benefit from collaborating with specialized advisors that can sustain the creation of strategic agility (Patel and Chan, 2023). In Paper D, the thesis investigates digital innovation management with an emphasis on its impact on sustainable development. The setting here involves various industries engaged in digital innovation to sustain the theoretically-developed framework. This diverse industry setting was chosen to better grasp the paradoxical tension between sustainable value creation and sustainable value destruction when managing artificial intelligence innovation to achieve sustainable development.

6. Research design and analysis

The research design and analysis refer to the decisions about data collection, coding, analysis, and interpretation (Dorobantu et al., 2024). The four studies in this doctoral thesis use a variety of methodological approaches to capture the complexities of risk and uncertainty in digital innovation. Paper A, Paper B, and Paper C employ qualitative methods, using single or multiple case studies to explore how companies approach digital strategy formulation as a reactive or proactive measure to high-risk and high-uncertainty conditions (Yin, 2014). In addition, Paper D uses a conceptual approach, developing a theoretical framework for understanding the complexities of the impacts of digital strategy formulation in high-risk and high-uncertainty environments (Fisher et al., 2023). Together, the mix of empirical and conceptual methods enhances the research's theoretical and practical depth, addressing gaps noted in prior studies. Indeed, while quantitative methods dominate the study of risk and uncertainty in innovation, they fail to capture the deeper meanings and understandings of formulating digital innovation strategies in high-risk and high-uncertainty environments, as opposed to qualitative methodologies (Williams et al., 2021).

7. Empirical findings

Findings are the empirical patterns observed in the research papers (Dorobantu et al., 2024). Paper A finds three phases that highlight how Walmart and Carrefour digitally transformed value creation and capture during the Covid-19 crisis (i.e., *"The marriage between physical and digital"*; *"The power of digital to expand customer portfolio"*; *"The new life of physical stores"*). In the first phase, the focus of digital innovation is to optimize and enhance platforms and applications enabling safe and effective shopping both online and in-store. The second phase involves a more comprehensive development of solutions that enhance physical and virtual shopping experiences, aiming to build customer loyalty and attract new user segments. Finally, the third phase emphasizes strategic, long-term initiatives to transform physical locations into hubs that can seamlessly support both digital and in-store purchasing needs. Paper B finds that organizational change was leveraged by Gucci, Nike, Hyundai, and Samsung to build and integrate capabilities aimed at managing digital assets and organizational factors by defining new roles, establishing new internal divisions or research and development hubs, and increasing trademark and patent filing. Furthermore, the paper also finds that the four companies leveraged innovation ecosystems to build and integrate capability via partnerships with market leaders as well as partnerships and acquisitions of startups. Paper C finds what corporate venturing services, promoted by the corporate venturing advisor Gellify, have low, medium, or high impacts on the firms and contribute to the development of resource fluidity, strategic sensitivity, and leadership unity. These corporate venturing services are venture clienting, venture acquisition, venture building, and venture builder building. Paper D, being a conceptual paper, does not present empirical findings.

8. Contributions

The contributions of a research project are about how empirical findings advance the theoretical understanding of the puzzle in a nontrivial, non-incremental, and nonobvious way (Dorobantu et al., 2024).

The findings of this doctoral thesis have significant implications for preparing organizations to navigate high-risks and high-uncertainties in digital strategy formulation. Below, there is an overview of the primary theoretical and practical implications of the dissertation, which are resumed in Figure 2.

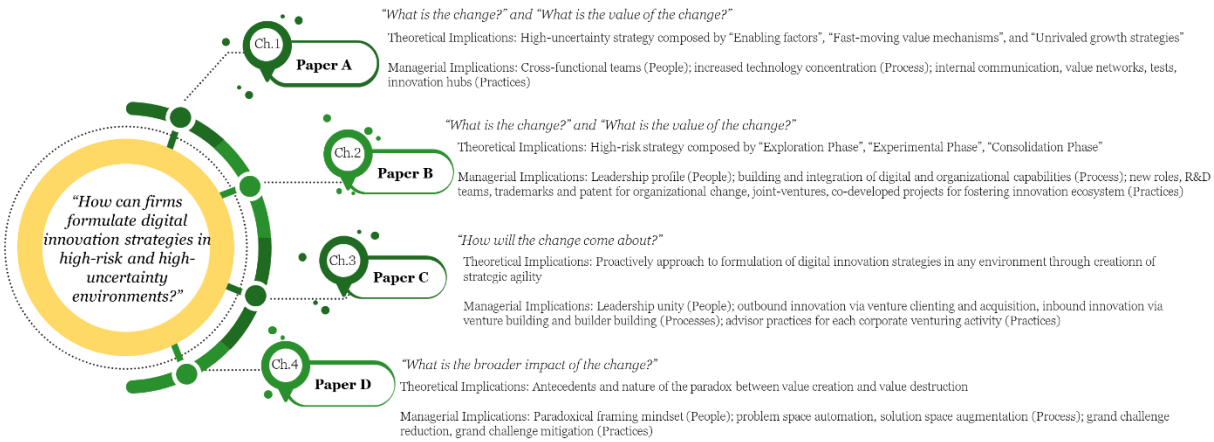


Figure 2 - Theoretical and Managerial Implications

From a theoretical perspective, the thesis clarifies how to operate in high-risk and high-uncertain environments, focusing on the formulation of digital innovation strategies (Teece et al., 2016; Statista, 2024). Moreover, the results represent the first attempt to extend within a business environment the

arguments made by Yin et al. (2024), who explored the responses of individuals to changing conditions.

The thesis begins by defining what does it means to digitally innovate under conditions of high uncertainty (Paper A) and high risk (Paper B). These two papers contribute to clear up the confusion in the strategy literature that conflates risk with uncertainty, failing to identify specific coping strategies for these two different scenarios (Williams et al., 2021).

Paper A investigates the unprecedented uncertainty brought by the Covid-19 crisis and examines its implications for digital strategy formulation. The paper proposes a two-stage model for formulating digital innovation in high-uncertainty environments. This model includes three main components, namely, *"Enabling factors"*, *"Fast-moving value mechanisms"*, and *"Unrivaled growth strategies"*. The first component, *"Enabling Factors"*, underscores the importance of internal team expertise, a collaborative network of partners who pool skills and resources for value creation, and mergers and acquisitions as critical elements for facilitating fast responses and unlocking long-term opportunities (Kähkönen, 2012; Zafari et al., 2020). Moving into the second component, *"Fast-moving value mechanisms"*, the model identifies four ways to digitally innovate during a crisis, namely process efficiency, portfolio enhancement, customer engagement, and new monetization strategies. Process efficiency improvements are digital-first responses, such as upgrading digital platforms to optimize online purchasing (Parida, 2019; Vaska, 2021). Portfolio enhancement, involving the expansion of digital services, enables firms to offer value-added customer experiences (Cenamor et al., 2017). Enhanced customer engagement took on a human-centered approach, placing both customer and employee experience at the forefront of digital innovation strategies (MacDonald et al., 2020). Finally, new monetization strategies allow companies to rapidly adapt to market demands and generate new income streams via platform-based subscription models and B2B or B2C marketplaces (Sorri et al., 2019; Mancha and Gordon, 2021). Following fast-moving value mechanisms modifications, *"Unrivaled growth strategies"* fostered long-term digital innovation by catalyzing radical business changes and exploring future growth opportunities. Radical transformations allow companies to reimagine their business models entirely, driven by digital tools that reshape customer interaction and value capture mechanisms (Sjödin et al., 2020; Linz et al., 2017). This study contributes to digital innovation literature in three main ways. First, it highlights how digital innovation enhances value creation and capture during crises, enabling rapid shifts in process efficiency (Parida et al., 2019), portfolio enrichment (Vaska et al., 2021), and new monetization methods (Sorri et al., 2019). The study further highlights how crises foster innovative, risk-oriented behaviors, accelerating the shift to digital strategies with a human-centered approach that emerged prominently during the Covid-19 pandemic (MacDonald et al., 2020; Fazio and Kuehnle, 2020). Second, the paper found that digital innovation supports both immediate crisis response and long-term growth opportunities, reaffirming findings by Archibugi et al. (2013) and Saebi et al. (2017) on the dual role of crisis-driven innovation, thus helping firms adapt and diversify (Linz et al., 2017; Osiyevskyy and Dewald, 2018; Verhoeven and Johnson, 2017; Fasnacht, 2020). Finally, this paper suggests a three-step business model innovation process composed by optimization, transformation, and new BM development (Rachinger et al., 2019) and asses how crises accelerate and merge these phases, thus intensifying innovation (Fasnacht, 2020; Gkeredakis et al., 2021).

Paper B explores strategic approaches to digital innovation in high-risk digital environments by focusing on how to build and integrate capabilities for managing both digital assets and organizational factors. The paper illustrates how companies unlock the metaverse's transformative potential through a three-step digital innovation strategy formulation process composed by the *"Exploration Phase"*, the *"Experimentation Phase"*, and the *"Consolidation Phase"*. This phased approach aligns with established frameworks for dynamic capability development, such as Teece's (2017) model of sensing, seizing, and transforming opportunities, and extends it to the challenges of building a digital innovation strategy. In the *"Exploration phase"* of the digital innovation strategy, firms collaborate with established digital leaders to access advanced technology and specialized expertise (Hatami et al.,

2023), while also tap into established networks to overcome initial market entry barriers (Kshetri, 2022). This phase provides a foundational understanding of the opportunities and risks in digital ecosystems, particularly valuable in markets that are still developing and characterized by evolving consumer demand and technical challenges. The second stage, *"Experimentation phase"*, is critical for firms seeking to build a competitive edge through active development and testing of new technologies. Collaborations with digital incumbents or established technology firms are useful at this stage, as they facilitate access to advanced technologies (Hurmelinna-Laukkanen and Nätti, 2018). In the final *"Consolidation phase"* firms shift toward acquisitions or collaborations with smaller, innovation-focused digital companies to rapidly expand their capabilities, secure market presence, and engage in serial innovation (Gupta, 2022). This study offers theoretical insights into the strategic steps companies can adopt for metaverse integration, expanding on Teece's (2017) framework for dynamic capability development by proposing three distinct phases: exploration, experimentation, and consolidation. First, partnerships with metaverse leaders provide firms with access to key technologies and market channels, which lowers entry barriers and opens opportunities to test the market (Kshetri, 2022; Li, 2020). This exploration phase allows companies to leverage leaders' expertise, especially under uncertain conditions (Hatami et al., 2023). Next, in the experimentation phase, collaborations with digital incumbents enable firms to co-develop cutting-edge technologies like augmented reality, which fosters sustainable competitive advantage through commitment and innovation sharing (Hurmelinna-Laukkanen and Nätti, 2018). Finally, in the consolidation phase, acquiring or partnering with metaverse startups allows firms to achieve immediate gains in market visibility and agility while enabling ongoing innovations that maximize returns (Brahambhatt, 2022). Through these phases, companies progress from initial market entry to solidifying a metaverse presence, highlighting a practical approach to capitalizing on metaverse opportunities (Teece et al., 2017).

After proposing within Paper A and Paper B how to reactively cope with high-uncertainty and high-risk in digital strategy formulation, **Paper C** identifies how organizations can proactively approach to digital innovation in high-risk and high-uncertainty contexts by fostering strategic agility. This aligns with the discussion presented by Mero and Haapio (2021), who argue that developing proactive strategies is essential for survival in such environments. Specifically, Paper C illustrates how to cultivate each strategic agility's meta-capability (i.e., resource fluidity, strategic sensitivity, and leadership unity) (Doz and Kosonen, 2010) through four specific corporate venturing activities with different impacts on firms' structures, assets, and resources. This approach addresses the recent call for clarity on how firms develop strategic agility to manage digital risks and uncertainties (Girod et al., 2023), offering a structured pathway for formulating a proactive digital strategy. The first strategic agility's meta-capability, i.e., *resource fluidity*, is promoted through venture clienting and venture acquisition. Venture clienting involves engaging with startups as clients, allowing companies to acquire and integrate innovative solutions without fully committing to acquisition, thus maintaining agility in resource allocation with a low impact on the firm's structure, resources, and assts. This enables firms to test new technologies or products and quickly reconfigure resources as market demands shift (Doz and Kosonen, 2010). Similarly, venture acquisition, that is acquiring startups to incorporate their competencies and resources, enhances resource fluidity with a medium impact on firm's structure, assets, and resources, thanks to the rapid access to new capabilities and technologies (Rossi et al., 2020a). The second, strategic agility's meta-capability, i.e., *strategic sensitivity*, is heightened through venture building. By establishing new ventures internally, firms cultivate a culture of awareness, focusing on continuous market monitoring and swift response to technological advancements (Doz and Kosonen, 2008). Finally, *leadership unity* is bolstered through the venture builder building approach, where firms establish autonomous entities dedicated to creating new digital ventures. This structure empowers leadership to make rapid decisions and facilitates alignment on long-term goals. Indeed, as venture builders operate independently to explore and scale digital solutions aligned with the firm's strategic objectives, they promote cohesive, agile leadership capable of effectively managing digital ventures within a high-risk and high-uncertainty environments (Doz and Kosonen, 2010). This study contributes

to corporate venturing and strategic agility literatures by revealing how corporate venturing enhances strategic agility, addressing recent calls for clarity on the mechanisms that enable strategic agility (Girod et al., 2023). First, the paper links four corporate venturing services, i.e., venture clienting, venture acquisition, venture building, and venture builder building, with strategic agility's key meta-capabilities: resource fluidity, strategic sensitivity, and leadership unity (Brand et al., 2021). Venture clienting and venture acquisition foster resource fluidity by enabling corporations to access external innovations and assess startups' potential before commitment, providing flexible resource reconfiguration options (Doz and Kosonen, 2010; Rossi et al., 2020a). Additionally, venture building supports strategic sensitivity by establishing internal ventures focused on market trends and technological shifts, promoting continuous awareness (Doz and Kosonen, 2008). Meanwhile, venture builder building contributes to leadership unity, granting leaders the autonomy for rapid decision-making and long-term planning (Doz and Kosonen, 2010). Second, this study expands the corporate venturing literature by conceptualizing the "corporate venturing advisory firm", a service provider that integrates both outside-in and inside-out corporate venturing models (Gutmann, 2019). Venture clienting and venture acquisition, following an outside-in model, allow firms to rapidly incorporate external innovations, fostering corporate renewal (Weiblen and Chesbrough, 2015; Feldman and Sakhartov, 2021). Conversely, venture building and venture builder building, reflecting an inside-out approach, leverage a corporation's internal resources and entrepreneurial capacities to support new ventures and business diversification (Weiblen and Chesbrough, 2015; Tidd and Bessant, 2020). Through these insights, the study highlights corporate venturing as a pathway for corporations to drive strategic agility.

Finally, recognizing that the literature on strategy and innovation management has *"traditionally focused on protection against downside risks while paying little attention to strategic opportunities or upsides"* (Slagmulder and Devoldere, 2018, p. 735), **Paper D** explores the broader impacts of digital innovation under conditions of high risk and uncertainty. It provides insights on how to conduct careful ex-ante planning regarding the overall impacts that risk or uncertainty conditions can impose on digital innovation activities. This ex-ante planning encompasses both the positive influences, such as the opportunities that risk or uncertainty can present, and the negative influences, including threats to the digital innovation process (Drnevich and West, 2023). Specifically, Paper D offers a comprehensive framework for understanding how conditions of risk or uncertainty can lead to both simultaneous and paradoxical effects on value creation and value destruction within firms. The concept of paradoxical tension underscores the inherent contradictions that emerge when attempting to achieve multiple, often conflicting objectives simultaneously (Smith and Lewis, 2011). The paper delineates the antecedents and nature of the paradoxical tension between value creation and destruction when managing digital innovation to achieve sustainable development. While the extant studies on sustainable development have emphasized trade-offs among objectives or stakeholders' interests (Walker et al., 2020; Bahadorestani et al., 2020), Paper D uniquely contributes to these streams by formalizing paradoxical tensions in the specific context of digital innovation management for the achievement of sustainable development. The antecedents of paradoxical tension are (1) the coexistence of multiple, conflicting objectives across economic, environmental, and social domains, and (2) the diverse and often contradictory priorities of stakeholders involved in sustainable development. The first antecedent, the coexistence of conflicting objectives, arises because sustainable development encompasses numerous goals that, while desirable individually, cannot all be pursued simultaneously without trade-offs (Hahn et al., 2018). As digital innovation' generativity enables applications beyond their original intent it can facilitate solutions to meet specific sub-goals but may inadvertently counteracts others (Yoo et al., 2012; Hjorth and Bagheri, 2006). The second antecedent, stakeholders' interests, is marked by the need to address the diverse and often conflicting priorities among stakeholders, such as organizations, governments, NGOs, and communities, each with unique perspectives on sustainable development. Digital innovation's flexibility allows customization to meet specific stakeholder demands, also heightening paradoxical tensions, as solutions tailored to one stakeholder group's priorities may

inadvertently create or exacerbate challenges for others (Hahn and Knight, 2021; Yoo et al., 2012). Paper D also posits the nature of the paradoxical tension between value creation and capture when managing digital innovation. Specifically, the creation of value consists of two primary processes (Cowls et al., 2021): (1) grand challenge reduction, which involves decreasing the frequency of social, environmental, or economic problems, and (2) grand challenge mitigation, which aims to reduce the severity or intensity of these challenges. Digital innovation plays a critical role in these value creation processes. For grand challenge reduction, digital technologies enhance organizations' abilities to define and understand problems more effectively. This improved problem definition enables firms to target root causes with greater precision, allowing for more effective solutions (Haefner et al., 2021). In terms of grand challenge mitigation, digital innovation facilitates the introduction of novel ideas and solutions, providing organizations with enhanced capabilities to respond to existing challenges (Cowls et al., 2021). Value destruction can occur when digital innovations implemented to solve a particular problem may inadvertently introduce new complexities or fail to resolve the original issue entirely (Cowls et al., 2021). The failure to address a grand challenge can happen due to unforeseen consequences during the development or deployment phases of digital solutions, leading to outcomes that counteract intended benefits (Chatterjee et al., 2023). The introduction of new grand challenges can happen when organizations intentionally or unintentionally embrace new issues during the design of digital innovations (Thomas et al., 2023). Thus, while digital innovation can drive significant value creation by addressing and mitigating grand challenges, it also poses inherent risks that must be carefully managed to prevent unintended consequences that lead to value destruction. It is evident that non-digital methods may at times prove more effective or cost-efficient in resolving social, environmental, or economic challenges (Cowls et al., 2021).

From a practical standpoint, the thesis explicitly highlights how to address high-risk and high-uncertainty conditions across three primary dimensions that guide the formulation of digital innovation strategies: processes, people, and practices (Slagmulder and Devoldere, 2018). While existing studies have predominantly focused on the people aspects (e.g., startup motivation, human reasoning) related to digital innovation in high-risk and uncertain contexts (Williams et al., 2021; Yin et al., 2024), this thesis enhances the practical insights. In particular, it provides a practical set of considerations on the people, processes, and practices that should be considered when answering to the four critical questions that drive the formulation of digital innovation strategies in high-risk and high-uncertainty environments (i.e., *"What is the change?"*, *"What is the value of the change?"*, *"How will the change come about?"*, and *"What is the broader impact of the change?"*).

"What is the change?"* and *"What is the value of the change?"

The first question addressed through Paper A and Paper B involves understanding the nature of the change that can generate high risk or high uncertainty in the formulation of a digital innovation strategy.

Paper A frames the most important aspects connected with the people, processes, and practices that sustain the formulation of a digital strategy in highly uncertain conditions.

- People: Cross-functional teams with expertise in technology, innovation, and crisis management are essential for coordinating responses to unpredictable market shifts and executing digital strategies swiftly.
- Processes: To digitally innovate value creation and capture mechanisms in high-risk environments initially firms should respond to the immediate uncertain effects of a change by focusing on short-term innovations that incorporate both established and emerging technologies. As time progresses and companies move beyond the uncertainty peak, they should pivot toward transformative digital strategies, leveraging cutting-edge technologies to enable sustainable, long-term growth.
- Practices: Key practices to formulate digital innovation strategies under conditions of high

uncertainty include developing enabling factors such as robust internal communication and strong value networks that support agile decision-making during uncertain times. Risk-taking practices, where firms use the crisis as an opportunity to test small adjustments to business models, are also highlighted. Practices such as fostering innovation hubs and expanding customer-focused digital offerings allow firms to create short-term value and set a foundation for sustained innovation.

In Paper B, the approach to formulating a digital strategy under high-risk conditions relies on structured processes, people, and practices.

- People: A strong leadership profile is essential to navigate high-risk environments. Managers must develop strategic planning capabilities to align long-term strategies with emerging opportunities, organizational adaptability, a culture that encourages innovation and learning, and networking capabilities to establish and sustain strategic partnerships.
- Processes: Firms should first build the capabilities aimed at managing digital assets and the capabilities aimed at managing organizational factors. Then, firms should proceed with the integration of such capabilities into their operational models.
- Practices: Two main practices sustain the formulation of digital innovation strategies in high-risk conditions. First, organizational change is crucial for optimizing performance and adapting to the dynamic digital landscape. This practice involves structured modifications, such as defining new roles to support digital initiatives, creating dedicated research and development teams focused on metaverse technologies, and increasing trademark and patent activities to protect innovations. Second, fostering an innovation ecosystem accelerates capability development, while facilitating exploration and adoption of cutting-edge technologies. Specifically, joint ventures and co-developed projects maximize resource-sharing and risk mitigation, fostering an environment that supports sustained innovation.

"How will the change come about?"

After grasping the nature of change, it is crucial to comprehend how this change will be integrated into the firm (Yin et al., 2024). Paper C provides insights into the people, processes, and practices required for incorporating change that drives risky or uncertain innovations within firms through strategic agility:

- People: Leadership unity emerges as pivotal for navigating complex and uncertain digital environments. Leadership unity involves fostering a cohesive leadership team aligned with long-term strategic goals and capable of making autonomous, swift decisions in response to rapid technological shifts. To build leadership unity, venture builder activities create dedicated venture units that empower leaders to define strategic priorities, allocate resources, and make agile decisions. This structured autonomy helps leaders aligning the company's long-term objectives with evolving market conditions, thereby enhancing cohesive decision-making that strengthens the firm's agility in high-risk and high-uncertainty environments.
- Processes: Two primary process models can be leveraged for integrating digital innovation within non-digital corporations via corporate venturing. These are outbound and inbound processes. Venture clienting and venture acquisitions exemplify inbound processes, which follow an outside-in approach to innovation by integrating external innovations and technologies into the corporate structure. Conversely, venture building and venture builder building represent outbound innovation processes that adopt an inside-out approach, enabling companies to develop new ventures by leveraging internal resources and organizational knowledge.
- Practices: Specific practices are available for advisors to facilitate each corporate venturing activity through specialized services. These practices include delivering informative

presentations on the adoption of startup technologies, organizing events in physical hubs for startups to showcase their innovations, and ensuring contractual guarantees for corporate-startup collaborations during venture clienting. Furthermore, practices such as roadmap design and validation, network exploitation, and the creation of new processes and operational models are essential for driving venture acquisition. In the context of venture building, key practices encompass strategic assessments, asset evaluations, market analyses, financial scenario assessments, minimum viable product development, and market monitoring. Finally, for the establishment of a venture builder, best practices for corporate venturing advisors include defining the venture builder's scope, identifying ecosystem partners and internal teams, establishing the builder's organizational structure, and leveraging internal funds and partners to manage multiple ventures effectively.

"What is the broader impact of the change?"

The final question that organizations must address when developing a digital innovation strategy in high-risk or uncertain environments concerns the broader implications of the change (Yin et al., 2024). Paper D provides insights into the essential aspects of people, processes, and practices necessary for a thorough assessment of the broader impact of risky and uncertain conditions on the formulation of digital innovation strategies:

- People: The adoption of a paradoxical framing mindset in the development of a digital innovation strategy is paramount for managers. These are encouraged to embrace a perspective that acknowledges the inherent contradictions associated with digital innovation, recognizing that both benefits and risks coexist and need to balanced.
- Processes: Two primary processes sustain digital innovation. The first process is problem space automation, that entails utilizing digital technologies such as AI to automate the identification and comprehension of root causes of complex issues, thereby enhancing firms' problem-framing accuracy and enabling them to address core challenges more efficiently. The second process is solution space augmentation and focuses on enhancing human capabilities through digital technologies such as AI by generating novel insights, recommendations, or predictive models to tackle complex challenges, thereby opening new avenues for innovation.
- Practices: Specific practices are essential for formulating digital innovation strategies aimed at sustainable development. Notably, the practice of grand challenge reduction involves minimizing the frequence of grand challenges by addressing their root causes through automated problem identification. Additionally, the practice of grand challenge mitigation aims to lessen the severity of a grand challenge by complementing human problem-solving efforts with digital technologies.

9. Boundary conditions and limitations

The discussion of the boundary conditions and limitations of a research project is an acknowledgment of how broadly the insights generated apply and where additional research might be needed before more general conclusions can be drawn (Dorobantu et al., 2024).

The present thesis features some limitations that can open for further research avenues.

First, the research papers count a limited number of cases or examples (two cases in Paper A, four cases in Paper B, one case in Paper C, seven examples in Paper D), especially within a specific sector (e.g., agri-food retail in Paper A) or a specific geographical context (e.g., European and Middle-East corporate venturing in Paper C). Future studies can test the generalizability or extend the theory developed under these boundary conditions.

Second, while qualitative methodologies have been acknowledged as the most suited way to unveil the mechanisms underlying the formulation of digital innovation strategies (Williams et al., 2021), future research can leverage this work for quantitatively testing hypotheses based on the relationships spotted between the variables of the papers presented in the thesis.

Third, while the thesis was aimed at responding to the key questions that firms should consider when formulating a digital innovation strategy in high-risk and high-uncertainty environments (Yin et al., 2024), further projects can longitudinally assess the efficacy of the formulated strategy. Specifically, these future research can examine if strategies formulated by answering to the proposed questions (Yin et al., 2024) are successful or fail to navigate high-risk and high-uncertainty environments.

"The greatest danger in times of turbulence is not the turbulence;
it is to act with yesterday's logic"

Peter Drucker

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Appendix A: Interview protocol

Describing Gellify's business model:

• What are Gellify's key resources/competencies?

• What are the key activities/processes of Gellify?

• Who are Gellify's clients (e.g., incumbents, SMEs)?

• What services does Gellify provide to its clients (i.e., offerings)?

Describing Gellify's services in the B2B segment:

• What does Gellify's CV intermediation activity between corporate companies and startups entail? Define the type of relationship established between a corporate company and a startup through Gellify's activity (e.g., acquisition, creation, collaboration, investment), and what role Gellify plays in each type of relationship (e.g., provider of physical spaces, services, technology, financial resources, facilitator in knowledge exchange).

• In your experience, what are the main reasons why a corporate company would turn to Gellify as an intermediary with a startup?

• What is Gellify's role in the process of creating/connecting with a startup on behalf of corporate companies?

• Who are the actors involved in the process of creating/connecting with a startup (e.g., Gellify departments, corporate company departments, entrepreneurs), and what flows (e.g., resource exchange, knowledge) occur between these actors?

• In your experience, what are the main advantages that corporate companies gain from turning to Gellify for the creation of/collaboration with a startup?

• In your experience, how do the startups created/connected by Gellify modify the processes or organizational structures of corporate companies?

Describing the support provided by Gellify for the development of strategic agility for corporate clients:

• In your experience, can you provide examples of how the startups created/connected by Gellify have enabled Gellify's corporate clients to develop agility?

• In your experience, can you provide examples of how Gellify's services aimed at creating/collaborating with startups release a quick reconfiguration of resources or partners (i.e., resource fluidity)?

• In your experience, can you provide examples of how Gellify's services aimed at creating/collaborating with startups release the identification of new market opportunities (i.e., market sensitivity)?

• In your experience, can you provide examples of how Gellify's services aimed at creating/collaborating with startups release the improvement of top-management decisions (i.e., leadership unity)?

• In your experience, with which startup-related services does Gellify support its corporate clients in developing agility? Can you provide examples?

• In your experience, how does Gellify generate and manage the startup-related services that enable its corporate clients to develop agility? Can you provide examples?

• In your experience, what are the main barriers or obstacles that Gellify encounters in supporting companies in developing agility through the creation/connection with startups?

• How does Gellify address these barriers?

Closing:

Is there anything you would like to add or that we have not discussed that you believe is relevant?

Endnotes

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[86] Digital innovation refers to a particular type of innovation where digital technologies modify product functionalities, drive servitization, sustain organizational shifts, and promote transformations in business models (Appio et al., 2021).

[87] As reported by Bughin (2018), "the potential for AI to boost productivity and economic growth is large - as large as, if not larger than, that of previous general-purpose technologies […] AI could boost world output by $13 trillion by 2030, lifting GDP by 1.2 percent a year".

[88] According to Vinuesa et al. (2020), AI can help achieve the 79% of Sustainable Development Goals set by the United Nations General Assembly to address some of the most pressing global challenges for sustainable development.