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Antecedents, Design and Outcomes of Digital Business Model Innovation - A Configuration Model

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Preface

Now, as I stand at the culmination of this journey to my doctorate, I can't help but marvel at the strange circumstances, late-night epiphanies, and serendipitous encounters that have led me to this point. In the midst of countless existential crises and an ever-growing stack of unread research articles, I have often wondered how I, a clueless graduate student, managed to navigate the labyrinthine world of academia and emerge with a completed dissertation in hand. Yet here I stand, a testament to the power of persistence, collaboration, and perhaps an unhealthy dose of caffeine and good luck.

First and foremost, I would like to express my deepest gratitude to my doctoral advisor, Prof. Helmut Krcmar. Your unwavering belief in my potential, coupled with your unwavering mentorship, has been crucial to my personal and academic development. Thank you for giving me the tools and freedom I needed to pursue my ideas and conduct relevant research. Your wisdom and expertise have been a constant source of inspiration to improve my research and develop little research nuggets. The opportunities you have provided me will hopefully be reflected in this thesis.

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Los Angeles, 09.04.2023 Timo Phillip Böttcher

Abstract

Problem Statement: To remain commercially successful, firms must be alert to change and seize new opportunities. Specifically, they must adapt their business models to meet the needs of their customers by leveraging digital technologies to create new value for their customers. However, most firms find it challenging to implement business model innovations despite the significant benefits and opportunities. Research provides a deep understanding of what elements of business models can be changed using digital technology and what digital business models look like. However, we must explore the link between sensed antecedents and firms' strategic responses to understand why, when, and how firms use digital technology to innovate digital business models. The question of why firms choose to innovate their business models has yet to be answered. Similarly, despite the known impact of the business model on performance, little research has been done on the impact and outcomes of business model innovation.

Research Design: This dissertation follows the pragmatic paradigm with a qualitative mixed-methods research strategy to better understand digital business model innovation in real-world examples. This dissertation uses a combination of empirical research methods to explain how digital business model innovation works in firms. The case survey method forms generalizable cross-sectional analyses in combination with deep case knowledge. It aggregates multiple cases to discover generalizable patterns. The goal is to discover how digital business model innovations work in different cases. Qualitative comparative analysis is a method used to combine qualitative and quantitative research methods to increase confidence in the results. This method is suitable for uncovering the complex relationships between change, business model design, and the impact of business model innovations. Quantitative methods are beneficial for establishing relationships and generalizing about a large sample population. They provide objective and reliable results, increasing the generalizability of the results and their reliability.

Results: First, we identify three internal and three external antecedents of digital business model innovation and, building on these, develop pathways to digital business model innovation that combine firms' sensing of the antecedents with their seizing of innovation opportunities. Second, we describe the complexity of digital business model innovation where part-whole relationships are critical. We discover that the elements of the business model, the stages of the customer journey, and digital technologies must be considered together to achieve the overall goal of creating a successful digital business model. In addition, we highlight six interdependencies in value-creation activities that create tensions that must be resolved through business model design decisions. Third, our research highlights the financial benefits of specific digital business model patterns while illustrating the dangers of not doing so while competitors undertake digital business model innovation. Finally, we show that digital business model innovation effectively strengthens a firm's resilience.

Contribution: This dissertation contributes to several research directions related to business models. First, we explain how different configurations of antecedents lead to different business model innovations by establishing a link between sensing and seizing capabilities and

identifying pathways to digital business model innovations. Second, we explain how firms can innovate their business models using digital technologies by extending the research to include a configurational perspective on the digital innovation process. Third, we show how innovative business models based on digital technologies are configurations of multiple interdependent elements, highlighting the complex interplay within business model components and between the business model, customer journey, and digital technologies. Fourth, we propose a multi-layered perspective on the outcomes of digital business model innovation, highlighting how business model innovation creates strategic and competitive advantage and introducing digital business model innovation as the origin of organizational resilience. In addition, we establish a link between the individual business model and the ecosystem by showing that digital business model innovation also has an impact at the ecosystem level. This dissertation contributes to understanding digital business model innovation and its impact on firms and ecosystems.

Limitations: The research studies in this dissertation relied on specific research methods, and data sets with natural limitations that must be considered when understanding the findings and contributions of this dissertation. First, some data sources used in the case surveys were not created for our specific research purposes, allowing them to focus primarily on other aspects of digital business model innovation. Second, the applied inductive, exploratory methods may be subjective depending on the individual researcher's point of view. Third, the data in P2 to P6 are context specific to retail (P2, P6) or finance (P5) or focus on startups (P4), especially in the context of sustainability (P3). Therefore, the results of these studies must be considered in their respective contexts. Fourth, all publications except P5 rely on a snapshot of the analyzed cases. This is particularly relevant concerning the results of digital business model innovation. The value of innovation is time-lagged, making it difficult to measure and account for a particular innovation.

Future Research: Based on the embedded publications and the herein proposed configurational process model of digital business model innovation, we have identified promising avenues for future research on digital business model innovation. In the context of digital business model innovation, we must explore how specific technologies, such as artificial intelligence, enable these sustainable business models and how established firms can design their pathways to digital and sustainable business model innovation. Scholars should consider this ecosystem level of digital business model innovation to develop theories of digital business model diffusion through digital ecodynamics. Future research should explore these firm-internal influences on the sensing, seizing, and transforming capabilities and the resulting business model innovations to refine and improve the model. Finally, information systems research needs to focus on the digital artifact in digital innovation and how that digital artifact affects the innovation process and innovation itself.

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List of Abbreviations

AMCIS	Americas Conference on Information Systems
BM	Business Model
CON	Conference
csQCA	Crisp-set Qualitative Comparative Analysis
ECIS	European Conference on Information Systems
fsQCA	Fuzzy-set Qualitative Comparative Analysis
HICSS	Hawaii International Conference on System Sciences
JN	Journal
JSIS	Journal of Strategic Information Systems
mvQVA	Multi-value Qualitative Comparative Analysis
NR	Not Ranked
P	Publication
PACIS	Pacific Asia Conference on Information Systems
QCA	Qualitative Comparative Analysis
RQ	Research Question
VHB	Verband der Hochschullehrer für Betriebswirtschaft
WI	Internationale Tagung Wirtschaftsinformatik

Part A

1 Introduction

As firms and their strategies differ, firms respond differently to change, and different business models emerge with different impacts. In this dissertation, I examine the relationship between emerging change and the impact on firms as they innovate digital business models from start to finish. First, I examine the relationship between the antecedents that firms sense before seizing opportunities with digital business model innovation and explain why firms change their business model with digital technology. Second, I analyze the design of such innovative business models to find challenges and interdependencies in digital business model design that must be addressed. Third, we clarify the implications of digital business model innovation and show that using digital technology for business model innovation is necessary, financially beneficial, and creates resilience. In summary, this dissertation contributes to understanding the development of digital business models comprehensively and clarifies how to maximize the potential of digital business model innovation.

1.1 Motivation

“No great business model lasts forever.” (Chesbrough, 2007b, p. 15) And forever is approaching faster and faster (Benbya et al., 2020). While in 1958, the average lifespan of firms listed in the Standard & Poor's 500 was 61 years, in 2016, it dropped to just 18 years and is estimated to fall to 12 years in 2027 (Hillenbrand et al., 2019). To succeed economically, firms must adapt to a changing environment subject to significant turbulence since the advent of digital transformation (Benbya et al., 2020; El Sawy et al., 2010). Digital technologies have created new digital business models that have turned entire industries upside down (Christensen et al., 2015; Veit et al., 2014). Firms, therefore, need to be very sensitive to change and the new opportunities it creates (Orlikowski, 1996; Overby et al., 2017; Warner & Wäger, 2019). They must adapt their business models to meet customer needs, offer digitally enhanced products and services, or use digital technologies to create novel customer value (Amit & Han, 2017; Teece, 2018b; Vial, 2019).

The business model as a research construct emerged with the advent of the Internet to harness the economic potential of this digital technology and make it accessible for the development and implementation of business strategies (Amit & Zott, 2001; Lanzolla & Markides, 2020; Massa et al., 2017). Inherently the business model has always been linked to digital technology, but research and practice still fail to explain how and why firms use digital technology to develop innovative digital business models (Foss & Saebi, 2017). As a result, firms are still struggling to innovate their business models using digital technologies (Teece, 2010).

For example, the grocery delivery business models reveal how different antecedents lead to different digital business models. Following Amazon's strategy, AmazonFresh requires an AmazonPrime subscription, and Walmart needs a time- and cost-efficient delivery network and therefore uses a digital platform to hire delivery drivers on a transaction basis. In contrast, Trader Joe's offers no delivery services as its customers' demands differ. These firms seize digital business model innovation, defined as the "novel, and nontrivial changes to the key elements of a firm's [business model]” enabled by digital technology (Foss & Saebi, 2018, p. 14; Veit et al., 2014), differently because of their organizational context, such as their possessed resources. Other possible antecedents of digital business model innovation, such as strategy alignment and technological capability, financial resources, or legal frameworks, further increase the challenge of connecting sensing and seizing for digital business model innovation (van Oosterhout et al., 2017).

In particular, research on business models and business model innovation has been dominated by conceptual or single-case study research. The missing cumulative empirical inquiry leads to concept unclarity, a major criticism of business model research ever since. Multiple research articles have issued the call for identifying antecedents and outcomes of business model innovation (Foss & Saebi, 2017, 2018; Lambert & Montemari, 2017; Schneider & Spieth, 2013). The business model innovation theory shall become more tangible and advance concept clarity.

In addition, the existing research on digital business model innovation primarily takes on a descriptive analysis view (Foss & Saebi, 2018). For example, we understand how firms leverage digital technology, such as artificial intelligence, to create innovative digital business models (e.g., Weber et al., 2021). Research on digital business model innovation shows how firms leverage digital technology to improve their value propositions or increase value chain efficiency (Amit & Han, 2017). While we have a profound understanding of what business model elements can be changed with digital technology and how these digital business models look like, we need to examine the connection between the sensed antecedents and the strategic responses taken by firms to understand why, when, and how firms are using digital technology to innovate toward digital business models.

Despite the benefits and opportunities business model innovation will likely offer, most established companies struggle to create business model innovations (Johnson et al., 2008; Voelpel et al., 2004). This may be why business model innovation research is a young research stream, even though Schumpeter (1934) already named a new form of organizing the business as a type of innovation. Thus, it still lacks fundamental research and practice (Foss & Saebi, 2017).

Expressly, Lambert and Montemari (2017) point out that on the one side, the understanding of enablers of business model innovation needs to be enhanced. The question of why firms decide to innovate their business model is yet to be answered (Arend, 2013; Foss & Saebi, 2018; Schneider & Spieth, 2013). On the other side, despite the known performance implications of the business model, the effects and outcomes of business model innovation are hardly explored (Schneider & Spieth, 2013). In two more recent research reviews (Foss & Saebi, 2017, 2018) still address this lacking understanding of antecedents and outcomes of business model innovation.

As findings are mainly based on single or multiple case study research, generalizability is still lacking (Foss & Saebi, 2015, 2017; Lambert & Montemari, 2017; Lambert & Davidson, 2013). Additional to understanding antecedents, outcomes, and the concept of business model innovation as isolated aspects, the relationships in-between must be explored (Saebi, 2015). Comparisons about the influence different antecedents have on which type of business model innovation and on the change of which business model component remains unavailable (Foss & Saebi, 2017).

In summary, research on digital business model innovation shows how firms leverage digital technology to improve their value propositions or increase value chain efficiency (Amit & Han, 2017; Reinartz et al., 2019; Wulf & Blohm, 2020). However, while we have a profound understanding of what changes digital technology can trigger in business models and how digital business models look like, we identified three problems in practice that are not sufficiently explored and explained in research and will therefore be addressed in this dissertation.

First, every firm with a new digital business model strives to be "the next Netflix" or "the next Amazon." The success of a few has inspired many to adopt successful business model patterns, such as the subscription pattern of Netflix and Spotify. However, research cannot yet explain if, when, and how the adaption of a business model pattern is successful or even advisable (Foss & Saebi, 2018; Lanzolla & Markides, 2020; Teece, 2018b). Research lacks the connection between the firm-specific context and the change happening within the firm and its ecosystem that sparks digital business model innovations (Foss & Saebi, 2017). However, to sustain or gain competitive advantage, firms must co-evolve with their complex and dynamic ecosystem (Tanriverdi et al., 2010). They must develop and leverage dynamic capabilities to sense changes, seize them, and respond with resource reconfiguration or business transformation (Tanriverdi et al., 2010; Teece, 2007, 2018b). Hence, we will examine the connection between the sensed antecedents and the seized digital business model innovation types.

Second, after deciding to implement a new digital business model, firms still struggle with the change (Chesbrough, 2010; Massa et al., 2017; Teece, 2010). Research has provided several supportive tools and insights, such as the business model canvas and patterns. However, the problem in practice persists. Recent research argues that we need to look into implementing business model innovations to support firms in being successful in their innovation efforts (Vatankhah et al., 2023; Verhagen et al., 2023). Related literature on digital transformations and digital business strategy suggests that traditional research methods fall short of the complexities in these contexts, thus, cannot sufficiently explain why it is difficult for firms to change their business models with digital technology (Benbya et al., 2020; El Sawy et al., 2010; Park et al., 2020). Therefore, we use configurational methods to explain how digital technologies and business models are interdependent in new digital business models (Fiss, 2007; Tanriverdi et al., 2010).

Third, there is general agreement in research that a unique business model is found to be a source of superior value creation (Morris et al., 2005), and the business model often is of greater importance for market success than the product itself or technological innovation (Chesbrough, 2007a, 2010; Teece, 2010). From this stems the interest in business model innovation as the enabler of this success (Schneider & Spieth, 2013), and the resulting knowledge base consists of innovative and successful business model designs (cf. Rietveld, 2018; Tidhar & Eisenhardt, 2020; Weking, Mandalenakis, et al., 2019; Zott & Amit, 2007). However, despite the business model's known performance implications, its innovation's effects and outcomes are hardly explored (Foss & Saebi, 2017). We, therefore, examine the outcomes of digital business model innovations to complete the process from the sensing of opportunities to the exploration and exploitation of these opportunities through digital business model innovations.

1.2 Research Questions

To address the shortcomings above in previous research, this dissertation develops a comprehensive understanding of digital business model innovation by examining the antecedents and reasons that lead firms to change their business model, formulating design decisions in the implementation of such digital business models, and presenting specific outcomes of how firms benefit from digital business model innovation. This end-to-end perspective is addressed through three research questions (RQs) that structure this dissertation:

RQ1: What is the connection between sensed antecedents and seized digital business model innovation?

In the first research question, we unravel the connection between sensing, which means identifying and assessing opportunities outside your organization, and seizing, through transforming resources and activities constituting the business model to capture value from those opportunities. By exploring this connection, we can differentiate the context-dependent value of business model innovation and give practical recommendations for strategically using an organization's limited resources. We identify three internal and three external antecedents to digital business model innovation. We extend these insights by identifying pathways to digital business model innovation by connecting the sensing of antecedents with the seizing in one of the five types of business model innovation.

RQ2: *What are design decisions when seizing digital business model innovation?*

In the second research question, we dig into the complexities of business model design decisions that need to be made when seizing digital business model innovation and transforming the firm's resources and value-creation activities. We build on empirical data from two case surveys in brick-and-mortar retail and sustainable entrepreneurship contexts. We identify part-whole relationships in digital business model innovation, where parts are individual changes in resource transformations but only collectively form a new digital business model. In addition, we find interdependencies in value-creation activities for sustainable business models that create tensions that need to be resolved through business model design decisions.

RQ3: *What are the specific outcomes of digital business model innovation?*

In the third research question, we demonstrate the value and necessity of digital business model innovation by analyzing the results of digital business model innovation on firm performance. We show that implementing specific digital business model patterns leads to financial success. In contrast, we show that not implementing digital business models is detrimental to incumbent firms when competitors make digital business model innovations. Finally, we show that digital business model innovation strengthens resilience.

In summary, this dissertation develops a comprehensive understanding from sensing opportunities and needs for digital business model innovation, to the specific design decisions in seizing digital business model innovation and transforming resources and activities to implement the new business model, to the outcomes achievable through digital business model innovation.

1.3 Structure

The structure of this thesis is outlined in Figure 1 and consists of three parts. Part A provides an introduction to the topic, explains the theoretical background and context of the research, and explains the research approach. The introduction sets the framework for the research, provides a brief overview of the problem, and explains its significance (Chapter 1). The theoretical background forms the basis of the dissertation with a summary of the relevant theoretical concepts, including the business model, digital business models, and business model innovation (Chapter 2). The research approach explains the methodology used to conduct the research, including the research strategy, data collection, and analysis methods (Chapter 3).

Part B contains an overview of the six publications that present the results of the dissertation concerning the three research questions. The entire publications in their original format can be found in Appendix A. The first publication (P1) identifies and analyzes the antecedents of digital business model innovation to explain why firms adopt different digital business model innovation types given the sensed antecedents (Chapter 4). Publications two (P2) and three (P3) use analysis in the context of retail (Chapter 5) and sustainability (Chapter 6) to highlight complex interdependencies in business model design that must be made when leveraging digital business model innovation. Publication four (P4) shows the relevance of business model patterns prevalent in digital business model innovation to financial success (chapter 7), and publication five (P5) shows negative financial consequences for a focal firm when digital business model innovation is implemented by competitors (chapter 8). Finally, publication six (P6) shows how various business model innovations proved successful and unsuccessful during the COVID-19 pandemic (chapter 9).

Part C begins by summarizing the six publications (Chapter 10). It then discusses the main findings (Chapter 11) and formulates the contributions to theory and practice (Chapter 12). In addition, limitations (Chapter 13) are identified, and avenues for future research that extends this dissertation are suggested (Chapter 14). Part C ends with a conclusion that summarizes the dissertation (Chapter 15).

Figure 1. Structure of the Dissertation

Part A | **Introduction, conceptual background, research approach**

Part B | **Published articles**

RQ1: What is the connection between sensed antecedents and seized digital business model innovation?

P1: Pathways to Digital Business Models: The Connection of Sensing and Seizing in Business Model Innovation

Method: Case survey, qualitative comparative analysis (QCA)

RQ2: What are design decisions when seizing digital business model innovation?

P2: The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail

Method: Case survey, QCA

P3: Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability

Method: Multiple case study

RQ3: What are the specific outcomes of digital business model innovation?

P4: Enter the Shark Tank: The Impact of Business Models on Early Stage Financing

Method: Quantitative methods

P5: Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks

Method: Quantitative methods

P6: The Good, the Bad, and the Dynamic: Changes to Retail Business Models During Covid-19

Method: Case survey

Part C | **Summary of results, discussion, limitations, implications, future research, and conclusion**

In the following paragraphs, I summarize the theoretical and practical problems, research methods, and contributions of each of the six publications in Part B. Table 1 lists the six publications.

Table 1. Overview of Publications Embedded in this Dissertation

#	Authors	Title	Outlet	Type (Ranking)	RQ
P1	Böttcher, T.P. Weking, J. Hein, A. Böhm, M. Krcmar, H.	Pathways to Digital Business Models: The Connection of Sensing and Seizing in Business Model Innovation	JSIS	JNL (VHB: A)	RQ1
P2	Böttcher, T.P. Kersten, T. Weking, J. Hein, A. Krcmar, H.	The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail	HICSS 2023	CON (VHB: C)	RQ2
P3	Böttcher, T.P. Petry, J. Weking, J. Hein, A.	Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability	HICSS 2023	CON (VHB: C)	RQ2
P4	Böttcher, T.P. Bootz, V. Zubko, T. Weking, J. Böhm, M. Krcmar, H.	Enter the Shark Tank: The Impact of Business Models on Early Stage Financing	WI 2021	CON (VHB: C)	RQ3
P5	Böttcher, T.P. Al Attrach, R. Bauer, F., Weking, J. Böhm, M. Krcmar, H.	Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks	PACIS 2021	CON (VHB: C)	RQ3
P6	Böttcher, T.P. Weking, J. Krcmar, H.	The Good, the Bad, and the Dynamic: Changes to Retail Business Models During Covid-19	Bled eConference	CON (NR)	RQ3

Outlet:
HICSS Hawaii International Conference on System Sciences
JSIS Journal of Strategic Information Systems
PACIS Pacific Asia Conference on Information Systems
WI Internationale Tagung der Wirtschaftsinformatik

Type:
CON: Conference
JNL: Journal
NR: Not Ranked
VHB: German Academic Association for Business Research

*All publications are published and peer-reviewed.

P1: Pathways to Digital Business Models: The Connection of Sensing and Seizing in Business Model Innovation. The first publication (Böttcher, Weking, et al., 2022) analyzes the dedicated connection between the antecedents sensed by a firm and the type of business model innovation it seizes as a consequence. Sensing and seizing cannot be considered isolated capabilities but must be connected for successful business model innovation. We use a combination of the case survey method and qualitative comparative analysis (QCA) to analyze a sample of 49 case studies. The research yields ten sensing (represented by six antecedents) and seizing (represented by four business model innovation types) configurations that describe the connection between sensed antecedents and seized digital business model innovation. We developed four explanatory factors and identified consolidating business model innovation as a novel form of business model innovation peculiar to the digital context to explain "what" and "how" firms connect sensing and seizing. This novel type enables firms to use and explore new business models and subsequent digital business model innovations based on new digital infrastructure. As a result, this publication contributes to a better understanding of how different business models evolve and firms construct digital business model innovations.

P2: The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail. The second publication (Böttcher, Kersten, et al., 2023) analyzes the digital transformations in brick-and-mortar retail. These digital transformations aim to create digital store customer experiences to mimic online retail. To explain what retailers need to implement and what to consider to ensure successful transformations, we analyze 38 digital transformation projects in retail that aim to create digital customer experiences. Based on a QCA combining elements of the business model, the customer journey, and digital technology, enriched by eight expert interviews, we identify three configurations: value chain innovation, seamless purchase experience, and personal experience. While each can be implemented separately, substantial overlaps and interdependencies suggest that all three configurations are necessary for successful transformations and holistic digital customer experiences. This publication demonstrates the complexity and interdependencies of business model design decisions while suggesting manageable breakdowns of business model innovation.

P3: Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability. The third publication (Böttcher, Petry, et al., 2023) explores innovative digital business models for sustainability. As the need for sustainable economies and consumption becomes evident, startups create innovative and sustainable products and services as part of their business models. For this publication, we interviewed experts from 15 startups implementing such a sustainable business model using digital technologies and one expert from an entrepreneurial incubator. We identified six success factors with underlying tensions that require business model design decisions to be made by the management team. The success factors are (1) aligning the firm's and team's sustainability purpose; (2) using digital technology effectively for sustainable value creation; (3) focusing on simultaneous economic, environmental, and social value creation; (4) selling the sustainable value in a targeted approach; (5) understanding customers' external sustainability motivations; and (6) finding supportive funding for economic growth and sustainable impact. The results demonstrate essential design decisions when implementing digital business models for sustainability and provide guidelines on navigating the tensions when balancing economic and ecologic sustainability.

P4: Enter the Shark Tank: The Impact of Business Models on Early Stage Financing. The fourth publication (Böttcher, Bootz, et al., 2021) tests the assumption that business model design determines financial success. Therefore, we test a dataset of 72 startups for correlations between implemented business model design patterns and received seed investments as an early measure for success. The results reveal that Two-Sided Market, Layer Player, and Freemium patterns significantly affect the investment sum. Interestingly, these patterns are predominant in digital business models. This publication underscores the benefit of business model innovation towards the digital business model and supports the relevance of business model design as a source for startup success.

P5: Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks. The fifth publication (Böttcher, Al Attrach, et al., 2021) examines the financial consequences of new entrants with digital business models for established banks with traditional business models. We analyze the financial ecosystem and hypothesize that the success of FinTech startups negatively affects the market valuation of established banks, as the new digital business models challenge investors' expectations of the future success of established banks. We test this hypothesis in an event study of 152 European FinTech funding rounds over six years and compare the changes in market capitalization of 30 incumbent European banks. We show in this paper that there are adverse outcomes for a focal firm caused by the digital business innovations of competing firms. Therefore, firms must address digital business model innovation to succeed commercially.

P6: The Good, the Bad, and the Dynamic: Changes to Retail Business Models During Covid-19. The sixth publication (Böttcher, Weking, & Krcmar, 2022) focuses on the impact of COVID-19 on retail firms and examines the success of business model innovations in response to induced closures. Since the literature and our previous publications have shown the importance of business models and business model innovations for economic success, we assumed that business model innovations would appropriately respond to the discontinuities. We analyzed 45 European retailers' business model innovations during the COVID-19 pandemic. We found and described 12 patterns of business model innovations. To assess the success of these changes, we compared revenues before and during the pandemic. This resulted in three types of business models: the good, the bad, and the dynamic. While the "good" business models withstood the crisis, retailers with "bad" business models failed to adapt successfully. The "dynamic" business models implemented changes to the business model based mainly on digital technologies to create digital customer experiences and become more resilient. Therefore, this publication introduces business model resilience as a new outcome of digital business model innovation.

In addition to the key publications P1-P6, this dissertation contains nine (see Table 2) that are tangentially related to our research questions. Publications P1-P6 highlight the fundamental findings and primary building blocks of this dissertation through published work, while publications P7-P15 provide further insights into the design and outcomes of digital business model innovation:

Related to question one, we analyzed 46 case studies to identify and structure the antecedents and outcomes of digital business model innovation (Böttcher & Weking, 2020).

In connection with question two, we analyzed business model designs in retail (Böttcher, Li, et al., 2021) and business models that leverage data (Baecker et al., 2021). We also examined how artificial intelligence affects the value creation aspect of business model design (Böttcher, Weber, et al., 2022). Generally, we examined the overarching characteristics of business models in highly innovative ecosystems (Böttcher, Phi, et al., 2021). We also summarized current knowledge on methods for designing digital business models (Strunz-Happe et al., 2022).

Related to question three, we examined which business models lead to the success of digital platforms (Böttcher, Bootz, et al., 2022). For the retail ecosystem, we showed how the ecosystem changes after introducing new digital business models (Böttcher, Rickling, et al., 2021). In addition, we tested whether the survival of startups depends on the design of the business model that supports economic success due to the change in the business model (Weking, Böttcher, et al., 2019).

Table 2. Overview of Additional Publications

#	Authors	Title	Outlet	Type (Ranking)
P7	Böttcher, T.P. Weking, J.	Identifying Antecedents and Outcomes of Digital Business Model Innovation	ECIS 2020	CON (VHB: B)
P8	Böttcher, T.P. Li, W. Hermes, S. Weking, J. Krcmar, H.	Combining Bricks and Clicks: A Taxonomy of Digital Business Models in Brick-and-Mortar Retail	PACIS 2021	CON (VHB: C)
P9	Baecker, J. Böttcher, T.P. Weking, J.	How Companies Create Value From Data – A Taxonomy on Data, Approaches, and Resulting Business Value	ECIS 2021	CON (VHB: B)
P10	Böttcher, T.P. Weber, M. Weking, J. Hein, A. Krcmar, H.	Value Drivers of Artificial Intelligence	AMCIS 2021	CON (VHB: D)
P11	Böttcher, T.P. Phi, D.A. Flötgen, R. Weking, J. Krcmar, H.	What Makes an Innovative Business Model? Evidence From the 70 Most Innovative Firms	AMCIS 2020	CON (VHB: D)
P12	Strunz-Happe, V. Böttcher, T.P. Weking, J. Krcmar, H.	Digitale Geschäftsmodelle	Book 2022	Chapter (VHB: NR)
P13	Böttcher, T.P. Bootz, V. Schaffer, N. Weking, J. Hein, A.	Business Model Configurations for Digital Platform Success - Towards a Typology of Digital Platform Business Models	ECIS 2022	CON (VHB: B)

Table 2. Overview of Additional Publications

P14	Böttcher, T.P. Rickling, L. Gmelch, K. Weking, J. Krcmar, H.	Towards the Digital Self-Renewal of Retail: The Generic Ecosystem of the Retail Industry	WI 2021	CON (VHB: C)
P15	Weking, J. Böttcher, T.P. Hermes, S. Hein, A.	Does Business Model Matter for StartupStartup Success? A Quantitative Analysis	ECIS 2019	CON (VHB: B)

Outlet:
AMCIS Americas Conference on Information Systems
ECIS European Conference on Information Systems
PACIS Pacific Asia Conference on Information Systems
WI Internationale Tagung der Wirtschaftsinformatik

Type:
CON: Conference
VHB: German Academic Association for Business Research
NR: Not Ranked

*All publications are published and peer-reviewed.

2 Theoretical Background

The following explains the core concepts and theoretical background to create a shared understanding and a theoretical basis for this dissertation. In the sections one and two, we define and explain the concepts of digital business models and digital business model innovation. In the sections three and four, we review the literature on the antecedents and outcomes of business model innovation.

2.1 Digital Business Models

The concept of business models was introduced in the late 1990s when the Internet-enabled new forms of value creation that put digital technologies at the core of a firm's business strategy (Amit & Zott, 2001). It progressed the predominant view on the separation of business and information systems strategy that needs to be aligned (Hedman & Kalling, 2017). Information systems strategy focuses on how business applications can align with business needs and enable competitive advantage (Reynolds & Yetton, 2015). With electronic businesses, such as e-commerce, information systems not only enabled the business strategy, information systems became the business strategy (Bharadwaj et al., 2013).

The complexity and dynamics of digital ecosystems opened a gap between the business strategy and the business processes executing this strategy (Al-Debei & Avison, 2017). Traditional theories of competition, such as Porter's basic competitive strategies (Porter, 1980), did not lose their relevance, but it became harder for firms to sustain the competitive advantage from these strategies as they became easier to imitate (Al-Debei & Avison, 2017; Amit & Zott, 2001; Hedman & Kalling, 2017). Hence, implementing the strategy became more important, as complex activity systems are harder to imitate from the outside perspective (Amit & Zott, 2001; Teece, 2007, 2010). However, business processes have become more agile and complex (Al-Debei & Avison, 2017). Thus, the business model concept was introduced to fill the gap between strategy and processes (Lanzolla & Markides, 2020). Following Lanzolla and Markides (2020) and Bigelow and Barney (2020), we perceive the business model as a novel, practically oriented lens on strategy research topics, especially digital transformation.

Table 3 lists selected definitions of the business model. While there have been three different perspectives on the concept (Massa et al., 2017), a consensus in research emerged towards the tactical implementation of the business strategy (Foss & Saebi, 2018) following the definition of Teece (2010, p. 179): "A business model articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value." This perspective of the business model thus directly responds to Drucker's core questions for management: "Who is the customer, what does he value, and how does an organization intend to earn money?" (Magretta, 2002). In line with other definitions, the business model consists of the critical elements of value proposition, value delivery, value capture, and value creation (Chesbrough, 2010; Demil & Lecocq, 2010; Osterwalder et al., 2005; Teece, 2010; Zott & Amit, 2010).

Furthermore, scholars agree that the business model is centered on activities emphasizing business and customer value (Massa & Tucci, 2014). Therefore the business model can also be defined as a system of interrelated and interdependent activities (Zott & Amit, 2010). It demonstrates how a firm aligns holistic value creation for all stakeholders (Zott & Amit, 2010).

Table 3. Definitions of Business Model

Definitions	Reference
"A business model depicts the design of transaction content, structure, and governance so as to create value through the exploitation of business opportunities."	Amit and Zott (2001, p. 511)
"A business model articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers. It also outlines the architecture of revenues, costs, and profits associated with the business enterprise delivering that value."	Teece (2010, p. 179)
'We view a business model as a system of activities that depicts how a firm "does business" with its customers, partners, and vendors. More precisely, we define a business model as the bundle of specific activities that are conducted to satisfy the perceived needs of the market, including the specification of the parties that conduct these activities (i.e., the focal firm and/or its partners), and how these activities are linked to each other." "Business model is a system of interdependent activities that transcends the focal firm and spans its boundaries."	Zott and Amit (2010, p. 216)
"The business model is the heuristic logic that connects technical potential with the realization of economic value."	Chesbrough (2002, p. 529)
"A business model describes the rationale of how an organization creates, delivers, and captures value."	Osterwalder and Pigneur (2010, p. 14)
"[...] an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization, as well as all core products and/or services the organization offers based on these arrangements that are needed to achieve its strategic goals and objectives."	Al-Debei and Avison (2017, p. 372)
"[...] conceptual tool that contains a set of elements and their relationships and allows expressing a firm's logic of earning money. It is a description of the value a firm offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams."	(Osterwalder, 2004, p. 15)

The interest in the business concept is highly motivated by the agreement in research that the concept of business models is relevant for firm performance (Afuah & Tucci, 2000; Al-Debei & Avison, 2017; Rietveld, 2018; Shafer et al., 2005) which thus has developed into one primary research stream (Foss & Saebi, 2015, 2017; Lambert & Davidson, 2013; Wirtz et al., 2016). Explanations for this phenomenon either use the business model as a source of differentiation (Casadesus-Masanell & Ricart, 2010; Gassmann et al., 2014) or as an intermediate since it defines a firm's way to create and capture value (Osterwalder et al., 2005). Both of these answer the core question of strategic management – how to create and sustain competitive advantage (Teece, 2010) – and, consequently, influence firm performance (Shafer et al., 2005). In quantitative research investigating startup survival and startup or stock market performance, statistical proof for this correlation has been found (Böhm et al., 2017; Malone et al., 2006; Weill et al., 2011; Weking, Böttcher, et al., 2019).

With the rising digital transformation and the increasing relevance of digital technologies for value creation, the business model has become critical for commercializing innovative ideas and technologies (Zott et al., 2011). Digital technologies do not possess any inherent value until this value is created and captured with an encompassing business model (Al-Debei & Avison, 2017; Chesbrough, 2002; Mata et al., 1995; Steininger, 2019; Teece, 2010; Zott et al., 2011). Digital technologies enable new business models and innovations of the business model elements, or on the activity level, to allow for optimization and reconfiguring of the activities executing the business model. Therefore, firms must understand technology and business model innovation (Chesbrough, 2007a; Fitzgerald et al., 2013; Nwankpa & Roumani, 2016; Yoo et al., 2012).

In early definitions of digital business models, digital technology use was not further differentiated, but a business model was defined as "digital if changes in digital technologies trigger fundamental changes in the way business is carried out and revenues are generated." (Veit et al., 2014, p. 48) Later, based on their specific purpose in the business model's activity system, Steininger (2019) defined four types of digital technology usage according to types of technology-enabled business models: technology-facilitated business models, technology-mediated business models, technology-bearing business models, and digital business models. Facilitated business models use technology as a resource in the infrastructure while selling non-digital products and services. Mediated business models, such as online shops, also use technology for their customer interface. Technology is the outcome of value creation for bearing business models, meaning the business model sells technology hardware or software. In the digital business model, all previously mentioned aspects apply, thus the product or service is digitally sold and delivered.

2.2 Digital Business Model Innovation

"No great business model lasts forever" (Chesbrough, 2007b, p. 15). For sustained business success, business models need to be changed to adapt to changing ecosystems (Chesbrough, 2002; Foss & Saebi, 2017; Lambert & Davidson, 2013; Saebi, 2015; Shirky, 2008; Teece, 2007, 2010). Moreover, it is preferable for firms to initiate this change themselves before the changing ecosystem forces the change (Teece, 2010). Famous examples such as Nokia, Kodak, and Blockbuster have failed to adapt their business models to the digital imperative and have been displaced by competitors and new entrants who changed the dominant business model for a more successful one (Cavalcante, 2013; Foss & Saebi, 2017; Teece, 2010).

As argued before, the business model is a source of superior value creation (Morris et al., 2005) and is highly important for the economic success of products and technology (Chesbrough, 2007a, 2010; Teece, 2010). The importance of innovation for sustainable firm success (Amit &

Zott, 2001; Han et al., 1998; Nwankpa & Roumani, 2016; Schumpeter, 1934; Van de Ven, 1986), in combination with the notion of using the business model for competitive differentiation (Casadesus-Masanell & Ricart, 2010; Gassmann et al., 2014) led to the idea of changing the business model has become a unique type of innovation (Schneider & Spieth, 2013).

Most definitions coincide in their core statement that business model innovations are created by changing business model elements or their interaction, which leads to a novel configuration. Table 4 lists several definitions of business model innovation from the literature. Foss and Saebi (2017) summarize and define business model innovation as “designed, novel, nontrivial changes to the key elements of a firm’s business model and/or the architecture linking these elements." Based on this definition of business model innovation, we use the terms business model innovation and business model change interchangeably in this dissertation.

Table 4. Definitions of Business Modell Innovation

Definition	Reference
“Business model innovation (business model innovation) is about innovating the value creation, delivery, and capture mechanisms of firms to entice customers to pay for value and convert this into profits."	Bocken and Geradts (2020, p. 1)
"Business Model Innovation considers the business model instead of products or processes as the subject of innovation."	Clauss (2017, p. 387)
"Defined as organizational action in "adding new activities, linking activities in novel ways or changing which party performs an activity …."	Clauss et al. (2021, p. 767)
“business model innovation hinges on the three process phases that unfold in collaboration with the customers: value proposition definition, value provision design, and value-in-use delivery.”	Sjödin et al. (2020, p. 158)
“business model innovation can be interpreted as the deliberate process of reconfiguring one or more components underlying the business value logic for the company, its customers, and the other stakeholders …."	Ciampi et al. (2021, p. 6)
“… designed, novel, and nontrivial changes to the key elements of a firm’s business model and/or the architecture linking these elements.”	Foss and Saebi (2017, p. 17)

Foss and Saebi (2017) developed a typology to classify different forms of business model innovation, differentiating the axes’ scope and novelty, as depicted in Table 5. It classifies innovation as new to the firm or new to the industry to distinguish the degree of novelty. Decomposing the business model in multiple interdependent subsystems (e. g. value creation, value delivery, value capture), a modular innovation only involves changes in a single subsystem, e. g. a new payment model. Instead, an architectural innovation changes multiple such subsystems, particularly their interdependencies. The four types comprise evolutionary, adaptive, focused, and complex innovation. Evolutionary and adaptive innovations are not necessarily new to the industry but innovative to the firm. While evolutionary business model innovation refers to fine-tuning individual business model subsystems, adaptive business model innovations represent changes to the whole business model. A focused innovation implies innovation in individual business model subsystems that are also new to the industry. Innovations of the entire business model new to the industry are classified as complex business model innovations.

Table 5. The Business Model Innovation Typology (Foss & Saebi, 2017)

		Scope	
		Modular	**Architectural**
Novelty	**New to the firm**	Evolutionary	Adaptive
	New to the industry	Focused	Complex

Even though business model innovation usually is a recombination of existing business models rather than entirely new ideas (Gassmann et al., 2014, 2019; Magretta, 2002), firms still struggle to change their business model (Teece, 2010). Research finds multiple explanations for this issue. Firstly, the firm must understand its business model before it can be innovated (Chesbrough, 2007a). Secondly, changing the business model requires changing the underlying activity system, implying changes to the fundamental business logic, roles, and responsibilities (Sawhney et al., 2006; Van de Ven, 1986). Innovating products or processes do not need such changes, thus is easier to implement within the organization (Gassmann et al., 2019; Sawhney et al., 2006).

Digital technology opens new opportunities for firms to create value (Bharadwaj et al., 2013; Rai & Tang, 2014; Steininger, 2019). We already saw that digital technologies have enabled new business models, such as digital platforms, that facilitate the scale, scope, and complexity of their operation (Baum & Haveman, 2020) and (re-)define value propositions (Steininger, 2019; Wessel et al., 2021). We term such business model innovations enabled by digital technologies as digital business model innovations if the introduction of digital technologies, such as digital platforms, significantly changes the firm's business model, leading to a new configuration of the business model or a shift in the business model related to IT (Steininger, 2019; Veit et al., 2014). Research on the digital transformation of ecosystems shows relationships and value exchanges alter through digital business models (cf. Riasanow et al., 2018; Riasanow et al., 2017). Thus, the complexity and speed of digital innovation and the pace of change in digital ecosystems reinforce the statement that firms must engage in digital business model innovation to stay competitive (El Sawy et al., 2010; Sosna et al., 2010).

2.3 Antecedents of Digital Business Model Innovation

Besides the emergence of digital innovations enabling new business model configurations, firms since various changes as antecedents of digital business model innovation. Digital business model innovation can originate outside and inside the focal firm (Demil & Lecocq, 2010).

The inside perspective is less researched when linked directly to digital business model innovation. However, most of the theories related to innovation and firm adaptivity (e.g., dynamic capabilities, organizational learning, absorptive capacity) also apply to business model innovation. For example, the entrepreneurial skills of managers influence the firm’s ability to sense opportunities for seizing business model innovation (Sosna et al., 2010). Sensing and seizing opportunities, as higher-order dynamic capabilities (Teece, 2007), are elementary to innovation. As the business model reflects the firm’s hypothesis about its customers’ needs and behaviors, firms, on the one hand, need to sense changes in these needs and behaviors to make new hypotheses about future needs (Teece, 2010). On the other hand, these new customer needs must be addressed, and the business model needs to be changed. The opportunity or need to react to change needs to be seized. Firms thus need strong dynamic capabilities to sense and seize business model innovation (Teece, 2018a).

The theory of dynamic capabilities further relates to the firm's market orientation, which is an antecedent to innovation in general (Jaworski & Kohli, 1993; Slater, 1997). The innovation management literature further introduced the concept of innovation capacity associated with dynamic capabilities. It refers to a firm’s capability to adopt and implement novel ideas into product and process innovations but is equally applicable to business model innovation (Hurley & Hult, 1998). The research suggests, that the higher this innovation capacity, the more likely firms are able to gain competitive advantages from the creation of innovations (Hurley & Hult, 1998). However, seizing an opportunity based on an untested hypothesis of changed customer needs is associated with uncertainty and risk-taking. Thus, decision-making is essential to business model design and influences whether a firm seizes business model innovation (Demil & Lecocq, 2010; Purkayastha & Sharma, 2016). As there is no explicit link between dynamic capabilities and business model innovation in existing research, but it is supposed to be evident. Teece (2018a, p. 48) summarizes that research on business model innovation will also advance the theory of dynamic capabilities, "even if such studies do not explicitly locate themselves within the dynamic capabilities."

Antecedents of business model innovation that originate outside the firm are more prevalent in empirical research. The main drivers of business model innovation are the aforementioned digital innovations resulting in new technologies, enabling new business models, and ecosystem-level changes in the overall market (de Reuver et al., 2009; Lambert & Davidson, 2013). The ecosystem plays a significant role as different actors become more interconnected in value creation, thus influencing each actor's business model design and triggering business model innovation (Ferreira et al., 2013; Miller et al., 2014; Riasanow et al., 2020). This also causes shifts in bargaining power towards customers, and competitive forces arise through business model innovation of competitors or new entrants, such as startups, that enter ecosystems with new, innovative business models (Gambardella & McGahan, 2010; Johnson et al., 2008). The focal firm then responds with business model innovation (Doz & Kosonen, 2010).

A significant driver of these ecosystem changes are digital innovations that alter the established industry logic (Pateli & Giaglis, 2005; Riasanow et al., 2020; Sabatier et al., 2012; Voelpel et al., 2004; Wirtz et al., 2010). Digital innovations create opportunities and necessities for firms to use the affordances created by new digital technologies to improve or redefine their business model (Foss & Saebi, 2017; Pateli & Giaglis, 2005; Teece, 2010, 2018b; Wirtz et al., 2010). For example, an important trend in industrial companies triggered by digital innovation is servitization, i.e., product-oriented firms are becoming service providers that no longer sell a product but a service that delivers the value of product use (Weking et al., 2020). Although the importance of digital technologies for business model innovation is widely recognized, and research highlights how important business models are for long-term success, little attention has been paid to the antecedents of successful business model innovation (Rai & Tang, 2014). It is, therefore, still unclear which digital technologies lead to a successful business model.

2.4 Outcomes of Digital Business Model Innovation

Since the business model is a source of competitive advantage, firms can create a competitive advantage by innovating the business model (Gassmann et al., 2017; Teece, 2010). The related innovation management literature links innovation to business performance ever since Schumpeter (1934) but also more recently, e.g., by Han et al. (1998) and (Nwankpa & Roumani, 2016). Tidd (2001) acknowledges the competitive advantage achieved by innovation and links expected advantages to the degree of innovation. Prime examples like Netflix (from renting DVDs to streaming movies online), Apple (e.g., creating a digital platform for mobile applications), or Xerox (from selling copy machines to providing copying as a service) owe much of their success and competitive advantage to their business model innovations (Gambardella & McGahan, 2010). Consequently, much of the research on outcomes of business model innovation focuses on these coherent effects: financial performance and competitive advantage.

Performance implications of business model innovation are a main legitimization for the business model and business model innovation research (Foss & Saebi, 2017). The correlation has primarily been tested on small firms, especially startups, demonstrating that innovative and novelty-oriented business models increase firm performance (Böhm et al., 2017; Cucculelli & Bettinelli, 2015; Haddad et al., 2020; Weking, Böttcher, et al., 2019; Zott & Amit, 2007). However, the correlation was also demonstrated for incumbent firms (Giesen et al., 2007; Malone et al., 2006; White et al., 2022). It is also beneficial for firms to introduce novel business models to the ecosystem rather than replicating the successful business models of others (Aspara et al., 2010; Teece, 2010). This is because the activities underlying the business model are usually hard to copy (Brea-Solís et al., 2015).

As noted earlier, business model innovation causes changes in the ecosystem by introducing new or altering existing value exchanges between actors or creating entirely new roles along the value creation (Riasanow et al., 2020). For example, in retail, the direct-to-consumer business model, such as online shops by manufacturing firms, eliminated intermediates and intermediate resellers. This lowers the cost of the end product, making it more attractive to customers and creating a competitive advantage for the manufacturing firm based on a cost leadership strategy (Gambardella & McGahan, 2010; Porter, 1985). This example also shows how business model innovation disadvantages resellers, forcing them to change their business model (Sawhney et al., 2006).

3 Research Approach

3.1 Pragmatism as Research Paradigm

The analysis of this dissertation's antecedents, design, and outcomes of digital business model innovation follows a pragmatic research paradigm. Pragmatism is a research paradigm emphasizing the practical and usable properties of theories and methods over their abstract and theoretical properties (Creswel & Plano Clark, 2017). Pragmatism concerns how knowledge is generated and applied to address research questions and how knowledge can be continuously adjusted and improved through experience. The philosophy of pragmatism replaces the older philosophy of knowledge that uses the meta-physical concepts of ontology, epistemology, and methodology (Morgan, 2014). However, pragmatism does not reject those philosophical views but argues for integrating and acknowledging their respective values and perspectives (Creswel & Plano Clark, 2017; Morgan, 2014).

Pragmatism emphasizes why and how to study a problem in a certain way. These two perspectives on choices and decisions in the research process are necessary to distinguish pragmatism from its bias of "doing what works." (Morgan, 2014) Therefore, the pragmatic researcher chooses the most appropriate research method, integrating qualitative and quantitative methods for a mixed-methods approach, to answer the defined research questions and create knowledge about how to solve a problem (Feilzer, 2009; Hanson, 2008). In this solution space, pragmatism also acknowledges the uncertainty of knowledge since it is not absolute and is relative to human experience (Tashakkori et al., 2020). Causality is difficult to discern, if it exists at all, and patterns in relationships, structures, and events change (Feilzer, 2009).

In this dissertation, we use qualitative and quantitative research methods to create a mixed-methods design. We use case surveys to create qualitative insights from multiple cases, QCA as a method between qualitative and quantitative methods to create set-theoretic findings from qualitative data, and quantitative methods to test correlations between business model innovation and its outcomes.

3.2 Research Methods

Following the pragmatic paradigm with a qualitative mixed-methods research strategy (Venkatesh et al., 2013), Table 6 shows the main methods used in the core publications of this dissertation. Since we ask research questions about how the phenomenon of digital business model innovation works in real-world examples, we use empirical research methods, namely case surveys (P1, P2, P3, P6), QCA (P1, P2), and quantitative methods (P4, P5). Empirical research usually aims to find a general explanation that can be applied to a population of cases over a period of time. Its goal is to gain new insights and explanations into how the world actually works (Bhattacharya, 2008). This dissertation aims to explain how digital business model innovations work in firms. Due to the research methods (i.e., case survey and quantitative methods), these explanations are also generalizable to a larger population of firms than those explicitly studied. The observation and analysis of qualitative case information in case surveys and interviews are methods from the natural sciences (Siponen & Klaavuniemi, 2021). Therefore, our research approach is comparable to research methods used in the natural sciences

(Bhattacharya, 2008). While each paper includes a detailed description of the methods and data sources used, the methods are briefly explained below.

Table 6. Research Methods

#	Title	Case Survey	QCA	Quant. Methods
P1	Pathways to Digital Business Models: The Connection of Sensing and Seizing in Business Model Innovation	●	●	
P2	The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail	●	●	
P3	Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability.	●		
P4	Enter the Shark Tank: The Impact of Business Models on Early Stage Financing			●
P5	Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks			●
P6	The Good, the Bad, and the Dynamic: Changes to Retail Business Models During Covid-19	●		

3.2.1 Case Survey

The case survey method bridges the gap between "nomothetic surveys and idiographic case studies to combine their respective advantages of generalizable cross-sectional analysis and in-depth, process analysis" (Larsson, 1993, p. 1515). The method aggregates results from a medium-sized sample of qualitative cases to discover generalizable patterns.

The original approach proposed by Larsson (1993) collects published case studies from academic sources. In research areas where case study research is prevalent, such as business model and business model innovation research, this approach is appropriate for the aggregation of existing findings and discovering emerging patterns. To identify relevant publications, it is recommended to follow the approach suggested for structured literature reviews, for example, by Webster and Watson (2002), by defining search terms for the database search as well as inclusion and exclusion criteria for the provided case information in order to select relevant case studies from the results of the database search to create a structured and reproducible dataset. We followed this approach for **P1**, and **P2**. For **P3**, we collected the primary case data by conducting semi-structured interviews with 15 startups, each representing a single case. In **P6**, we relied on publicly available information on a theoretically defined case sample following Floetgen et al. (2021).

For data analysis, Larsson (1993) proposes a quantitative approach using statistical methods such as correlation analysis, regression analysis, or cluster analysis. This involves defining a survey instrument with information to be collected and constructs to be measured and creating a quantitative model of independent and dependent variables to test previously formulated hypotheses (Jurisch et al., 2013). Because we followed exploratory research paradigms in **P1-P3** and **P6**, we did not define hypotheses for the case analysis. In **P2**, we defined the constructs we wanted to extract from the case studies. These constructs served as input for a QCA to identify configurations that describe patterns in the cases. In **P1**, **P3**, and **P6**, we used inductive coding methods from grounded theory to discover aggregate dimensions in the data (Gioia et al., 2012). These dimensions then served as input for subsequent QCA (Ragin, 1987) in **P1** and for further qualitative cross-case comparisons (Eisenhardt, 1989) in **P3** and **P6**.

3.2.2 Qualitative Comparative Analysis

QCA was introduced by Ragin (1987) and has its roots in set theory. QCA bridges qualitative and quantitative research methods, thereby increasing the "confidence" in the results (Duşa, 2007). QCA is an appropriate method to answer our research questions because in QCA, combinations of conditions influence the outcome, for example, which combinations of changes promote business model innovation (Soto Setzke, Böhm, & Krcmar, 2020). Similar to a case study, a QCA aims to derive cause-effect relationships based on case analysis. Instead of correlations that support variance-based methods, QCA uses Boolean algebra and configuration relationships to find configurations of conditions that lead to a particular outcome (Ragin, 2009). Conditions in QCA are what are called independent variables in variance-based methods. Thus, the outcome in a QCA represents the dependent variable. Unlike correlation-based methods, QCA does not assume symmetric effect sizes on an outcome variable (Ragin, 1987). Instead, the resulting configurations represent combinations of conditions that lead to an outcome. It follows that QCA accounts for asymmetric relationships: While the presence of a condition in one configuration may lead to the desired outcome, the absence of that condition in combination with other conditions in another configuration may also be necessary for the outcome. Consequently, the solution quality of a QCA cannot be evaluated with significance levels. The corresponding values are consistency and coverage. Consistency indicates the proportion of similar cases that lead to the same result. Coverage indicates the relevance of the configurations for an outcome (Fiss, 2007).

QCA can be used for any sample size and is based on many data collection methods, such as interviews for small n-samples and surveys for large n-samples (Soto Setzke, Kavili, & Böhm, 2020). In this dissertation, QCA is based on case studies that analyze qualitative data from published case studies and other public data sources. In this qualitative approach based on in-depth case knowledge, QCA involves six steps (Mattke et al., 2022; Soto Setzke, Böhm, & Krcmar, 2020). Once data are collected, they must be coded and calibrated. Based on this coding, QCA can be divided into several "flavors." Fuzzy-set QCA (fsQCA) uses fuzzy-coded data. Values can range from zero to one, where one indicates full membership in a set and zero indicates complete absence from a set (Ragin, 2009). Crisp-set QCA (csQCA) uses binary-coded data to indicate either the membership or absence of a condition for a particular case (Rihoux & De Meur, 2009). In **P1**, we used csQCA and coded whether a particular antecedent was sensed before the firm embarked on a digital business model innovation. As a third variant, multivalued QCA (mvQCA) uses dichotomous encoding of conditions (Vink & Van Vliet, 2009). This allows multiple factorial values to be encoded for a condition. We used mvQCA in **P2** to code which of the three steps of the customer journey (i.e., pre-purchase, purchase, and post-purchase stage) and which of the two elements of the business model (i.e., value proposition and value chain) were changed as part of the digital transformation initiative. In the second step, the coded data is analyzed and checked for necessary conditions (Soto Setzke, Kavili, & Böhm, 2020). Necessary conditions exclusively explain the existence of the result. Therefore, they must be considered and discussed separately. The third step is creating the truth table from the calibrated data set. The truth table lists all possible configurations and their empirical observations in the data set. All configurations for which there are no empirical observations are called logical remainders and should be discussed, regardless of whether there are theoretical or practical reasons why they were not observed or whether it is a limitation of the data set (Schneider & Wagemann, 2010).

In the fourth step, the truth table is minimized by Boolean logic to determine sufficient configurations to explain the existence of the result. For this minimization, the frequency and consistency threshold must be defined (Mattke et al., 2022). The frequency threshold depends on the size of the case sample. In both **P1** and **P2**, we set this threshold to one due to the mean sample size. A low frequency threshold also allows us to identify configurations that are represented by only a few cases but may be theoretically relevant and interesting configurations, such as edge cases or emerging business models. The consistency threshold should be at least 0.75 to ensure the validity of the configurations (Mattke et al., 2022; Schneider & Wagemann, 2010). In minimization, the researcher can choose between three levels of minimization that lead to complex, intermediate, or simple solutions. These solutions differ in how much the minimization incorporates logical residues into the solution. The complex solution does not include logical residues and thus provides the most detailed representation of the data, while the parsimonious solution includes logical residues and thus provides the simplest solution. According to Fiss (2011), it is best to combine the intermediate and parsimonious solutions by computing both to distinguish between core and boundary conditions. Core conditions are present in the intermediate and parsimonious solutions, while peripheral conditions are present only in the intermediate solution. In both **P1** and **P2**, we follow this approach of Fiss (2011).

Step five of QCA then involves visualization of the results. While early QCA work used set-theoretic formulation of solutions, Fiss (2011) introduced the common practice of using configuration tables with symbols indicating the presence, absence, and necessity of conditions, where the size of the symbols distinguishes whether the condition is a core or a boundary condition. Such tables can be found in both **P1** and **P2**. In addition, **P2** uses the visualization of the configurations in a Venn diagram that illustrates the overlapping conditions that make up the configurations. In the final sixth step, the solution is tested for robustness by changing the thresholds used in the minimization. This shows the solution's dependence on the chosen threshold and how it can change with different data.

3.2.3 Quantitative Methods

Quantitative methods are beneficial for establishing relationships and generalizing about a large sample population. They provide objective and reliable results and reduce the potential for researcher bias by providing numerical evidence to support or reject hypotheses (Backhaus et al., 2021). We use quantitative methods as part of RQ3 in **P4** and **P5** to test the correlation between business model innovation and firm performance. Using quantitative methods in these two publications allows us to make generalizable and statistically supported claims about the performance outcome of digital business model innovation. We use two different methods in **P4** and **P5**.

In **P4**, we tested the correlations between applied business model patterns as building blocks of the complete business models of startups and the received seed investment as a performance proxy. The correlation tests provide a coefficient as a measure of the strength and direction of the correlation (Backhaus et al., 2021). Hence, it allowed us to identify business model patterns with positive and negative effects on firm performance. In **P5**, we tested our hypothesis with a correlation analysis inspired by the event study research design (Bromiley et al., 1988). We measured the effect of events induced by digital business model innovations of FinTech startups on the performance of incumbents. We used a one-tailed t-test to test our hypothesis (Backhaus et al., 2021), stating that incumbents experience adverse performance effects from the success of digital business model innovations.

Part B

4 P1: Pathways to Digital Business Models: The Connection of Sensing and Seizing in Business Model Innovation

Table 7. Fact Sheet Publication P1

Authors	**Böttcher**, Timo Phillip[1] **Weking,** Jörg[1,2] **Hein,** Andreas[1] **Böhm,** Markus[3] **Krcmar**, Helmut[1]
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Outlet	**JSIS** Journal of Strategic Information Systems
Status	**Published** (Runner-Up JSIS Best Paper Award 2022)
Contribution of First Author	Problem Definition, Research Design, Data Collection, Data Analysis, Interpretation, Reporting

Abstract. Digital business model innovation (business model) is critical to achieving and sustaining competitiveness in technology-driven environments. In those environments, firms must not only sense changes to identify opportunities but also effectively seize them in business model. Therefore, sensing and seizing cannot be considered as isolated dynamic capabilities, but must be combined for successful business model. However, research on sensing and seizing does not offer compelling suggestions for firms that struggle with connecting both while pursuing digital business model. We use qualitative configurational analysis (QCA) to analyze a sample of 49 case studies on digital business model to identify the antecedents that firms sense before seizing these changes with digital business model. Based on ten configurations of sensing (represented by six antecedents) and seizing (represented by four business model types), we explain the relationship between sensed antecedents and seized digital business model. In addition, we derived four variables that explain "what" and "how" firms connect sensing and seizing. Based on the sensing-seizing connection, we introduce consolidating business model as a new type of business model unique to the digital context. This novel type enables firms to exploit and explore new business models and subsequent digital business models through the means of digital infrastructure. This study extends the understanding of how different business models emerge and how firms create digital business models

5 P2: The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail

Table 8. Fact Sheet Publication P2

Authors	**Böttcher**, Timo Phillip[1] **Kersten,** Tanja[1] **Weking,** Jörg[2] **Hein,** Andreas[1] **Krcmar**, Helmut[1]
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Outlet	**HICSS 2023** 56th Hawaii International Conference on System Sciences
Status	**Published**
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. As brick-and-mortar retail increasingly disappears while online retail flourishes, the customer experience (CX) becomes a critical source of competitive advantage. Customers expect the same information, personalization, and availability in a brick-and-mortar store as they do online. While digital technology enables such CXs and enhances the advantage of the physical experience, brick-and-mortar retailers struggle with the complexity of these digital transformations. We analyze 38 cases of retailers implementing digital transformations to create digital CXs by conducting a qualitative comparative analysis. In eight expert interviews, we refine our understanding of CX in retail and discuss the validity and generalizability of the three resulting configurations: value chain innovation, seamless purchase experience, and personal experience. They provide actionable pathways to digital CX representing individual transformation initiatives. Since the configurations overlap strongly, we discuss the necessity to combine the three configurations to implement digital CX across all phases of the customer journey and business model.

6 P3: Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability.

Table 9. Fact Sheet Publication P3

Authors	**Böttcher**, Timo Phillip[1] **Petry,** Jana[2] **Weking,** Jörg[3] **Hein,** Andreas[1]
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Outlet	**HICSS 2023** 56th Hawaii International Conference on System Sciences
Status	**Published**
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. We need innovations that enable sustainable economies and sustainable private consumption to meet the grand challenges of the UN Sustainable Development Goals. As an essential source of innovation, startups play a crucial role in improving sustainability by creating innovative and sustainable products and services as part of their business models (business models). Since business models are at a firm's core, business models are a decisive factor that influences whether startups fail or thrive; we analyze the success factors of sustainable business models. We interviewed 16 experts from 15 startups implementing sustainable business models based on digital technologies and one incubator specializing in sustainability. We identify six success factors representing tensions in digital business model design that entrepreneurs need to address. Our analysis shows how the design of sustainable digital business models differs from regular digital business models and how the tensions affect the success of startups. For established firms, the results guide business model design and technology use.

7 P4: Enter the Shark Tank: The Impact of Business Models on Early Stage Financing

Table 10. Fact Sheet Publication P4

Authors	**Böttcher**, Timo Phillip[1] **Bootz**, Valentin[1] **Zubko**, Tetiana[1] **Weking,** Jörg[1] **Böhm**, Markus[1] **Krcmar**, Helmut[1]
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Outlet	**WI 2021** 16th International Conference on Wirtschaftsinformatik, 2021, Essen, Germany
Status	**Published**
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. Investments are the necessary fuel for startup development. However, new ventures face difficulties in obtaining financial investments. The investors aim to invest in startups with high success chances and quick return on investment. The business model (BM) of a startup was proven to be a determinant of its success. However, there is a lack of research on the influence of the BM on the amount of received seed funding. This study analyzes the BMs of 72 startups and the amount of received seed investment. We applied Pearson's product- moment correlation tests to calculate the correlation between these variables. Our research shows a correlation between the BM and the amount of received seed investment. We identify the patterns Two-Sided Market, Layer Player, and Freemium to have a significant positive effect on the investment sum. This research guides entrepreneurs in BM design and contributes to the discussion of success factors for startup success.

8 P5: Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks

Table 11. Fact Sheet Publication P5

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Outlet	**PACIS 2021** Pacific Asia Conference on Information Systems, 2021, Virtual
Status	**Published**
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. Startups play a significant role in the digital transformation of ecosystems. In the financial ecosystem, these startups are called FinTechs, a term representing the combination of financial services and digital technology. Technological innovations, such as artificial intelligence and blockchain, enable disruptive innovations in the financial ecosystem, potentially replacing incumbent firms. Based on this disruptive potential, we hypothesize negative repercussions of FinTech success on incumbent banks. We conduct an event study of 152 European FinTech funding rounds in 6 years to test our hypotheses. We test the repercussions of these events on the market capitalization of 30 incumbent European banks. The results support our hypothesis that FinTechs' funding rounds have negative repercussions on incumbents' market capitalization. Our quantitative results show that the success of FinTechs challenges investors' expectations of the future success of incumbents. Hence, incumbents must invest in digital services themselves or collaborate with FinTechs.

9 P6: The Good, the Bad, and the Dynamic: Changes to Retail Business Models During Covid-19

Table 12. Fact Sheet Publication P6

Authors	**Böttcher**, Timo Phillip[1] **Weking,** Jörg[1] **Krcmar**, Helmut[1]
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Outlet	**Bled eConference 2022** 35th Bled eConference, 2022, Bled, Slovenia
Status	**Published** (Outstanding Paper Award, Bled eConference 2022)
Contribution of First Author	Problem Definition, Research Design, Data Collection, Interpretation, Reporting

Abstract. Crises, such as the COVID-19 pandemic, challenge the economy and require firms to become resilient to external change. During COVID-19, the retail industry faced double-edged consequences. While brick and mortar business models (business models) were discontinued, online retail thrived. Extant business model research has investigated several crises; however, it still lacks an explanation of how business model innovation increases resilience to cope with crises. We analyze the business models of 45 European retailers and the business model innovations implemented during the COVID-19 pandemic and their influence on the retailers' revenue. We identify three types of retailers implementing different strategies to cope with the crises: the »good,« the »bad,« and the »dynamic.« These represent resilient business models, un-resilient business models, and business models becoming resilient enabled by digital technology. We show how business model innovation creates resilience and performance benefits. For practice, we show how retailers adapted their business model to a crisis leveraging digital technology.

Part C

10 Summary of Results

In six papers, this dissertation addresses three research questions about the antecedents, design, and outcomes of digital business model innovation. This chapter summarizes the results from the contributions to answering the three research questions. Table 14 provides a summary of the results of this thesis.

RQ1: What is the connection between sensed antecedents and seized digital business model innovation?

Pathways to Digital Business Models. Based on a qualitative case survey of 49 published case studies on digital business model innovation, we identified six antecedents for firms to innovate their business models with digital technology. We used QCA to identify configurations of the six antecedents that lead to different types of business model innovations (P1). The main finding is that creating different types of digital business model innovation depends on the interaction of sensing and seizing capabilities manifested in the combination of four variables: context, attention, resources, and strategic orientation. In addition, we identify a fifth type of business model innovation that is unique to the digital context in that it consolidates the firm's digital infrastructure to enable future digital business model innovations. Surprisingly, we did not find that technological innovation enables complex business model innovation.

RQ2: What are design decisions when seizing digital business model innovation?

Interdependencies between Customer Journey, Business Model, and Technology. By conducting QCA on a sample of 38 cases of digital transformation initiatives in retail and eight expert interviews to verify the configurations, we identify three interconnected and overlapping innovation paths that combine customer journey, business model, and digital technology to improve digital customer experiences in brick-and-mortar retail (P2). The three resulting configurations are, first, *value chain innovation*, second, *seamless purchase experience*, and third, *personal experience*. Value chain innovations represent technology implementations in the pre-purchase stage and changes in the business model's value chain. Seamless purchase experiences combine technology implementation in the pre-purchase and purchase stages. Personal experiences combine the absence of technology implementations in the pre-purchase and purchase phases, with the enhancement of the value proposition without technology to create customer experiences. In sum, they offer actionable paths to digital customer experience that represent individual transformation initiatives.

Tensions in Digital Business Models for Sustainability. We interviewed 15 startups using digital business models for sustainability and an expert from a startup incubator to identify six success factors for designing business models that are nevertheless at odds with economic and environmental success (P3). First, the firm's and the team's purpose must be aligned with an overall sustainable goal. Second, firms must understand their customers' internal and external motivations to engage in sustainability. Third, value creation must balance economic, environmental, and social values without neglecting or overemphasizing one over the other. Fourth, digital technology plays an ambivalent role that must be managed. Fifth, selling a sustainable product or service should target specific audiences rather than broad ones. Sixth, firms must find suitable investors; in particular, they must choose between commercially oriented and impact-oriented investors.

RQ3: What are the specific outcomes of digital business model innovation?

Impact of Business Models on Startup Financing. Based on Pearson product-moment correlation tests with 72 startups, we identified business model patterns that correlate with higher or lower funding amounts for startups (P4). The business model patterns *Two-Sided Markets* and *Layer Player* have significantly favorable effects on startup investment amounts at a confidence interval of 95%, and the pattern *Freemium* has a significantly positive effect on investment amounts at a confidence interval of 90%. In addition, the higher-level *Value Network* pattern shows a strongly significant positive effect on startup funding amounts at a confidence interval of 99%.

Repercussions of New Digital Business Models on Incumbent Business Models. Based on an event study of 152 European FinTech funding rounds over six years, we find statistical confirmation for our hypothesis that the successful entry of new actors negatively affects the financial performance of incumbent firms in the financial ecosystem (P5). We find that the stock prices of incumbent firms increase by +0.0074% on average daily on days when a new round of financing is announced by a FinTech firm, while they decrease by -0.1728% on average daily. The one-sided t-test shows a significant difference in the daily changes on regular and event days, supporting our hypothesis that the announcement of funding rounds of FinTechs negatively impacts the stock price of incumbent banks.

Impact of Business Model Change During Covid-19. Based on changes in retailers' business models and sales during the COVID-19 pandemic, we identify three types of business models with different financial outcomes and describe the resilience of each type based on its application of digital technology (P6). First, we identified 265 individual retailer business model changes during COVID-19, which can be summarized into 12 patterns of business model changes during the pandemic. Based on the business model changes, we identified three business models: the good, the bad, and the dynamic. The good business models are inherently resilient to the crisis and benefited with an average year-over-year revenue increase of +36.92%. The bad business models had to scale back parts of their business model, resulting in an average year-on-year revenue decline of -35.29%. The dynamic business models used digital technology to adapt their business model to the changing environment and inherent constraints, resulting in an average year-on-year increase in revenue of +7.66%.

Table 13. Overview of Key Results

#	RQ	Findings *
P1	RQ1	– Creating different types of digital business model innovation depends on combining the four variables context, attentionality, resources, and strategic orientation. – There is a fifth type of business model innovation in extension to the four ideal types identified by (Foss & Saebi, 2017), that is unique to the digital context as it consolidates the firm's digital infrastructure to enable future digital business model innovation. – Sensing and seizing capabilities interact to influence the creation of digital business model innovations along the four previously mentioned variables. – Technology innovation is not found to enable complex business model innovation.
P2	RQ2	– Innovation paths to digital customer experience combine the customer journey, the business model, and digital technology. – The three innovation paths are interconnected and thus can be implemented individually, but their combination is required to create digital customer experiences. – The three innovation paths are value chain innovation, seamless purchase experience, and third, personal experience. – Value chain innovations combine technology implementations in the pre-purchase stage and change the business model's value chain. – Seamless purchase experiences combine technology implementation in the pre-purchase and purchase stages. – Personal experiences combine the absence of technology implementations in the pre-purchase and purchase phases, with the enhancement of the value proposition without technology to create customer experiences.
P3	RQ2	– The successful business model design for business models for sustainability depends on six design decisions that imply tensions that need to be resolved by management. – Firm vision and team motivation need to be aligned with the overall sustainable goal. – Firms must understand their customers' internal and external motivations to engage in sustainability. – Value creation must balance economic, environmental, and social values without neglecting or overemphasizing one over the other. – Digital technology plays an ambivalent role that must be managed. – Selling a sustainable product or service should be targeted to specific audiences rather than a broad audience. – Firms must find suitable investors, deciding between economically and impact-oriented investors.
P4	RQ3	– Business model patterns correlate with higher or lower funding amounts for startups. – Two-Sided Markets, Layer Player, and Freemium business model patterns have significantly positive effects on startup investment amounts. – The higher-level Value Network pattern has a positive effect on startup funding amounts.
P5	RQ3	– The successful entry of new actors negatively affects the financial performance of incumbent firms in the ecosystem. – While the share prices of established firms rise slightly every day on average days, they fall on days when new market participants announce new financing rounds.

Table 13. Overview of Key Results

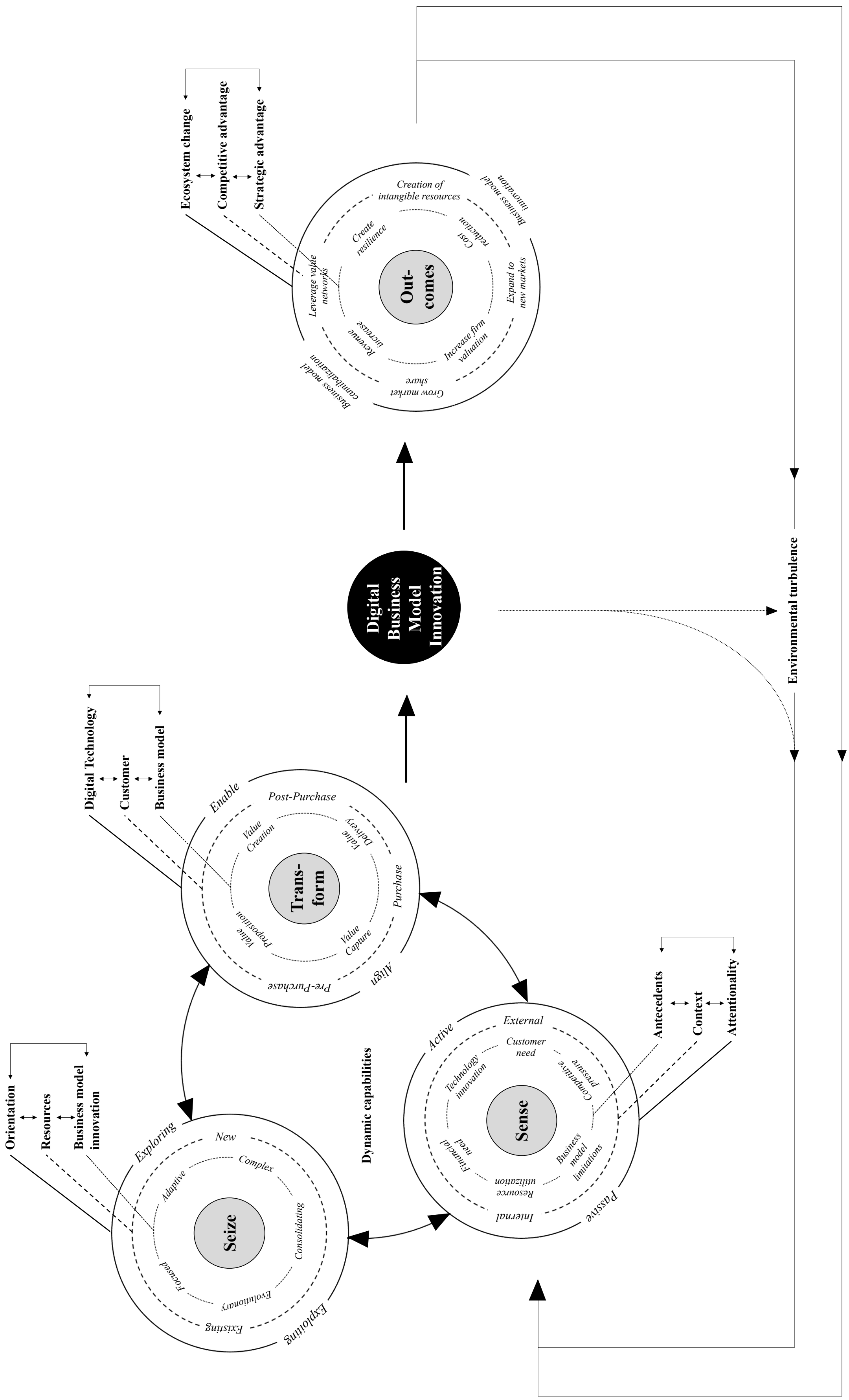
		– This difference is significant, confirming the hypothesis that the announcement of funding rounds of new entrants negatively impacts the stock price of incumbent firms.
P6	RQ3	– The design of business models affects the resilience of firms. – Digital business model change can increase firm resilience. – Digital business models were more resilient during COVID-19, and digital business model change positively impacted firm resilience during COVID-19. – Retailers that successfully changed their business model to become more resilient during COVID-19 used digital technologies to create digital customer experiences and interact with their customers digitally.
* Partially taken from the respective embedded and published publications.		

11 Discussion

In 2010, El Sawy et al. (2010) introduced the phenomenon of digital ecodynamics, describing the perspective that there are three-way interdependencies between digital technologies, environmental change, and a firm's dynamic capabilities. Considering these three elements in nexus, the authors suggest that research is more capable of explaining the strategic advantage and firm performance in turbulent environments (El Sawy et al., 2010). This dissertation adopts this perspective to explain why and how firms respond to change with various forms of digital business model innovations and how they benefit from these innovations. Therefore, we identified three research gaps and asked three research questions accordingly. First, we asked how and why firms innovate their business model in different ways; second, why it is difficult for firms to change their business model and what design decisions need to be made; and third, what are the outcomes of business model innovation for firms to justify why they should engage in digital business model innovation. Overall, these questions aim to improve our understanding of digital business model innovation by clarifying the process of business model innovation, explaining why different business models emerge in similar contexts, why firms benefit differently from digital business model innovation, and ultimately guiding firms in their digital business model innovation efforts.

We conducted six research studies to answer these questions, which are presented and discussed in the six publications included in this dissertation. Figure 2 illustrates the summarized results and guides the following discussion of the implications of this dissertation. Based on our results, we developed a configurational understanding (Park & Mithas, 2020) of the business model innovation process based on the dynamic capabilities theory (Eisenhardt & Martin, 2000; Teece et al., 1997). This configurational perspective contrasts the linear and correlational perspectives on innovation, as illustrated in Foss and Saebi (2017). By discussing each step of the business model innovation process as a configuration of several elements, our perspective explains how firms manage the complexity of digital ecodynamics (El Sawy et al., 2010; Solaimani et al., 2018; Vatankhah et al., 2023). The process view extends the literature focusing on the design of digital business models for the change and implementation of a new digital business model (Casadesus-Masanell & Ricart, 2010; Verhagen et al., 2023) that explains the emergence of different business models and varying economic outcomes of business model innovation (Foss & Saebi, 2017, 2018; Verhagen et al., 2023).

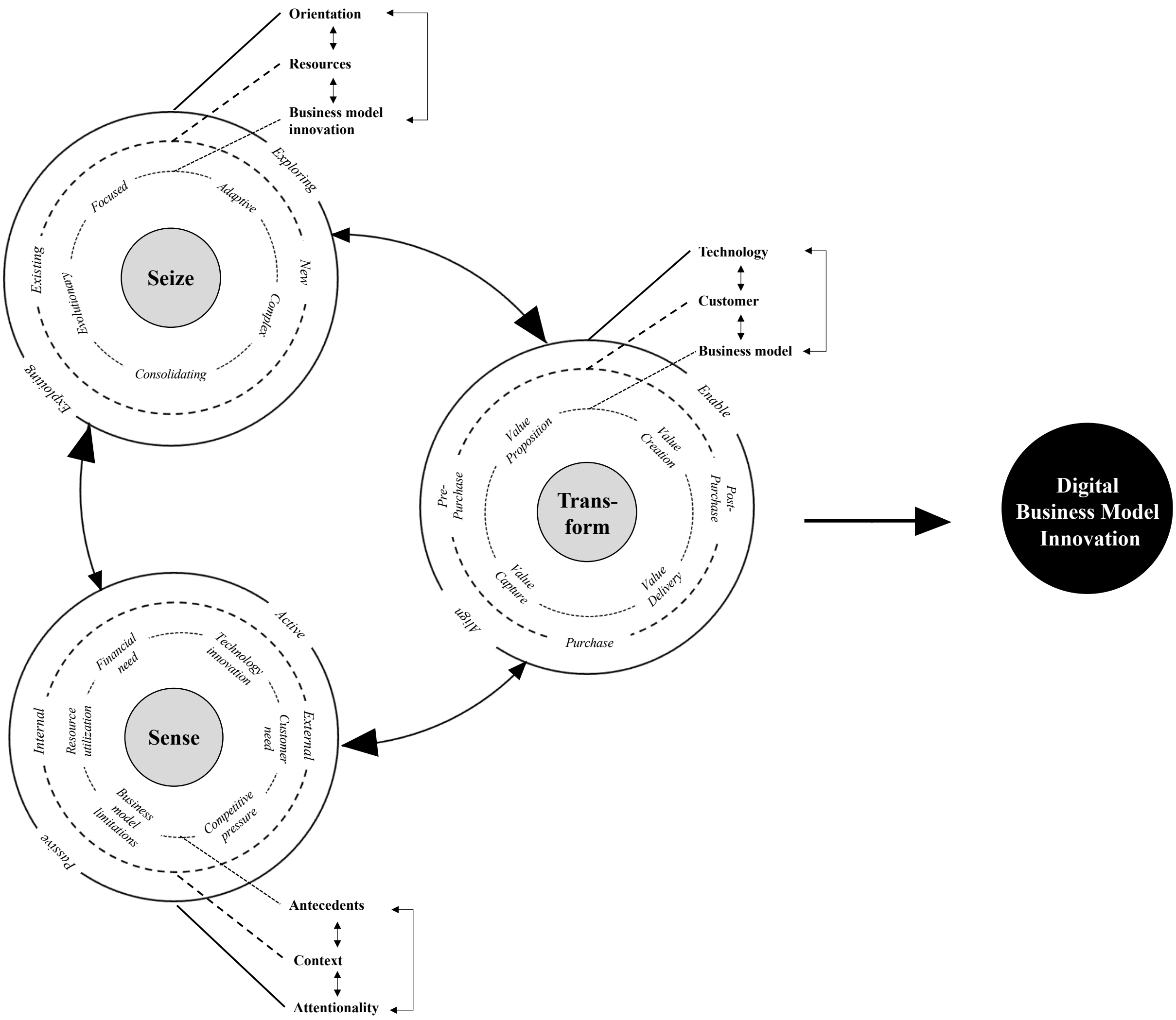
Figure 2. The Configurational Process of Digital Business Model Innovation



11.1 A Configurational Perspective on Dynamic Capabilities for Digital Business Model Innovation

Digital business model innovations are tightly coupled to the firm's dynamic capabilities (Teece, 2010, 2018a). Dynamic capabilities enable a firm to sense opportunities and threats emerging from internal changes or environmental turbulences, seize them or respond to threats by innovating their business model, and transform their resources accordingly (Teece, 2007, 2018a). These three dynamic capabilities govern the firm's other organizational capabilities, such as its IT capabilities (Teece, 2014). Therefore, they are responsible for the firm's sustained competitive advantage and achieving positive outcomes from digital business model innovation (Peteraf et al., 2013; Schwarz et al., 2010; Steininger et al., 2022).

Figure 3. A Configurational Perspective on Dynamic Capabilities for Digital Business Model Innovation



While the three core dynamic capabilities (i.e., sense, seize, transform) are logically engaged in a linear order, change must be sensed before it can be seized, and then resources are transformed accordingly, P1 shows that the sense and seize capabilities are interrelated, and the existing literature provides arguments that this is true for all three dynamic capabilities (Brown & Eisenhardt, 1997; Demil & Lecocq, 2010; Kranz et al., 2016; Schaffer et al., 2022). For example, Clauss et al. (2021) demonstrate that different dynamic capabilities affect the change of each business model element differently. Furthermore, research argues that strategic agility as a lower-order dynamic capability (Teece et al., 2016) and continuous experimentation and prototyping of new business models influence the dynamics of business model innovation (Bruni & Comacchio, 2023; Ghezzi & Cavallo, 2020) as well as the firm's performance change achieved through digital business model innovation (Chakravarty et al., 2013; Tallon & Pinsonneault, 2011). We conclude that the three higher-order dynamic capabilities act as a virtuous cycle, as illustrated in Figure 3, ultimately leading to digital business model innovation and producing organizational and ecosystem-level outcomes.

Since the business model is a complex system (Lanzolla & Markides, 2020; Vatankhah et al., 2023; Zott & Amit, 2010), the assumptions of complex systems should also apply to the underlying theory of dynamic capabilities (Teece, 2018a). Complex systems are characterized by hierarchy and division into subsystems and components that can be analyzed individually but have nonlinear interrelationships (Cilliers, 2011; Levy, 2000; Simon, 1991). In what follows, we will discuss these subsystems of dynamic capabilities (i.e., "Sense," "Seize," "Transform") in the context of digital business model innovation and explain how individual components interact in nonlinear configurations to form the central subsystem.

Sensing antecedents for digital business model innovation and using them for digital business model innovation are interconnected to define pathways for different types of business model innovation (P1). How, where, and which antecedents are sensed configures the pathways for using digital business model innovations (P1). Based on P1, this configuration of sensing capability for digital business models is defined by the antecedents ("what"), their context ("where"), and the firm's attentionality ("how") to opportunity and threat perceptions. The antecedents that form the core of the sensing capability are not individually responsible for the business model innovation opportunities, but sensing is a configuration of multiple antecedents. The cognitive output of sensing that projects the path to digital business model innovation is configured by where, internally or externally, and how, actively or passively, firms search for these opportunities.

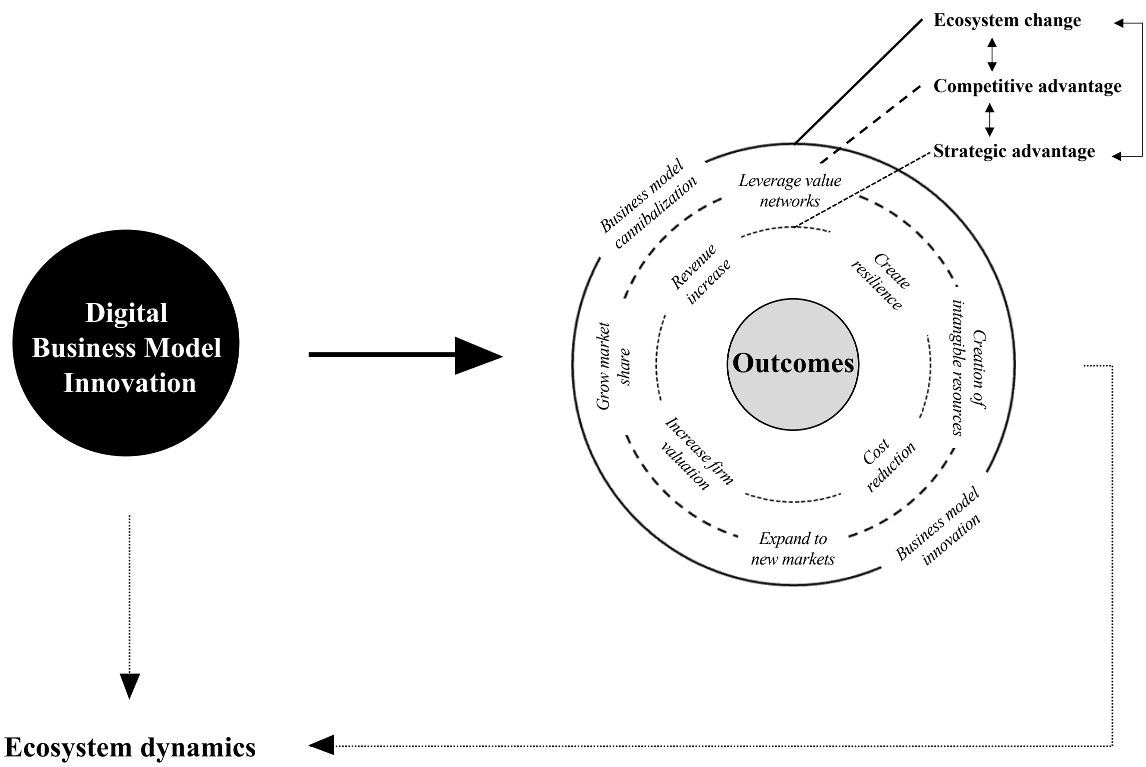
Based on this sensing configuration, the seizing capability is conceived in different configurations, leading to different digital business model innovations. In P1, we identified five pathways to five different digital business model innovation types. Seizing different types of digital business model innovation is dependent on both the configuration of the sensing and the configuration of the seizing that is defined by the use of existing or the creation of new resources ("what") and the strategic orientation towards exploring or exploiting these resources for the new business model ("how").

The type of digital business model innovation to be adopted ultimately determines how and which of the firm's resources will be transformed to implement the new digital business model. At the heart of the transformation are the four core elements of the business model ("what"). Viewing the business model as a complex system, the individual elements are interdependent to form the business model configuration (P3). The transformation of these business model elements is also linked to the customer, represented by the three stages of the customer journey ("when") (i.e., pre-purchase, purchase, and post-purchase) in Figure 2 (P2), and to the digital technology ("how") used to enable a new business model or align the use of digital technology with the business strategy (P2, P3).

11.2 Multi-Layered Outcomes of Digital Business Model Innovation

The primary motivation for firms to innovate digital business models is to achieve better business performance (Foss & Saebi, 2017). In three studies (P4-P6), we analyzed the outcomes of digital business models at the organizational and ecosystem levels to create a multi-layered perspective, shown in Figure 4. We distinguish the achievement of strategic, competitive, and ecosystem change. Again, the three layers and the individual outcomes that can be achieved are configurational and show interdependencies within and between each layer.

Figure 4. Multi-Layered Outcomes of Digital Business Model Innovation



At the strategic advantage layer, digital business model innovation improves the firm's financial performance (Verhagen et al., 2023). Introducing a new digital business model that better meets current customer needs or responds to changing ecosystem realities can increase revenue and company valuation or reduce operating costs, thereby increasing profits (P4, P6). In particular, using digital technologies for business model innovation can increase the resilience of firms (P6). This stems from the possibilities of digital technology to engage with customers (P6) digitally and to create digital customer experiences (P2) that bind customers, for example, through subscription-based business models (P4), to the firm and its business model and thus withstand shocks and crises. Similar research has shown that digital platforms have organizational leverage to pivot the business model in times of crisis, providing the means to be resilient, for example, through new collaborations or targeting new customers (Floetgen et al., 2021).

For sustainable economic success, firms must create competitive advantages by differentiating themselves from the competition through a differently designed or implemented business model. For example, digital business model innovation supports the creation of competitive advantage by developing a new business model that serves new markets (Böttcher & Weking, 2020). By placing digital technologies at the center of the business model, they are easier to scale and expand (Henfridsson & Bygstad, 2013; Woodard et al., 2013). In growing markets, this facilitation offered by digital technology also enables growing market share (Böttcher & Weking, 2020). The retention of customers through digital technologies and digitally-enabled business models described above is an example of the creation of intangible resources (P2, P6) that are critical to creating competitive advantage and competitive differentiation (Barney, 2016), which ultimately leads to taking market share from competitors (Böttcher & Weking, 2020). These intangible resources also include the dynamic capabilities needed to create the digital business model innovation but are also enabled through the exploration of digital innovations (Leidner et al., 2011; Schwarz et al., 2010). These resources and capabilities are essential to maintain a competitive advantage as they make it difficult for competitors to imitate the business model (Brea-Solís et al., 2015). To avoid such imitation, implementing the business model is crucial (Brea-Solís et al., 2015), and creating value networks between multiple actors and business models supports the sustainable advantage (P4).

Creating value networks is one cause of change at the ecosystem level. In digital transformation, ecosystems and relationships between individual actors and their aggregated roles change (Riasanow et al., 2020; Snihur et al., 2018). On the one hand, digital business model innovations create new roles in these ecosystems but also cannibalize old roles and business models (Böttcher & Weking, 2020). The new models are often more profitable or scalable and therefore attractive to investors because of their long-term perspective (P4). In addition, digital business models, such as digital platforms, enable attractive and more favorable value propositions for customers (Khanagha et al., 2020; Teece, 2018b; Zhao et al., 2020). However, they render other business models obsolete either by triggering a reconfiguration of the value exchange in the ecosystem (Hinings et al., 2018; Riasanow et al., 2020) or by originating on the strategic and competitive advantage of the new digital business model being more attractive to customers and partners. Thus, they negatively impact the performance of incumbent business models (P5) and eventually replace the incumbent firm (Bower & Christensen, 1995; Christensen, 1997; Snihur et al., 2018).

11.3 Creating Turbulence in Digital Ecodynamics Through Digital Business Model Innovation

Following the discussion on the outcomes of digital business model innovations, especially at the ecosystem level, these outcomes can be related to the antecedents of digital business model innovations discussed at the beginning. This connection or feedback loop is illustrated in Figure 2 by the two connection arrows at the bottom of the figure. By combining organizational and ecosystem perspectives as configurations (El Sawy et al., 2010) of both antecedent and outcome of digital business model innovation, we can better understand the entire digital business model innovation process.

While other research streams related to digital business model innovation, such as information systems strategy and alignment (Park & Mithas, 2020) or platform research (Sandberg et al., 2020), account for ecosystem complexity, business model research to date mainly isolates business models from the influences of and on their ecosystem. Even though the business model concept has been used in research on value networks, this perspective has not incorporated dynamics and interdependencies (Bogers et al., 2019). Instead, business model research has focused on the organizational view (Adner, 2016; Riasanow et al., 2020).

It is argued that digital transformation, unlike IT-based transformations that are limited to individual organizations and focus on business processes, impacts the firm's ecosystem (Vial, 2019). Also, digital business model innovation is a central element of a firm’s digital transformation, hence arguably having the same impact (Vial, 2019; Wessel et al., 2021). By digitally innovating its business model, a firm’s value creation changes lead to environmental turbulence (P4, P5). The traditional value-creation process becomes obsolete with intertwined processes (Coltman et al., 2015), creating complex ecosystems (Riasanow et al., 2020). Hence, a focal firm’s digital business model innovation creates turbulence in the ecosystem by evoking different responses and consequences for other actors’ business models (cf., Hinings et al., 2018; Snihur et al., 2018).

Other firms sense these external changes and consequences for the sustainability of their business model and firm performance and may seize the emerging opportunity for digital business model innovation (P1). As discussed, firms must sense such changes and evolve within the digital ecodynamics by forming and using dynamic capabilities to sustain or gain a competitive advantage (El Sawy et al., 2010; Tanriverdi et al., 2010; Teece, 2018b; Teece et al., 2016). Thus, a firm's digital business model innovation is an antecedent that can be sensed and seized for digital business model innovation (cf., Steininger et al., 2022). In this way, it also influences the configuration of the dynamic capabilities of other ecosystem actors and the path for digital business model innovations (P1).

12 Implications

The overarching configurational perspective taken in this dissertation (El Sawy et al., 2010; Park et al., 2020) based on the recognition of business models and business ecosystems as complex systems (Benbya et al., 2020; Bruni & Comacchio, 2023), provides several novel insights for theory and actionable practice recommendations. In addition to the implications discussed in the following, each publication in this dissertation makes additional, context-specific contributions to research and practice.

12.1 Implications for Theory

This dissertation contributes to different research streams related to the concept of business models. These research streams are business model research and the overarching field of strategy research, dynamic capabilities theory, and digital innovation, transformation, and entrepreneurship research.

First, we explain how firms can innovate their business models with digital technologies, complementing the literature on innovative business models formulated in business model taxonomies (Weber et al., 2021; Weking, Mandalenakis, et al., 2019). Most business model innovation and strategy research have focused on the importance of innovation for economic success in dynamic ecosystems, as created through digital transformations of ecosystems (Rai & Tang, 2014; Saebi, 2015; Teece, 2018b). It is generally argued that the business model is a suitable construct for strategy development (Lanzolla & Markides, 2020), but how strategies can be translated into business models and the underlying complex system of activities is mainly ignored (Casadesus-Masanell & Ricart, 2010). Hence, the process of business model innovation and the design of the new business model are still under-researched (Verhagen et al., 2023). Through our discussed configurational process model of digital model innovation, we explain how dynamic capabilities, in correspondence with environmental turbulences, are configurations of the firms' pathways to different implementations of the new digital business models. We further explain why the design of the new digital business model is a configurational exercise, extending research on the non-linearity of digital innovation (Benbya et al., 2020; Lamperti et al., 2023; Leidner et al., 2011; Van Zeebroeck et al., 2022) and supporting the view of business models as complex systems (Anderson, 1999; Benbya et al., 2020; Bruni & Comacchio, 2023; Cilliers, 2011).

Second, we demonstrate how innovative business models based on digital technology are configurations of multiple interdependent elements. We show a complex interplay within the business model components and between the business model, the customer journey, and digital technologies. The ubiquity and penetration of digital technology influence both the business model elements and the customers' behavior (Piccinini et al., 2015), creating tensions in the business model design and implementation. Yet, digital technologies also offer the affordances to resolve these tensions (Li, 2022; Turienzo et al., 2023) but influence the overall strategic trajectory of the firm's business model innovation through different business model designs and variance in their outcomes (Van Zeebroeck et al., 2022). Hence, in our configurational process model, we argue, that these interdependencies are resulting from the dynamic capabilities' configuration. In the configuration of the business model, the interdependencies between business model elements, the customer journey, and digital technologies must be considered to ensure positive organizational outcomes of the digital business model innovation.

Third, we show how different configurations of antecedents cause different business model innovations, providing insights into firms' strategic responses to change (Foss & Saebi, 2017, 2018; Hinings et al., 2018; Saebi et al., 2017; Vial, 2019). We provide pathways to digital business model innovation, connecting sensing and seizing capabilities (Chesbrough, 2007b; Foss & Saebi, 2017; Teece, 2010, 2018a), which demonstrates the equal necessity of the three higher-order dynamic capabilities (Ravichandran, 2018; Tallon et al., 2019). The findings prove that understanding dynamic capabilities as interdependent configurations can explain variance in the emergence of digital business model innovation (Foss & Saebi, 2017, 2018; Saebi, 2015). Thus, the findings contribute to an explanatory theory of business model innovation (Prescott & Filatotchev, 2020). The analysis of the connection between antecedents, design, and outcomes of digital business model innovation as configurations through the lens of dynamic capabilities theory provides a novel explanatory theory on digital business model innovation (Gregor, 2006), and thus the digital transformation of firms at large (Riasanow et al., 2020; Vial, 2019; Wessel et al., 2021).

Fourth, we propose a multi-layered perspective on the outcomes of digital business model innovation. We present tangible outcomes creating strategic and competitive advantage, that is in line with previous research on the benefits of digital business model innovation (Clauss et al., 2021; Foss & Saebi, 2017; Lambert & Davidson, 2013; Pati et al., 2018; Tidhar & Eisenhardt, 2020; White et al., 2022; Zott & Amit, 2007, 2008). We also enhance the discussion about successful business model design patterns (Böhm et al., 2017; Haddad et al., 2020; Weking, Böttcher, et al., 2019). We extend this stream of research by introducing digital business model innovation as the origin of organizational resilience, thus also contributing to the scant research on business model performance differences during crises (Niemimaa et al., 2019; Ritter & Pedersen, 2020). We also extend the outcome-oriented research, by demonstrating that digital business model innovation also has outcomes on the ecosystem level. We connect the organizational level focusing on the individual business model, and the ecosystem level focusing on the macro-environment (Adner, 2016; Adner & Kapoor, 2010; Enkel et al., 2020; Foss & Saebi, 2017, 2018; Jacobides et al., 2018). We show that individual firms' business models influence other ecosystem actors' business models, for example, by altering the value creation process along a value chain, thus creating turbulence in the ecosystem. We model this relationship as a feedback loop of the individual business model innovation in the ecosystem, serving as an antecedent for further business model innovations. Thus, we contribute to understanding how digital transformations change entire ecosystems.

Fifth, this dissertation makes an overarching contribution to all previously mentioned research streams by demonstrating how the configurational perspective helps understand complex relationships and processes that are not sufficiently explainable by linear thinking and variance-based approaches (Benbya et al., 2020; Bharadwaj et al., 2013; El Sawy et al., 2010; Park et al., 2020). This configurational perspective on business model innovation partially contrasts the research model proposed by (Foss & Saebi, 2017) by arguing that the proposed moderators, such as ecosystem influences, are not moderators, but part of the configuration, thus equally crucial to the path of business model innovation as the firm's dynamic capabilities. Recent business model research argues in the same direction, arguing that digital business model innovation is nonlinear and complex (Lamperti et al., 2023; Van Zeebroeck et al., 2022).

12.2 Implications for Practice

The business model is a popular construct in practice and is used as a tool for strategy development (Bigelow & Barney, 2020; Lanzolla & Markides, 2020), for example, using the business model canvas (Osterwalder & Pigneur, 2010) and business model patterns (Gassmann et al., 2014; Weking et al., 2018). Communicating research findings to practitioners (e.g., managers, entrepreneurs, or students) is particularly useful (Bigelow & Barney, 2020). Hence, the following practical implications for practice can be derived from this dissertation.

First, the configurational process model of digital business model innovation discussed in this dissertation provides a comprehensive understanding of digital business model innovation for managers and entrepreneurs. By examining the internal and external antecedents and reasons that lead firms to change their business model, formulating design decisions in the implementation of such digital business models, and presenting specific outcomes of how firms benefit from digital business model innovation, the model supports incumbents and startups to sense and seize opportunities for digital business model innovation, transform their resources and implement a successful digital business model. Previous analytical business model research provides a source of inspiration for what the future business model might look like (e.g., Weber et al., 2021; Weking, Mandalenakis, et al., 2019). This dissertation presents the relationships and interdependencies that explain when change is necessary or presents opportunities and how to respond to that change with digital business model innovations to achieve beneficial organizational outcomes. Research still shows that firms struggle to innovate their business models (Chesbrough, 2007b; Solaimani et al., 2018; Teece, 2010). Knowing how possible business model innovations can seize sensed antecedents helps firms make appropriate decisions when sensing change. Thus, firms can effectively leverage their resources and capabilities on a designated path for designing and experimenting with new digital business models.

Second, the configurational perspective in this process model emphasizes the complexity of digital business ecosystems, highlighting the need for practice to manage digital transformation's internal and external complexity. We show that it is not sufficient to focus on one particular antecedent, commonly technology innovations, such as artificial intelligence or blockchain, but to analyze the current situation's configuration and the changes in the ecosystem. If these complex configurations are neglected, and the focus is on single components, firms risk being disrupted, as explained in the infamous innovator's dilemma (Christensen, 1997; Lucas & Goh, 2009). Furthermore, the configurational perspective on business model design, articulating the business model elements, the customer journey, and digital technology helps to overcome the problems in practice to translate overarching strategies into business model designs and implementations (Solaimani et al., 2018). Practitioners benefit from understanding the configurational interdependencies and resulting tensions in business model design, particularly with regard to the role of digital technology in resolving these tensions. Firms engaging in digital business model innovation can refer to our model's configurations as guidelines for structuring digital business model innovations and making strategic decisions about digital technology implementations.

Third, our findings underscore the importance of dynamic capabilities, particularly sensing change and seizing the opportunities it creates. Thus, we show practitioners why they must invest in building dynamic capabilities to achieve sustainable economic success and prospectively environmental sustainability (Böttcher, Empelmann, et al., 2023). Because competitors quickly imitate successful business models (Al-Debei & Avison, 2017; Amit & Zott, 2001; Enkel & Gassmann, 2010; Hedman & Kalling, 2017), dynamic capabilities are necessary to create hard-to-imitate activity systems (Amit & Zott, 2001; Teece, 2007, 2010) that must undergo constant review and innovation (Casadesus-Masanell & Zhu, 2013; Zhao et al., 2020). Our cyclical perspective on dynamic capabilities states that dynamic capabilities must be constantly deployed to sustain successful business models and continuously benefit from digital innovation and environmental turbulences.

Fourth, we summarize and extend the well-studied performance implications of business model innovation from a multi-layered perspective. For practice, we extend the existing knowledge with the achievement of organizational resilience through digital business model innovation that holds implications for the management of future shocks and economic crises. We also add environmental turbulences (Benbya et al., 2020; El Sawy et al., 2010; Teece, 2018b), providing evidence on how digital business model innovations alter the value creation in the ecosystem and affect the performance of other business models. We further demonstrate that business model innovations that leverage the ecosystem outperform others.

13 Limitations

The research studies in this dissertation relied on specific research methods, and data sets with natural limitations that must be considered when understanding the findings and contributions of this dissertation.

From a methodological perspective, the approach of case surveys P1, P2, and P6 relied on secondary data derived from published case studies (P1, P2) or publicly available information (P6). These data sources were not created for our specific research purposes, allowing them to focus primarily on other aspects of digital business model innovation. We used inclusion and exclusion criteria to ensure that the cases analyzed provided rich information (Larsson, 1993) and triangulated the data with multiple data sources to understand the cases comprehensively. For P2, we also conducted expert interviews following the case study to validate our findings. P3 follows a case survey approach but relies on one expert interview per case. Therefore, the case information from the interviews may not be complete. Again, we attempted to mitigate this by triangulating the interview data with other publicly available data sources. However, this approach led to the limitation that we can only observe the presence of the analyzed conditions (e.g., antecedents and outcomes). The absence is due to the lack of reporting these conditions in the data sources. Therefore, we cannot ensure that the conditions analyzed as absent were not present in the cases.

In addition, the data analysis in P1-P3 and P6 was conducted using inductive exploratory methods (Gioia et al., 2012), which may be subjective depending on the individual researcher's point of view. We addressed this limitation by having multiple researchers code the data and having group discussions within the author teams to ensure consistency and neutrality in coding the data. We used examples and quotes from the case study in the papers to explain and illustrate our coding process and provide transparency. In P1, we also published our data sources and data coding so that other researchers could replicate our study. Generalization and quantification (specific to P1 and P2) of qualitative data naturally lead to a loss of information about individual cases. We addressed this limitation by the number of cases (49 in P1, 38 in P2, 45 in P6), the use of QCA (P1 and P2), which emphasizes in-depth case analysis, and the use of expert interviews for validation (P2).

The data in P2 to P6 are context specific to retail (P2, P6) or finance (P5) or focus on startups (P4), especially in the context of sustainability (P3). Therefore, the results of these studies must be considered in their respective contexts. We tried to generalize our findings in each study. In P2, we interviewed experts from the software industry who confirmed our findings from the retail sector. In P3, we argue that sustainability is not an industrial niche but must become essential to every firm's business model. P4 is specific to early-stage startups, but discussion with existing literature supports our findings. Similarly, P5 tests hypotheses derived from the literature that are not specific to the financial industry. Therefore, we can assume that our results are replicable in other contexts.

The use of csQCA in P1 and P2 also has some limitations. QCA relies on the researcher's expertise in the literature and in-depth knowledge of individual cases. It cannot quantify the effect sizes of individual conditions like the correlation-based methods used in P4 and P5. We use the approach Fiss (2011) proposed to differentiate the relevance of individual conditions. However, even this approach cannot compare the relevance of individual conditions.

Finally, all publications except P5 rely on a snapshot of the analyzed cases. This is particularly relevant with regard to the results of digital business model innovation. The value of innovation is time-lagged, making it difficult to measure and account for a particular innovation (Tidd, 2001) because, as we also argue, firms and their ecosystems are constantly changing. Achieved results of business model innovations may also result from other changes within the firm or ecosystem.

14 Future Research

Based on the embedded publications and the herein proposed configurational process model of digital business model innovation, we have identified promising avenues for future research on digital business model innovation.

The proposed configuration process model incorporates findings from this dissertation and the literature. While some parts, such as the improved financial performance outcome, have been empirically validated by several publications, other parts are based on initial studies conducted as part of this dissertation or from related literature streams. Future research should therefore apply, validate, and extend the proposed model.

First and foremost, researchers must explore strategies, business models, and digital technologies for sustainability that combine economic, environmental, and social impacts. Recent reports on climate change progress show that optimizing processes and business operations is not enough to avoid climate catastrophe (IPCC., 2023). We need an innovative economy with sustainable business models from the ground up. While initial research has begun to explore the potential of digital technology to create such business models (Böttcher, Empelmann, et al., 2023; George et al., 2020; Paiola et al., 2021), more attention needs to be paid to this area. In particular, in the context of digital business model innovation, we need to explore how specific technologies, such as artificial intelligence (Schoormann et al., 2023), enable these sustainable business models and how established firms can design their pathways to digital and sustainable business model innovation (Böttcher, Empelmann, et al., 2023; Holzmann & Gregori, 2023; Snihur & Bocken, 2022).

Second, the ecosystem implications of focal digital business model innovations need to be further explored. Research on digital platforms shows that business models in these ecosystems are interdependent and combine value-creation activities to create shared value (Hein et al., 2019; Schulz et al., 2020), leading to the co-evolution of business models (Allen & Varga, 2006; Riasanow et al., 2019; Tanriverdi et al., 2010). For example, business models become more digitized through digital servitization (Nambisan, 2013; Sklyar et al., 2019; Suarez et al., 2013; Tan et al., 2017; Yoo et al., 2012), these interdependencies between business models will increase. Scholars should consider this ecosystem level of digital business model innovation to develop theories of digital business model diffusion through digital ecodynamics (El Sawy et al., 2010; Wang, 2021).

Third, the current model uses sensing, seizing, and transforming as the three higher-order dynamic capabilities. It is suggested that lower-order capabilities, such as entrepreneurial orientation, risk aversion, and firm culture, influence the pathways to digital business model innovation (Foss & Saebi, 2017, 2018). Further, the role of organizational identity (Fisher et al., 2016; Kohtamäki et al., 2019; Wessel et al., 2021) could foster or hinder the development of new digital business models within a firm. Future research should explore more of these firm-internal influences on the sensing, seizing, and transforming capabilities and the resulting business model innovations to refine and improve the model.

A fourth avenue for future research is applying the process model to identify patterns in the paths through the digital business model innovation process. While the model explains how and why the process steps and business model innovations are configurations of multiple elements to be combined, future research needs to examine the specific pathways from perceiving change to profiting from digital business model innovations. Since complex systems can only be explained by patterns, not paths (Baygi et al., 2021; Benbya et al., 2020), research must find patterns connecting process steps and their respective configurations. As we showed in P1, these patterns are also likely to be configurational. If we combine these findings into patterns, we can fully explain how, why, and when firms change their business models and develop an entirely prescriptive digital business model innovation theory.

Finally, information systems research needs to focus on the digital artifact in digital innovation and how that digital artifact affects the innovation process and innovation itself (Orlikowski & Iacono, 2001; Piccoli et al., 2022). A particular contribution of Information Systems to the business model and strategy research should be to provide explanations and guidance on the strategic value of digital technologies, how firms can use them to achieve desired outcomes, and the economic, environmental, and social consequences of these digital technologies that firms need to consider when digitally innovating their business model (Clemons et al., 2022; Schoormann et al., 2023). While this is an old debate (Orlikowski & Iacono, 2001), the ubiquity of digital technologies in today's world warrants a new discussion on this topic (Faraj & Pachidi, 2021; Piccoli et al., 2022).

15 Conclusion

Firms respond differently to change, and different business models emerge, impacting business performance and creating environmental turbulence. This dissertation examined the relationship between emerging change and its impact on firms as they innovate digital business models. We developed a comprehensive process model for digital business model innovation and argued that these innovations follow a configuration logic. We base this model on six research studies embedded in this dissertation that examined how firms sense and seize change in digital business model innovation, how they design the new business model based on digital technologies, and what benefits firms gain from innovating their business model. The configuration perspective of this dissertation contrasts with the predominantly linear and correlation-based research on business model innovation. However, it allows us to explain why different business models emerge in similar contexts, why firms benefit differently from digital business model innovation, and finally, to provide a process model to guide firms in their digital business model innovation efforts. We hope to open a new frontier in business model research that extends analytical knowledge about the design of innovative business models toward an explanatory and predictive theory of how, why, and when firms can and must innovate their business model to thrive and survive in the digital ecodynamics, and that explains the role of digital technologies in enabling these innovations.

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Appendix A: Embedded Publications in Original Format

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Pathways to digital business models: The connection of sensing and seizing in business model innovation

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ABSTRACT

Digital business model innovation (BMI) is critical to achieving and sustaining competitiveness in technology-driven environments. In those environments, firms must not only sense changes to identify opportunities but also effectively seize them in BMI. Therefore, sensing and seizing cannot be considered as isolated dynamic capabilities, but must be combined for successful BMI. However, research on sensing and seizing does not offer compelling suggestions for firms that struggle with connecting both while pursuing digital BMI. We use qualitative configurational analysis (QCA) to analyze a sample of 49 case studies on digital BMI to identify the antecedents that firms sense before seizing these changes with digital BMI. Based on ten configurations of sensing (represented by six antecedents) and seizing (represented by four BMI types), we explain the relationship between sensed antecedents and seized digital BMI. In addition, we derived four variables that explain "what" and "how" firms connect sensing and seizing. Based on the sensing-seizing connection, we introduce consolidating BMI as a new type of BMI unique to the digital context. This novel type enables firms to exploit and explore new BMs and subsequent digital BMIs through the means of digital infrastructure. This study extends the understanding of how different business models emerge and how firms create digital BMIs.

Introduction

The pervasiveness of digital technology enables digital business model innovations (BMIs) at an unmatched pace as well as creates dynamic and complex business environments (Benbya et al., 2020; Tanriverdi et al., 2010). Digital BMIs are essential to coping with these changes and profiting from emerging digital technologies (Teece, 2018b). Firms depend on dynamic capabilities to adapt their business models (BMs) to thrive during the advent of technological change (Lucas and Goh, 2009). Dynamic capabilities describe the proficiencies needed to sense and seize change by forming a coherent BM and transforming resources to achieve a competitive advantage (Teece, 2018a). However, sensing the necessity or opportunity and having the ability to seize that change does not reveal how to seize what is sensed (Tallon et al., 2019). Hence, neither sensing nor seizing is sufficient, and it is critical to connect both (Ravichandran, 2018; Tallon et al., 2019).

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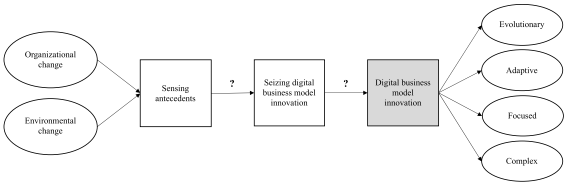

Fig. 1. Research outline.

Firms still struggle to implement digital technology into their BMs and often seize the sensed changes differently (Teece, 2010). For example, the customer demand for grocery delivery reveals how different antecedents lead to different digital BMIs. As part of Amazon's business strategy, AmazonFresh requires an AmazonPrime subscription. Walmart needed a time- and cost-efficient delivery network and therefore uses a digital platform to hire delivery drivers on a transaction basis. In contrast, Trader Joe's or Aldi do not offer any delivery or curbside pick-up services as their customers do not demand such a service. These firms seize digital BMI opportunities differently because of their organizational context, such as their possessed resources. Other possible antecedents of BMI, such as strategy alignment and technological availability, capability, (limited) financial resources, or legal frameworks, further increase the challenge of connecting sensing and seizing (van Oosterhout et al., 2006). These examples illustrate the challenge of translating what is sensed into seizing with digital BMI.

Although research acknowledges the importance of BMI in today's dynamic and digital environment (Doz and Kosonen, 2010), it lacks a thorough explanation of how sensing change and seizing BMIs are connected, as illustrated in Fig. 1 (Foss and Saebi, 2018; Ravichandran, 2018; Saebi, 2015; Tallon et al., 2019). Firms lack guidance and available pathways for BMI to effectively leverage limited resources and capabilities given their current situation and sensing changes (Chesbrough, 2007). It remains unclear why firms undergo digital BMI and what antecedents account for differences in how firms innovate their BMs (Foss and Saebi, 2017, 2018; Saebi, 2015). To explain how firms translate the sensed changes into BM innovations, we tackle the following research question: *What is the connection between sensed antecedents and seized digital BMI?*

We connect sensing and seizing for digital BMI following a qualitative configurational approach. We conduct a case survey of 49 case studies on digital BMIs and use qualitative comparative analysis (QCA) to seek configurational pathways from antecedents to digital BMI. Thus, we review the literature on BMI, the role of dynamic capabilities for BMI, and Foss and Saebi's (2017) BMI typology that informed our coding scheme. In our research approach, we first collected 49 case studies from extant literature and, using open coding, identified six antecedents that firms sensed before seizing digital BMI. Next, we coded the case data using these antecedents and the four BMI types before analyzing the data set with crisp-set QCA (csQCA). The csQCA results in ten configurations of antecedents, leading to four different types of digital BMI. We further analyze these configurations using illustrative examples from our sample. Based on the results, the raw case data, and extant literature on dynamic capabilities and BMIs, we introduce four variables that describe the connection of sensing and seizing: context, attentionality, resources, and orientation.

These four variables explain what and how firms sensed the antecedents and seized the digital BMI. In addition, the variables allow us to connect sensing and seizing to explain how firms create different types of digital BMI. In the discussion, we extend the BMI typology by Foss and Saebi (2017) with how the different types are created and find a new type of BMI unique to the digital context. This novel type enables firms to exploit and explore new BMs and subsequent digital BMIs through digital infrastructure. We discuss how firms leverage dynamic capabilities for digital BMI and the role of this new BMI type. Finally, we conclude the paper with our contributions to research and practice and provide avenues for future research.

Business model innovation and dynamic capabilities

Business model innovations

We use BM as the unit of analysis to elaborate on how firms connect sensing and seizing capabilities to create and capture value in dynamic environments (Teece, 2010). The BM has emerged as a core construct to explain how a firm's strategy and business processes interact (Al-Debei and Avison, 2010). It consists of three interconnected pillars: value creation, value capture, and value delivery (Massa et al., 2017). Each pillar represents sub-systems comprised of multiple, single interdependent activities (Foss and Saebi, 2017). Thus, the BM composes a system of activities that go beyond the focal firm but facilitate interactions with partners and customers (Teece, 2010; Zott and Amit, 2010). This activity system perspective presents a helpful construct to manage environmental dynamism in business strategies (Lanzolla and Markides, 2021). As firms can achieve strategic goals in several ways, numerous BMs can serve the same generic business strategy. The strategy's goal is to find BMs that fit the organizational and environmental context. Lanzolla and Markides (2021) describe the process as "the business model construct – because of its granularity and its focus on bridging value

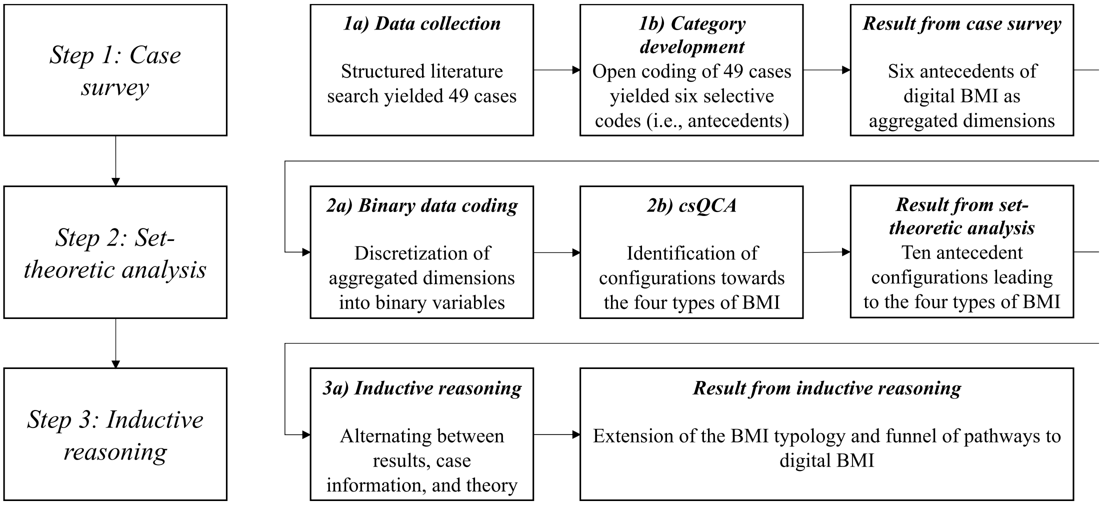

Fig. 2. Research methodology.

creation and value capturing activities – can provide a […] platform to […] develop a less descriptive and more dynamic set of ideas on how to design a superior system of interconnected activities, all else being equal.".

Firms with stronger dynamic capabilities can adapt their BMs in dynamic and digital environments. A firm's ability to perform and profit from BMIs by seizing arising opportunities or avoiding threats articulates its dynamic capabilities (Rai and Tang, 2014; Yeow et al., 2018). Firms with stronger dynamic capabilities are more likely to be balanced between continuing an existing BM while trying to profit from change with an adapted or new BM (Andriopoulos and Lewis, 2010; Weber and Tarba, 2014). Consequently, despite the known performance benefits of BMI (Han et al., 1998; Massa et al., 2017; Van de Ven, 1986), firms struggle to change their BM (Teece, 2010), as they also struggle to build dynamic capabilities. Therefore, BMI is a suitable lens for analyzing how firms connect sensing and seize changes to create and capture value (Steininger et al., 2022; Teece, 2018a; Vial, 2019).

Business model innovation types

BMI is defined as "designed, novel, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements" (Foss and Saebi, 2017). This definition implies that BMI requires changing fundamental business logic, roles, and responsibilities (Sawhney et al., 2006; Veit et al., 2014). Focusing our research on a digital context, a BMI is digital if the introduction of digital technology, such as a digital platform, significantly innovates the firm's BM, leading to a new IT-related configuration or shift in the BM (Steininger, 2019; Veit et al., 2014).

Foss and Saebi (2017) developed a typology to classify different forms of BMI using the axes of novelty and scope. The typology classifies the degree of novelty of innovation as new to the firm or new to the industry. When it comes to the BMI's scope, the BM can be decomposed in several ways: into multiple interdependent sub-systems (e.g., value creation, value delivery, value capture), into a single sub-system (e.g., a new payment model represented as modular innovation), and into an architectural innovation that changes multiples of such sub-systems and their interdependencies.

Based on the above classification, Foss and Saebi (2017) identify-four types of BMI: evolutionary, adaptive, focused, and complex. Seizing change through BMI can take all four forms. Evolutionary and adaptive innovations are not new to the industry but new to the firm. Whereas evolutionary BMI refers to fine-tuning individual BM sub-systems, adaptive BMIs represent changes to the whole BM. A focused innovation implies a change in individual BM sub-systems that are also new to the industry. Last, complex BMI describes the adjustment of the entire BM of a firm that is also new to the industry.

Theoretical research outline

The extant literature on dynamic capabilities indicates that the connection between sensing and seizing is still unclear (Schilke et al., 2018) (see Fig. 1), which also hinders the design of repeatable mechanisms in digital BMIs (Vial, 2019). Foss and Saebi (2017) point to the current challenge in both BM research and practice to illuminate the process from conjecture to implementation of a specific digital BMI to seize a sensed need. We use the four types of BMI to classify the seized digital BMIs and link them to configurations of sensed antecedents.

Research method

To analyze the connection of sensing and seizing capabilities, we followed a three-step process combining a case survey with

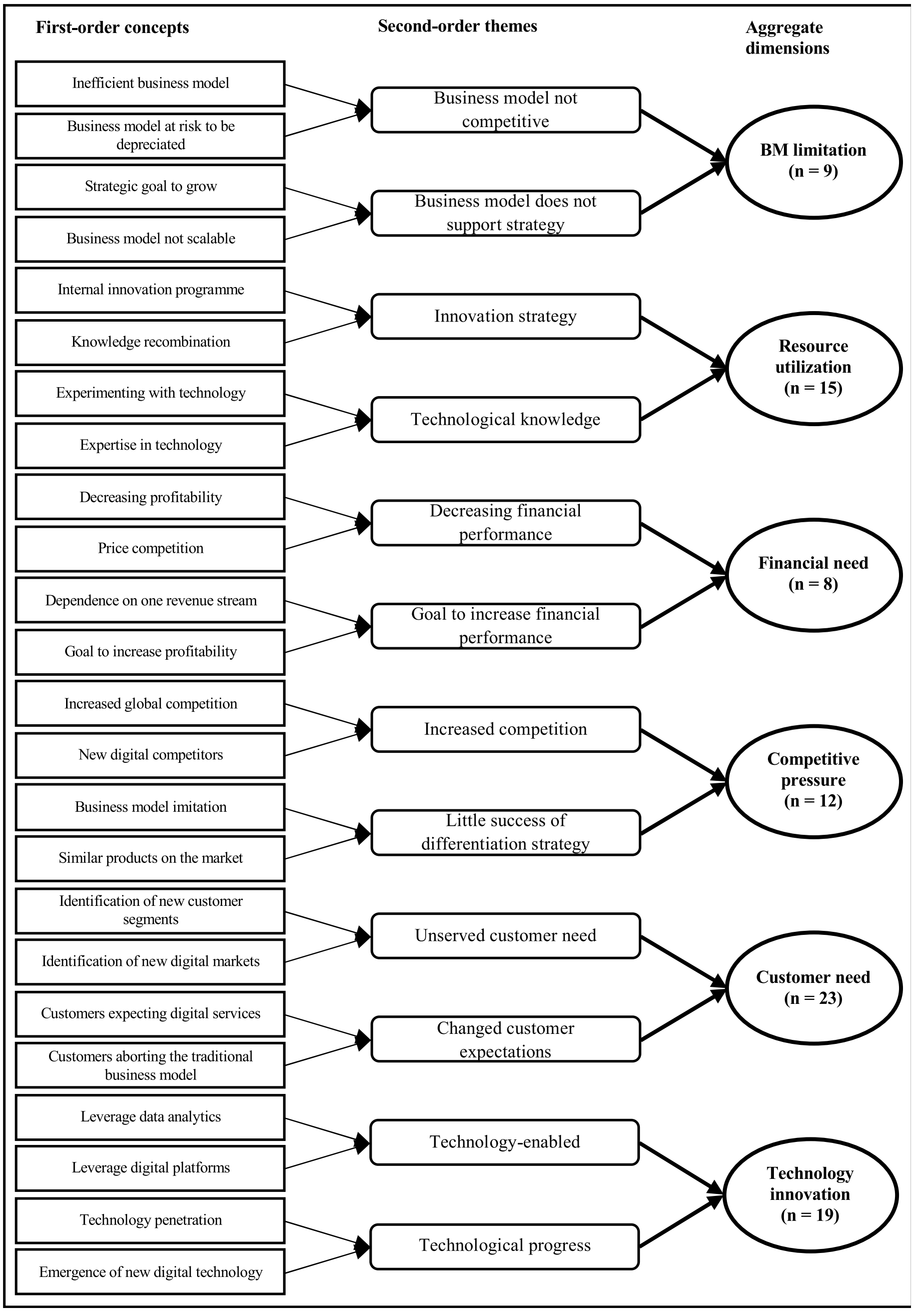

Fig. 3. Data structure (cf. Gioia et al., 2012).

csQCA, as shown in Fig. 2. First, we conducted a case survey (Larsson, 1993) on digital BMI, based on 49 cases, to identify sensed antecedents and seized digital BMIs. The case survey method allows us to compare and generalize findings from extant research on digital BMI (Larsson, 1993) to populate the boxes in Fig. 1. Second, we conducted a csQCA (Rihoux and De Meur, 2009) to determine combinations of antecedents leading to digital BMI, linking the boxes in Fig. 1. The csQCA reveals how the same antecedents in different combinations produce different outcomes (Fiss, 2011). Third, we used inductive reasoning, alternating between the resulting configurations, case information, and extant literature on dynamic capabilities and BMI to understand the configurations and develop a theoretical model (Park et al., 2020).

Case survey

Data collection

We searched for digital BMI case studies following the guidelines by Webster and Watson (2002). We consulted the three scientific databases – Web of Science, Scopus, and the AIS eLibrary – to select case studies.[1] The research terms were taken from Foss and Saebi (2017) and supplemented with the term "disruptive," which proved relevant in the initial literature search. We used inclusion and exclusion criteria to filter the initial results (Larsson, 1993) and only included case studies that described a digital BMI. The case studies also included antecedents (such as changing customer needs), leading to the digital BMI. We enriched published cases with secondary, available information from the firms' press releases, articles in relevant newspapers, and public interviews with informed experts to aim for data triangulation. Eventually, we selected 49 cases from 44 articles for analysis. We collected supplementary information such as headquarter location, firm size (i.e., employees, revenue), industry, year of the BMI, and technologies relevant to the BMI. We used this supplementary information to control for potential biases in our case sample.[2]

Category development

We inductively coded the 49 cases comprising the articles and secondary data through open, axial, and selective coding (Corbin and Strauss, 1990) to derive the sensed antecedents of digital BMI in the cases. We classified the antecedents that firms sensed before seizing them by innovating their BM (e.g., Daimler sensed that the traditional sales-based BM might not be future-proof and new customers can be reached by introducing a car-sharing platform BM). One of the authors first extracted the quotes from the text and developed open codes as first-order concepts (e.g., Daimler's BM was at risk of being depreciated). We then reduced similar open codes to axial codes representing second-order themes (e.g., BM is not competitive). Using selective coding, these codes were iteratively developed until they were distinct and mutually exclusive toward aggregate dimensions (e.g., BM limitation). This is crucial since we used these codes as conditions in the following csQCA. Fig. 3 represents the data structure (Gioia et al., 2012), providing an overview of the category development. We also classified the themes as either "organizational" (such as limitations in the BM) or "environmental" antecedents (such as the emergence of technology innovations), depending on whether they originated inside or outside the firm.

Set-Theoretic analysis

Data coding

After we had developed and defined the antecedents of BMI, we coded the conditions to create the dataset for the csQCA. We coded binary ("crisp") since we rely on secondary data analysis that does not allow us to differentiate scaled or fuzzy levels. In our csQCA, a "1" indicates the presence of the coded antecedent, while a "0" indicates its absence. Hence, one case may have several but at least one condition coded as "1" while all others are coded as "0".

To code the outcome describing the digital BMIs, we followed a defined coding scheme based on the BMI typology of Foss and Saebi (2017), describing four types of BMI. We coded four binary outcome variables describing which type of BMI resulted from the antecedents. Hence, one case can have only one outcome variable coded to "1." The second author then verified the resulting codes to validate the synthesis process. In case of ambiguity, the collected case information was re-examined and discussed. We went through all cases iteratively, building on the constant comparison.[3]

csQCA

Following Rivard and Lapointe (2012) and Henfridsson and Bygstad (2013), we performed csQCA on our binary-coded dataset to identify configurations of sensed antecedents and how firms seized those antecedents represented by the four types of BMI. Hence, the resulting configurations uncover the connection between sensing and seizing in digital BMI.

QCA is suitable for deriving cause-effect relationships based on case analysis (Fiss, 2007; Ragin, 1987). Instead of correlations that support variance-based methods, QCA uses Boolean algebra and configurational relationships to find configurations consisting of multiple interdependent causal conditions and their relative importance towards an outcome (Fiss, 2007; Ragin, 2009). Conditions refer to independent variables in variance-based methods, and outcomes represent the dependent variable. The set-theoretic character of QCA allows us to account for the complexity and inherent dynamics in digital environments and the non-linear behaviors of digital BMI (Benbya et al., 2020; Fiss, 2007). It reveals how the same antecedents in different configurations yield different outcomes (Fiss,

[1] We searched for the terms in the topic (in Web of Science) or the papers' title, abstract, or subject (in Scopus and AIS eLibrary). In addition, we filtered for peer-reviewed articles from journals, conference proceedings, or books published in English. We excluded reviews and editorial material. Table A-1 in Appendix A lists the explicit search terms and the results obtained from the databases.

[2] Table B-1 in Appendix B lists the included cases and their sources from academic papers. Table B-2 in Appendix B presents the collected descriptive case information.

[3] The resulting case coding, which serves as input data for the csQCA, is attached in Appendix C.

2011), in our case, digital BMI. It follows that QCA considers asymmetrical relationships: while the presence of a condition in one configuration may lead to the desired outcome, the absence of this condition may also be necessary for the outcome in combination with other conditions in another configuration.[4]

Combining a case survey with csQCA overcomes both methods' shortcomings, as demonstrated by Rivard and Lapointe (2012) and Henfridsson and Bygstad (2013). One major shortcoming of the case survey method, when applied in combination with variance-based statistical analysis, is that this analysis relies on the number of cases available for the chosen research question (Larsson, 1993). A medium number of cases (n = 12– 50) limits the scientific contribution based on limited insights and often low statistical significance. csQCA's advantage of information-rich results provides fruitful ground for empirical sound theorizing but works well with a medium number of cases, which are not always feasible to conduct (Greckhamer et al., 2018; Soto Setzke et al., 2020). Analyzing a sample of published case studies using csQCA allows us to build on existing research findings to identify sensing-seizing configurations for digital BMI.

Conducting a csQCA consists of several steps, of which we explain the relevant terms and our methodological choices below.[5] We have already described the data collection, derivation of conditions, data coding, and data calibration to values between 0 and 1. Thus, we continued with analyzing the necessary conditions for the four outcomes. QCA allows the distinction between necessary and sufficient conditions, whereas conditions in variance-based methods are always both necessary and sufficient (Fiss, 2007). Necessary conditions are conditions that are always present when the desired outcome is achieved. Hence, the outcome is never achieved if the necessary condition is not present. Sufficient conditions indicate that the outcome is always achieved when a condition or configuration of conditions is present. To test for necessary conditions, we used a consistency threshold of 0.90 and a coverage threshold of 0.60 (Mattke et al., 2022). Coverage indicates the empirical relevance and effectiveness of the configurations toward the outcome (Fiss, 2007). For crisp datasets, this equals the proportion of cases yielding the outcome represented by the configuration (Greckhamer et al., 2018). Consistency represents the ratio of similar cases leading to the same outcome; its role is comparable to the p-value in variance-based methods. The cut-off thresholds define the minimum value needed to detect necessity or sufficiency. For example, with a coverage threshold of 0.6, a necessary condition needs to yield the outcome for at least 60 % of cases. The analysis revealed no necessary conditions for our outcomes.

Next, we constructed the truth table that lists all possible configurations.[6] For our six conditions, the table consists of 64 (two to the power of six) rows. We observe 21 different configurations in our data. Since we observed that all antecedents lead to all four outcomes (with one exception: financial neediness is not an antecedent for adaptive BMI), there is no contradiction with our understanding ("difficult counterfactuals") of antecedents of digital BMI in the 43 residuals. Therefore, we classify them as "easy counterfactuals," meaning that they can lead to one of the four types of BMI and can be used to simplify the solutions in logical minimization (Ragin and Fiss, 2008).

To identify sufficient configurations, csQCA uses logical minimization. Like the necessity analysis, the sufficiency analysis builds on the consistency and minimum frequency threshold. Frequency refers to the number of cases representing a configuration. As recommended in the literature, we set the consistency threshold to 0.75 (Mattke et al., 2022). We set the frequency threshold to 1 following the recommendations given in the literature for small and medium-sized case samples (Greckhamer et al., 2018; Soto Setzke et al., 2020). This is also in line with the argumentation that configurations covering few cases can still be relevant if they present novel or unexpected insights (Schneider and Wagemann, 2010).

To minimize the truth table, we used the intermediate and parsimonious solutions (Ragin, 2009). The two solutions differ in the degree they include counterfactuals in the minimization.[7] Since we defined four different outcome variables representing the four BMI types, we performed the logical minimization eight times (two minimizations per outcome). Following Fiss (2011), we defined core conditions present in both solutions and peripheral conditions only present in the intermediate solution. Core conditions thus remain part of the solution even if counterfactuals occur and possess a higher relevance for achieving the outcome.

Inductive reasoning

Last, we revisited the individual cases when analyzing the configurations to understand the circumstances under which these configurations emerge, as suggested by Park et al. (2020). We iterated between the configurations, case information, and extant

[4] For example, Park et al. (2017) found by conducting a fuzzy-set QCA that both the presence of organization size (= large organization) and its absence (= small/medium organization) lead to decision-making agility; however, only in combination with the presence (for large organizations) or absence (for small organizations) of the effective usage of communication technology. Hence, they concluded that decision-making agility in large organizations relies on effective communication technology while small and medium-sized organizations do not. To identify sensing-seizing connections, these properties of QCAs are better suited than variance-based models.

[5] For detailed guidance on the application of QCA in IS research, we refer the reader to Mattke et al. (2022), Park et al. (2020), and Soto Setzke et al. (2020), who helped us with our application.

[6] The aggregated truth tables are in Appendix D.

[7] The parsimonious solution includes all counterfactuals to minimize the truth table and thus produces the most minimalized (i.e., most parsimonious) solution. The intermediate solution includes counterfactuals based on an expectation vector provided by the researcher. Since we observed all of our conditions for all four different outcomes in our case sample, we expected the presence of all conditions to yield any outcome. QCA also provides a third type of minimization, producing a complex solution. The complex solution does not consider any counterfactuals and thus only provides configurations observed in the dataset. For our goal of creating a theoretical model of sensing-seizing connections for digital BMI, we did not consider this a suitable approach because we wanted to acknowledge the presence of configurations not observed in our case sample.

Table 1
Categories for sensing and seizing digital BMI.

		Category	Explanation	Example	E	A	F	C	N (%)
Sense: Antecedents	*Organizational antecedents*	*Business model limitations*	Recognizing that a new BM is more suitable for further growth or the future business environment	Donkey Republic	4	1	1	3	9 (18 %)
		Resource utilization	Specific capabilities and knowledge that could be exploited in a digital BMI	Apple	5	4	3	3	15 (31 %)
		Financial need	Facing shrinking financial indicators (e.g., profit) or opportunities to improve financial performance	Lufthansa	3	0	3	2	8 (16 %)
	Environmental antecedents	*Competitive pressure*	Market participants or new entrants putting pressure on a firm's BM	Ericsson	4	5	1	2	12 (24 %)
		Customer need	Identification of a new or changed customer need or an entire market that can be served	Uber	4	5	6	8	23 (47 %)
		Technology innovation	The ascendance of new technology provided a way to rethink the firm's BM	IBM	5	5	5	4	19 (39 %)
Seize: Digital BMI		*Evolutionary*	Fine-tuning of individual BM sub-systems	Donkey Republic					15 (31 %)
		Adaptive	Changes to the whole BM that are new to the firm but not to the industry	Apple					10 (20 %)
		Focused	Innovation in individual BM sub-systems that are an innovation to the industry	Uber					12 (24 %)
		Complex	Innovation of the whole BM that is new to the industry	Hilti					12 (24 %)

Table 2
Sensing-Seizing Configurations in Digital BMI.

Configuration Antecedent		**Outcome: Digital BMI type** Evolutionary E1	E2	E3	E4	Adaptive A1	A2	A3	Focused F1	F2	Complex C1
Organizational antecedents	BM limitation			●	●	⊗	●				●
	Resource utilization		●		●	●					⊗
	Financial need	●					⊗		●	●	
Environmental antecedents	Competitive pressure	●		⊗			●	●	⊗		
	Customer need	⊗	⊗	⊗	•	●			●		●
	Technology innovation		●			⊗		●		●	
Consistency		1	1	0.75	1	1	1	1	1	1	1
Unique coverage		0.2	0.133	0.2	0.067	0.2	0.1	0.2	0.083	0.083	0.25
Raw coverage		0.2	0.133	0.2	0.067	0.2	0.1	0.2	0.083	0.083	0.25
Cases		16, 18, 28	1, 42	8, 14, 34, 41	44	11, 46	26	3, 25	24	43	29, 32, 40
Solution consistency		**0.9**				**1**			**1**		**1**
Solution coverage		**0.6**				**0.5**			**0.167**		**0.25**

Black circles "•" indicate the presence of a condition, and empty circles "⊗" indicate its absence. Large circles indicate core conditions; small ones peripheral conditions. Blank spaces indicate irrelevance.

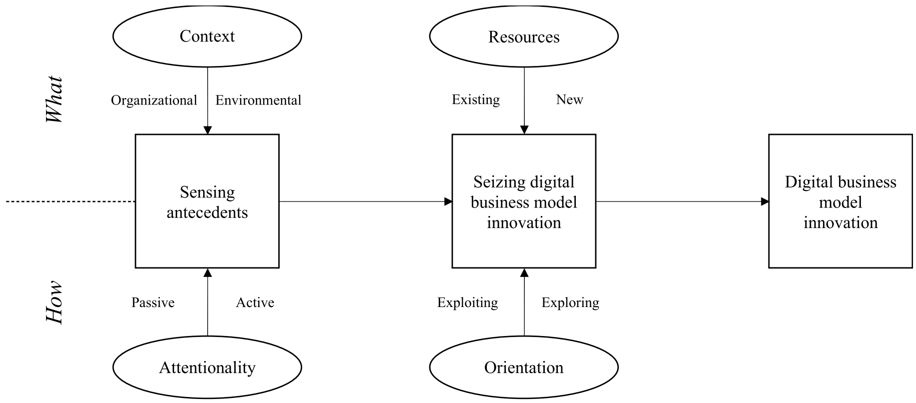

Fig. 4. Connecting sensing and seizing for digital BMI.

literature to develop a theoretical model connecting sensing and seizing for digital BMI.

Results

Categories for sensing and responding in digital business model innovation

We identified six sensing categories from the case survey and four seizing categories from the literature. The sensing categories comprise *organizational* and *environmental* antecedents, which indicate the origin of the sensed change. *Organizational* antecedents cover reasons such as current BM limitations, resource utilization, and financial needs for innovating within the firm. *Environmental* antecedents refer to external changes, such as competitive pressure, changing customer needs, and technological innovation that require seizing digital BMI. Table 1 summarizes the sensed and seizing antecedents through BMI, the identified categories, a brief explanation, and an illustrative example based on the cases.[8] The table also shows the frequency distribution of sensing-seizing combinations within our sample's 49 cases (columns "E" = evolutionary; "A" = adaptive; "F" = focused; "C" = complex) and the total number of occurances in the case sample "N". It shows which antecedent changes lead to which type of BMI. We observe an almost equal distribution of the four innovation types, ranging from 10 (20 %) cases to 15 (31 %) cases. The antecedent changes range from eight occurrences (16 %; financial need) to 23 (47 %; customer need).

Sensing-seizing configurations

Based on the csQCA, we reveal ten sensing-seizing configurations (see Table 2). The configurations show which combination of

[8] Appendix E gives a detailed explanation of all categories.

specific organizational and environmental antecedents can be seized by different digital BMIs. We find effective configurations for the two seizing outcomes of evolutionary and adaptive BMIs, explaining 60 % and 50 % of the case sample. Our configurations explain 16.7 % and 25.0 % for focused and complex BMIs. All configurations show high consistency (i.e., 0.9 or 1), expressing a robust empirical foundation in our case sample, above the suggested threshold of 0.80 (Ragin, 2009). Hence, our solution quality is comparable to other IS research, such as Park et al. (2017), Lee et al. (2019), Koo et al. (2019), and Bui et al. (2019).

We explored how the sensing of antecedent configurations leads to seizing different types of BMI by revisiting the cases and extant literature. To illuminate the connection of sensing and seizing, we differentiate the "what" and "how," as depicted in Fig. 4. The "what" describes the context of the sensed antecedents (organizational or environmental) and the resources used (existing or new resources) in their seizing. The "how" describes the attentionality (active or passive) toward the antecedents and the strategic orientation (exploiting or exploring) when seizing BMI. All four influence the digital BMI type; different combinations then explain the differences between types.

Context describes the sensed antecedents' origin, thus what is sensed (Park et al., 2017). Organizational antecedents cover reasons for innovating within the firm. Environmental antecedents refer to external changes, such as changing environments, that require seizing opportunities with a digital BMI. *Attentionality* describes "how sensing possibilities for action is about being exposed and attuned to corresponding flows of action" (Baygi et al., 2021). Active sensing thus refers to exploring opportunities, challenging existing BMs, and sensing change ahead of competitors (Gambardella and McGahan, 2010; Sawhney et al., 2006). Passive sensing refers to sensing natural changes evolving to fine-tune the strategy as organizations are exposed to change.

Seizing sensed change alters the firm's *resources* (Doz and Kosonen, 2010). Extant resources are linked in a novel way by redeploying unchanged resources. Redeploying existing resources strengthens dynamic capabilities, supporting responsiveness (Ravichandran, 2018). In contrast, deploying new resources into adapted BMs is a key micro-foundation of dynamic capabilities (Teece, 2010). The *orientation* describes how these resources are changed, differentiating between exploiting and exploring new BMs to alter the firm's competitive position. An exploiting orientation leverages the sensed antecedents to keep the firm's position and increase its efficiency (Osiyevskyy and Dewald, 2015). On the other hand, an exploring orientation refers to seizing the change in its BM to reposition itself in a more advantageous market position instead of competing in an unfavorable position (Tanriverdi et al., 2010).

Evolutionary digital business model innovation

The csQCA reveals four combinations of antecedents that lead to evolutionary BMI (E1–E4). Evolutionary refers to the fine-tuning of individual BM sub-systems (Foss and Saebi, 2017). These small changes affect individual aspects of a BM and express a small degree of novelty. The sensed antecedents for these configurations mainly originate from an organizational context. While the configurations include environmental antecedents, the case analysis reveals that firms only sense the need for BMI when consequences emerge within the organization. This also implies that firms implementing evolutionary BMI do not proactively search for BMI opportunities but recognize BMI as a solution to an emerging threat. Therefore, the BMI primarily builds on transforming existing resources to exploit the firm's competitive position.

In E1, we see a combination of competitive pressure and financial need with unchanged customer needs. This combination shows competitive markets with strong market participants and a low potential for product differentiation. Consequently, the competition is based on price differentiation, which leads to shrinking profits. However, some firms reconfigure their existing resources for small BM changes and, thus, for differentiation. For example, instead of competing with prices, Allianz Suisse changed from standard car insurance with periodical payments to usage-based pricing, using car sensors and usage data (Bucherer et al., 2012; Desyllas and Sako, 2013).

E2 represents a combination of resource utilization and technology innovation with unchanged customer needs. Using their existing capabilities, knowledge, and other resources, firms respond to technological advancements. For example, IBM has fundamental capabilities in hardware. They innovated their BM from hardware sales and services to integrated management consulting. As revenues from hardware sales decreased, IBM used its IT integration and solution provisioning knowledge to become a technology and business consultancy (Jetter et al., 2009).

The third solution leading to evolutionary innovation, E3, comprises firms that sensed emerging limitations in their original BM without being exposed to competitive pressure or changing customer needs. For example, the bike-sharing startup, Donkey Republic, recognized the limited scalability of its original peer-to-peer-sharing BM. As a result, they implemented a platform-based BM, matching local bike rentals with customers, seizing the technological opportunity through exploitation, and addressing the BM limitation (Winslow and Mont, 2019).

The fourth configuration, E4, is the only evolutionary innovation that responds to a change in customers' needs, combined with BM limitations and resource utilization. The configuration represents a change in customer needs that cannot be served with the existing BM. However, capabilities and resources to meet the customer needs exist in the firm. In our sample, one anonymous case responded to this situation by exploiting separated value propositions into one digital platform BM (Mezger, 2014).

Adaptive digital business model innovation

Adaptive BMI shows fundamental changes to the entire BM: new to the firm but not the industry (Foss and Saebi, 2017). The sensed antecedents for adaptive BMI originate from organizational and environmental contexts where firms sense that their current BM does not align with environmental changes and requires modification. Again, this need for BMI is only sensed when it already affects the current BM. The seizing builds on the existing resources complemented with new resources or capabilities for the innovated BM. Similarly, the BMI is oriented toward exploiting the competitive position, but firms also leverage the architectural change of the BM to reposition to explore a new competitive position. We find three combinations of antecedents (A1, A2, A3) that lead to adaptive digital

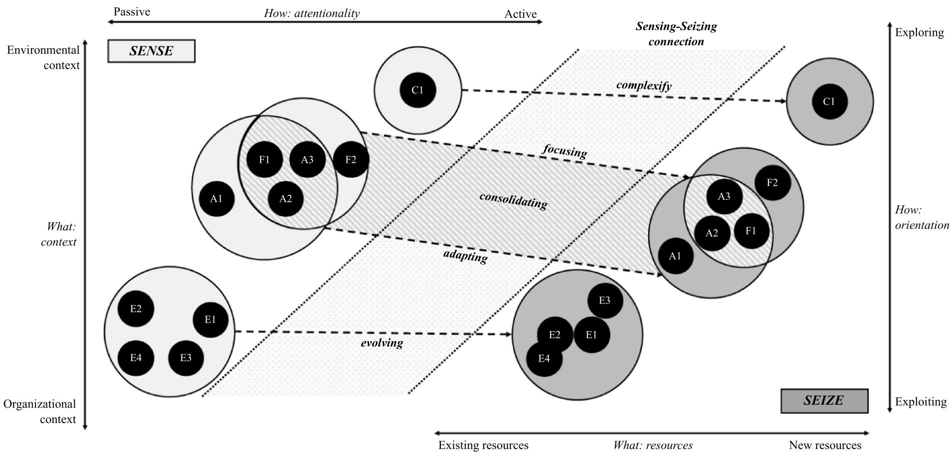

Fig. 5. The connection of sensing and seizing for digital business model innovation.

BMIs.

As part of the sensing-seizing configuration A1, firms sensed the opportunity for digital BMI from noticing emerging BMs that serve a new customer need. They sensed no need to appropriate new technologies, since they already possess the required organizational resources and digital infrastructure. There was no threat or limitation from the current BM as it was still profitable. For example, when Apple launched iTunes, there were already online music shops in the market. However, Apple sensed an opportunity to build a solution with a better user experience by exploiting their design and technology knowledge and resources (Park, 2011).

In contrast to A1, firms in configuration A2 sensed rising competitive pressure and limitations in the current BMs but without a pressing financial need. An anonymous IT provider sensed new, strong, international competitors entering their market with cloud computing BMs. Their traditional product sales and service BM hindered the expansion of their customers to international and small local businesses. Adopting a cloud service BM and the required digital infrastructure allowed the firm to use existing resources more efficiently, remain competitive, and even expand its customer base (Ahokangas et al., 2014). The observation of competing firms with innovative BMs drove the discovery of digital BMI to escape the threatening competition.

Following the slogan "offense is the best defense," A3 cases sensed technology innovations enabling digital BMI to escape arising competitive pressure. For example, Ericsson seized the emergence of cloud computing by actively exploring the opportunities and threats to their BM. Before it could become a threat, they adopted a cloud infrastructure that allowed them to exploit existing and explore new resources to iteratively adapt their BM and organizational structures to become a cloud firm (Khanagha et al., 2014).

Focused digital business model innovation

We identified two configurations (F1, F2) for seizing focused digital BMI, which changes specific elements of the BM (e.g., value delivery) that are new to an industry (Foss and Saebi, 2017). Both configurations show firms that face financial needs. Firms actively probed opportunities outside the organization to solve this problem and found new customer segments to serve or new technologies to integrate. They also deployed new resources to create the BMI. As with adaptive BMIs, firms pursued focused BMIs to exploit their competitive position, but the degree of novelty in the new BM creates a forward orientation, exploring an improved competitive advantage.

The first configuration, F1, is caused by firms sensing declining revenues because of changing customer needs. The existing BM was not under competitive pressure, and the firms could have sustained themselves without BMI. Firms in this configuration only require a focused BMI to exploit their strengths and address new customer groups. In one case, Dow Corning actively figured out that the need for cheap standardized products was not served but could complement its stagnating premium service-oriented offering. Dow Corning seized the BMI by deploying a new digital infrastructure in the form of an online store. This in turn allowed the firm to not only exploit this platform by offering a more cost-effective offering, but also to explore new opportunities to reach new customers with the new BM.

The second configuration for focused digital BMI, F2, combines a financial need with technology innovation as antecedents. Whereas a financial need typically occurs due to shrinking profits, leveraging technology innovation can reduce costs or enable new opportunities. Unlike F1, but similar to A3 (which also utilizes technology innovation), seizing this antecedent configuration, which explores a new technology to solve a financial need, provides firms with the opportunity to explore technological innovation to complement existing digital infrastructure. The resulting changes to the BM are small but pivotal. In the case of THA Group, for example, a change in the payment system for home care services led to a decline in revenue, forcing THA Group to look for ways to reduce costs or otherwise increase revenue. They added a new digital monitoring solution that complements their resource base and pivots their BM from in-person service delivery to around-the-clock, data-driven remote service (Singh et al., 2011).

Complex digital business model innovation

Finally, one configuration shows the antecedents of complex digital BMIs. A complex digital BMI creates an entirely different BM

Table 3
BMI Typology Extension.

		Evolving	**Adapting**	***Consolidating***	**Focusing**	**Complexify**
Sensing	**Context**	Organizational			Environmental	
	Attentionality	Passive			Active	
Seizing	**Resources**	Existing resources			New resources	
	Orientation	Exploiting			Exploring	
Role of digital technology		BM first	BM first	Tech. first	BM first	Tech. first
Foss and Saebi (2017)	**Novelty**	New to the firm		New to the industry		
	Scope	Modular	Architectural	Modular	Architectural	
		Evolutionary	**Adaptive**	**Focused**	**Complex**	

that is new to the industry and severely impacts its environment (Foss and Saebi, 2017).

Configuration C1 shows that firms create a complex digital BMI when they sense both limitations in their initial BM and a changed customer need but do not possess the internal resources to implement the BM before seizing it. The sensed context lies in the firm's environment as it recognizes that the current BM will not serve future customer needs and is thus at risk of being disrupted. This future customer need is sensed only by active attentionality. The complex digital BMI is built through experimentation and iterative learning, which deploys new resources in the firm. In our case sample, we observed this situation in the case of Daimler. The traditional BM for car sales will not meet the future needs of customers who do not want to own a car for a variety of reasons, such as using more sustainable public transport (Spickermann et al., 2014; Willing et al., 2017). To counteract the projected declining car sales, Daimler explored the opportunity for a new free-floating car sharing BM. To become a platform owner in this new BM, Daimler had to build an entirely new resource base in a new organization (Bucherer et al., 2012). The complex BMI provided an opportunity to explore their early competitive position, which is important in platform competition.

The connection of sensing and seizing for digital BMI

Despite the relevance of dynamic capabilities for digital innovation, ways to connect sensing and seizing change for superior economic performance or competitive advantage remains scarce (Ravichandran, 2018; Schilke et al., 2018). By articulating the ten configurations along four dimensions, we show how firms connect sensing and seizing to create digital BMIs. Fig. 5 positions the configurations along with the causal connection of sensing (*top-left*) and seizing (*bottom-right*). The corridor in-between (*dotted area*) highlights the connection of sensed antecedents and seized digital BMI. The sensing-seizing connection for digital BMI results in the corresponding BMI type exposing how firms sense which antecedents determine how firms seize digital BMI.

The initial step for BMI is sensing an opportunity or need that can be addressed by a new BM (Teece, 2018a). Sensing involves the context of what is sensed and attentionality to how the antecedents are sensed. Theory often references changed or unfulfilled customer needs and technological progress as the sensed antecedents of BMI (Foss and Saebi, 2017, 2018). Based on the antecedent configurations yielding digital BMI, what is sensed ranges from the organizational context within the firm, such as BMs not supporting the firm's long-term strategy, or the environment external to the firm, such as changing customer needs and technology innovation. Sensing differs in how firms identify these antecedents, as this can be done actively or passively. At one extreme, this means that a firm actively creates a digital BMI opportunity by developing new technology, such as when Kodak developed digital photography (Lucas and Goh, 2009). At the other extreme, the firm (e.g., a retailer) remains passive in identifying BMI opportunities until the need can no longer be ignored (e.g., to have an online store).

In seizing digital BMI, firms address these sensed antecedents by creating, extending, or modifying their resources (Teece, 2018a). Thus, firms can use existing and new resources in the process of seizing by exploiting and exploring the new BM. Firms seize the new BM differently depending on their previous resource base, including their physical and technological resources, knowledge, and capabilities. Building on the existing resource base, firms reconfigure their resources for the BMI or augment it with new resources. However, some BMIs, such as transforming to a BM based on digital photography, require the development of an entirely new resource base. This modification of resources follows an exploitation or exploration orientation. By exploitation, the firm strengthens the original BM by adopting a new BM in whole or in part (Osiyevskyy and Dewald, 2015). In exploration, the firm develops a different BM, for example, to gain a new competitive position or enter a new customer market.

For effective digital BMI, firms need to connect sensing and seizing. Otherwise, the Kodak example shows, that sensing opportunities (such as from technology innovation) can fail to seize the digital BMI opportunity and exploit the technology (Lucas and Goh, 2009). This sensing-seizing connection depends on their current situation and the changes they are sensing. Depending on the sensed antecedents, firms seize different types of BMI (Foss and Saebi, 2017, 2018; Saebi, 2015). Firms putting active attention on searching opportunities for digital BMI do so predominantly in their environment. They especially monitor their customers, both current and (potential) future. If the firm senses changes, such as the BM no longer being suitable to meet customers' needs, the current BM cannot be exploited. Firms should then seize focused or complex BMI and explore opportunities not associated with current BMs and resources (Gambardella and McGahan, 2010; Sawhney et al., 2006).

The more passive the sensing, the more the antecedents stem from the organizational context than the environment. Then, the firms sense a stagnation or even decline in their competitive position. However, if the current BM still serves the customers' needs, firms strengthen their BM and exploit extant resources and capabilities (Christensen, 1997; Markides, 2006) to evolve or adapt their BM. The resulting BMIs are natural changes to stay competitive in dynamic environments (Lanzolla and Markides, 2021).

In-between those two distinguishable sensing-seizing connections, we observe an intersection of adaptive and focused BMI in both sensing and seizing (highlighted by the striped area). Both adaptive and focused BMI position themselves in the middle between active and passive sensing, sensing environmental and organizational changes affecting the current BM. Seizing balances exploration and exploitation of both existing and new resources. While this sensing-seizing connection seems contradictory at first, it can be explained when looking at the firms at this intersection.

The key to resolving those contradictions lies in the role of technology and how firms at this intersection adopt new digital infrastructure[9] to undergo a digital BMI. We name this novel type of BMI as "consolidating." Firms consolidate technology toward a digital infrastructure, such as cloud computing, that allows them to exploit (e.g., reducing costs) and explore (e.g., pay-*per*-use payment) new BMI opportunities. Based on this consolidation and reduction of complexity, firms can undergo further adaptive BMI (constantly exploiting new infrastructure horizontally to become more efficient) and focused BMI (exploring new affordances of the infrastructure vertically). Sensing describes then how each of the further steps is being triggered.

After the consolidation to a digital BM infrastructure, there are distinct sensing-seizing connections for adaptive and focused BMI. For example, Apple's introduction of iTunes exploited the existing digital infrastructure for developing software and managing online transactions, expanding horizontally. Based on such infrastructure and consolidating BMI, firms are implementing focused BMI by using specific digital technologies that focus on solving a particular problem and pivot a single BM element, such as THA Group's remote monitoring solution to solve the problem of rising costs.

We extend Foss and Saebi's (2017) dimensionalization of the BMI construct (i.e., novelty and scope), with the dimensions of BMI creation emerging from the connection of sensing and seizing (i.e., context, attentionality, resources, orientation). There are four types of BMI (evolutionary, adaptive, focused, and complex) in terms of novelty and scope (Foss and Saebi, 2017). However, for firms leveraging digital technology for digital BMI, there are five ways to create these types of BMI in the sensing-seizing connection, listed in the header of Table 3. Every BMI type has a distinct sensing-seizing connection, which we added to Foss and Saebi's (2017) BMI typology resulting in Table 3. The fifth connection, which we call consolidating BMI, deploys the technological basis for further adaptive or focused BMI. It differentiates the role of digital technology. Consolidating BMIs put digital technology first, fundamentally changing the value creation to enable radically new BMIs that eventually become disruptive (Christensen, 1997; Lucas and Goh, 2009). In evolving, adapting, and focusing BMIs, digital technology complements a salient BM to provide economic benefit (Al-Debei and Avison, 2010; Chesbrough, 2007; Weber et al., 2021; Weking et al., 2020b).

Theoretical contributions

This work sheds light on the connection between sensing change and seizing digital BMI. Neither sensing nor seizing capabilities alone are sufficient to profit from change (Ravichandran, 2018; Tallon et al., 2019). However, the differences in firms' approaches to creating and capturing value in dynamic and digital environments reside in translating what has been sensed into how a digital BMI is seized (Foss and Saebi, 2017, 2018; Saebi, 2015). Thus, the connection of specific sensed antecedents with particular seizing strategies reveals the mechanisms underlying digital BMIs and the role of dynamic capabilities enabling firms to innovate their BM (Chesbrough, 2007; Foss and Saebi, 2017; Teece, 2010).

This study makes several contributions to the BMI and digital business strategy literature. First, it explains why firms engage in digital BMI. Most BMI research has focused on the importance of BMI in managing change, such as digital transformation and its economic outcomes (e.g., Rai and Tang, 2014; Saebi, 2015; Teece, 2010), overlooking how BMI responds to different antecedent contexts (cf. Foss and Saebi, 2018; Saebi, 2015). Thus, pathways to digital BMI remain unclear. We looked at the antecedents that firms sensed and responded to by seizing different types of digital BMI. This study explains how the connection of sensing and seizing results in four different types of BMI, as conceptualized by Foss and Saebi (2017). We introduce consolidating BMI as a new type of BMI unique to the digital context, enabling firms to adopt a new BM and subsequent digital BMIs based on a renewed digital infrastructure. The sensing-seizing connections, shown in Fig. 5, indicate what firms do to achieve the different types of BMI. Thus, even though these connections are not fully prescriptive, they show what firms are supposed to do to innovate their BMs in a certain way. For example, while the predominant technologies in our sample are digital platforms, mobile apps, and cloud computing, we argue that the connections will apply similarly to new digital technologies, such as artificial intelligence. Therefore, this study contributes to a prescriptive BMI theory. It complements literature on innovative BMs formulated in BM taxonomies (e.g., Weber et al., 2021; Weking et al., 2020a). Whether the firm has consolidated its BM and digital infrastructure to enable further adaptive and focused BMI, the digital BM taxonomies apply differently to focal BMIs.

Second, the connection of sensing and seizing for digital BMI theorizes how firms leverage dynamic capabilities for different types of BMI. This goes beyond how to build dynamic capabilities and moves toward connecting sensed antecedents with seizing strategies. These connections expand our understanding of what capabilities are needed for sensing and seizing, such as Battistella et al. (2017). We show that the emergence of different BMI types cannot be solely explained by the antecedents causing a firm's decision to innovate their BM, but the combination of what and how these antecedents are sensed and seized. Scholars building on dynamic capabilities theory need to acknowledge such connections when explaining the change, innovation, or the creation of competitive advantage.

[9] Teece (2018b) refers to these technologies as "enabling technology" that "are capable of ongoing technical improvement; and enable complementary innovations in application sectors." This builds on Martin's (1993) notion of "generic technologies" whose exploitation will "benefit a wide range of sectors of the economy and/or society.".

Practical implications

Strategy is about what the firm chooses to do and not to do; it is about sensing changes within and outside the organization and deciding whether and how to seize them (Gavetti and Rivkin, 2005). As firms struggle to innovate their BMs (Chesbrough, 2007; Teece, 2010), our results support analogical thinking for strategists (Gavetti and Rivkin, 2005). Knowledge about how possible BM innovations can seize sensed antecedents helps firms make appropriate decisions when sensing change. Firms can draw their evaluation from our sensing-seizing connections, configurations, and individual cases, providing different pathways to digital BMI. Thus, firms can effectively leverage their resources and capabilities on a designated path for designing and experimenting with new digital BMs.

Limitations

Combining the case survey method and csQCA mitigates some shortcomings of both approaches. Analyzing a sample of published case studies using csQCA allows us to build on existing research findings, considering the antecedents and understanding digital BMI's complexity and dynamic capabilities. Nevertheless, our research faces some limitations. First, our analysis relies on secondary data derived from case studies. We used inclusion and exclusion criteria to select cases with rich information and triangulated the data to aim for an adequate understanding of the cases. However, the cases originally served a different purpose and focused on different aspects of digital BMI that we cannot understand in-depth; thus, we used only a few cases that explicitly focused on dynamic capabilities and the implications of change. We include the coding of the cases in Appendix C for researchers to question our coding and comprehension. Second, the quantification of qualitative case data necessarily results in information loss (Larsson, 1993). This is conveyed by the number of cases (49) and the use of QCA, which emphasizes the in-depth case analysis, to analyze our configurations. We coded the information binary, only accounting for the presence of an antecedent. Hence, it is not possible to compare the impact strength of antecedents. We must acknowledge that our analysis was performed at a high level and does not aim for exceedingly detailed analyses of each case.

Future research

This study warrants several avenues for future research on digital BMI. First, empirical research can build on our findings to refine digital BMI moderators, thus further extending the BMI typology. The differences in connecting sensing and seizing digital BMI may manifest in variances in firm-level moderators, such as entrepreneurial behavior, culture, or cognition (e.g., Aspara et al., 2013; Doz and Kosonen, 2010; George and Bock, 2011). On an ecosystem level, the pathways may be impacted by digital BMIs in the ecosystem or the economy (Floetgen et al., 2021; Teece, 2018b). Second, quantitative studies can further refine our set-theoretic approach by examining the strength of relationships between sensed antecedents and the seized BMI. Third, the role of technology innovation for digital BMI requires further clarification. As we argued, the application of digital BM taxonomies differs for firms depending on their context. Future BM taxonomy research could emphasize this difference when providing recommendations on innovating the BM based on the investigated digital technology.

Conclusion

Dynamic capabilities are highly relevant to the environmental changes caused by digital transformations, and digital BMIs are essential for thriving amidst the ongoing transformations. As previous research shows, sensing and seizing are interrelated components of dynamic capabilities. This paper explains how firms connect sensing and seizing for digital BMI based on a configurational analysis. Thereby, we extend the BMI typology by Foss and Saebi (2017) with the perspective of how different types of BMI emerge and find one new type unique to the digital context. The connection of sensing and seizing shows that pathways to digital BMI depend on the digital infrastructure that has been built in these consolidating BMIs and that enables different future directions of digital BMI.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Explanation of research methodology

See Table A1.

Table A1
Search terms and database hits.

Database Search term	Web of Science	Scopus	AIS Electronic Library*
"business model innov*"	818	1,086	98
"innov* business model"	143	617	100
"business model transform*"	26	60	0
"transform* business model"	4	34	44
"business model renewal"	6	11	5
"business model reinvention"	2	2	0
"business model evolution"	29	47	30
"business model dynamics"	8	26	81
"disruptive business model"	16	71	15
"business model disruption"	5	8	15
Unique per database	955	1,785	238
Unique	1,850		
Full-text analysis	233		
Covering digital BMI	67		
Covering antecedents of BMI	44		
Selected for analysis	**44**		

* The search of the AIS Electronic Library does not function with wildcard searches(*). Search terms with * at the end waived the wildcard. Search terms with * in the middle of a term were divided into two terms linked with the AND operator (e.g., "transform" AND "business model").

Appendix B. Case sample

Within the sample of 49 firms listed in Table B1, most headquarters are located in Europe (22), followed by 14 in the USA and eight in Asia. Two firms were located in Oceania and one in the UAE. The firms were mainly active in ICT (9), media (9), manufacturing (7), mobility (5), and retail (5). Other industries include finance (3), health (2), insurance (2), and telecommunication (2). The sample covers a wide range of firm sizes (revenue and employees), ranging from below US$10 M to above US$500B (avg.: US$65B: US$16B) and from 100 to more than two million employees (avg.: 160,000; median: 36,000). (SEE Table B2.).

Table B1
Case sample and references.

No	Case	Reference
1	Progressive Corporation	Desyllas and Sako (2013)
2	China United Telecommunication Corporation	Wu et al. (2013)
3	Anonymous (Ericsson)	Khanagha et al. (2014)
4	Anonymous	Velu (2016); Velu and Stiles (2013)
5	Suning Appliance Company Limited	Cao (2014)
6	Uber	Khare et al. (2016); Watanabe et al. (2016)
7	Edeka	Zolnowski et al. (2014)
8	100percent	Newth (2016)
9	Anonymous	Velu (2017)
10	Cyberlibris	Laïfi and Josserand (2016)
11	Apple (iTunes)	Park (2011); Purkayastha and Sharma (2016)
12	Philips	Brock et al. (2019)
13	Walmart	Lv and Liu (2012)
14	Donkey Republic	Winslow and Mont (2019)
15	Salesforce	Snihur et al. (2018)
16	eBay Classifieds	Comberg and Velamuri (2017)
17	Schindler	Wißotzki et al. (2017)
18	Lufthansa	Chen et al. (2017); Chen et al. (2016)
19	DP World	Kamoun (2008)
20	Alibaba	Tan et al. (2009)
21	Netflix	Rayna and Striukova (2016)
22	Spotify	Rayna and Striukova (2016)
23	Hilti	Johnson et al. (2008)
24	Dow Corning	Bucherer et al. (2012); Johnson et al. (2008)
25	Anonymous	Ahokangas et al. (2014)
26	Anonymous	Ahokangas et al. (2014)
27	RTL Television	Huyskens and Loebbecke (2007)

(continued on next page)

Table B1 (*continued*)

No	Case	Reference
28	Allianz Suisse	Bucherer et al. (2012)
29	Daimler: Car2Go	Bucherer et al. (2012)
30	e24	Bucherer et al. (2012)
31	Endress + Hauser	Bucherer et al. (2012)
32	Tencent	Dai et al. (2011)
33	Card Union Technology Co., ltd	Gou et al. (2018)
34	Card Union Technology Co., ltd	Gou et al. (2018)
35	Anonymous	Günzel and Wilker (2012)
36	Wishberry	Gupta and Bose (2019)
37	Apple	Purkayastha and Sharma (2016)
38	Anonymous	Rajala et al. (2018)
39	Rubicon Global	Rajala et al. (2018)
40	Mohawk	Stamas et al. (2014)
41	GoGet	Tan et al. (2017)
42	IBM	Jetter et al. (2009)
43	THA Group	Singh et al. (2011)
44	Business	Mezger (2014)
45	Technology	Mezger (2014)
46	Games	Mezger (2014)
47	Knowledge	Mezger (2014)
48	Printing	Mezger (2014)
49	Education	Mezger (2014)

Table B2
Collected descriptive case information.

ID	Firm	Headquarter location	Industry (primary)	Revenue (estimate)	Employees (estimate)	Startup / Incumbent	Year of BMI	Technologies
1	Progressive Corporation	USA	Insurance	$ 30.000.000.000	35,000	Startup	1999	Internet, GPS, digital maps, data analytics
2	China United Telecommunication Corporation	China	Telecom	$ 40.000.000.000	n. a.	Incumbent	2003	Internet, mobile, digital platforms
3	Anonymous (Ericsson)	Sweden	Telecom	$ 22.000.000.000	110,000	Incumbent	2009	Cloud computing
4	Unknown	USA	Finance	n. a.	n. a.	Incumbent	2002	Digital platforms
5	Suning Appliance Company Limited	China	Retail	$ 36.900.000.000	39,031	Incumbent	2010	E-commerce, digital platforms
6	Uber	USA	Mobility	$ 11.270.000.000	22,263	Startup	2009	Mobile apps, digital platforms
7	Edeka	Germany	Retail	$ 60.018.600.000	376,000	Incumbent	2013	Mobile apps, mobile payment
8	100percent	New Zealand	Social	n. a.	n. a.	Startup	2014	Digital platforms
9	Anonymous	India	Farm & Food	n. a.	n. a.	Incumbent	2007	Mobile
10	Cyberlibris	France	Education	$ 2.463.450	< 100	Startup	2001	Internet
11	Apple	USA	IT	$ 265.595.000.000	132,000	Incumbent	2003	Internet, digital platforms
12	Philips	Netherlands	Manufacturing	$ 20.290.989.750	77,400	Incumbent	2011	Internet-of-Things
13	Walmart	USA	Retail	$ 514.400.000.000	2,200,000	Incumbent	n. a.	E-commerce
14	Donkey Republic	Denmark	Mobility	n. a.	< 100	Startup	2005	Mobile apps, digital platforms
15	Salesforce	USA	IT	$ 13.280.000.000	35,000	Startup	1999	Cloud computing, digital platforms
16	eBay (Kleinanzeigen)	USA	Retail	$ 10.746.000.000	14,100	Incumbent	2004	Digital platforms
17	Schindler	Germany	Manufacturing	$ 10.414.134.900	58,271	Incumbent	2016	Cloud computing, hardware technology
18	Lufthansa	Germany	Mobility	$ 40.131.840.000	135,500	Incumbent		Data analytics
19	DP World	UAE	Logistics	$ 4.231.000.000	36,000	Incumbent	2008	RFID
20	Alibaba	China	Retail	$ 200.000.000.000	102,000	Startup	1999	Digital platforms
21	Netflix	USA	Media	$ 15.794.000.000	5400	Startup	2007	Internet, data analytics, digital platforms
22	Spotify	Sweden	Media	$ 5.980.000.000	4165	Startup	2006	Internet, mobile, digital platforms
23	Hilti	Germany	Manufacturing	$ 5.747.676.750	27,000	Incumbent	n. a.	

(*continued on next page*)

Table B2 (*continued*)

ID	Firm	Headquarter location	Industry (primary)	Revenue (estimate)	Employees (estimate)	Startup / Incumbent	Year of BMI	Technologies
								Software technology
24	Dow Corning	USA	Manufacturing	$ 6.120.000.000	12,000	Incumbent	2002	E-commerce
25	Anonymous	Finland	IT	n. a.	n. a.	Incumbent	n. a.	Cloud computing
26	Anonymous	Finland	IT	n. a.	n. a.	Incumbent	n. a.	Cloud computing, digital platforms
27	RTL Television	Germany	Media	n. a.	n. a.	Incumbent	2006	Digital platforms
28	Allianz Suisse	Switzerland	Insurance	$ 4.255.050.000	3600	Incumbent	n. a.	Telematics
29	Daimler: Car2Go	Germany	Mobility	$ 187.446.150.000	298,683	Incumbent	2009	Mobile apps, digital platforms
30	e24	Switzerland	Finance	n. a.	n. a.	Startup	2007	Mobile apps, mobile payment
31	Endress + Hauser	Switzerland	Manufacturing	$ 2.509.359.750	13,299	Incumbent	n. a.	
32	Tencent	China	IT	$ 44.000.000.000	54,309	Incumbent	2003	Mobile apps, digital platforms
33	Card Union Technology Co., ltd	China	IT	n. a.	n. a.	Incumbent	2006	E-commerce, digital platforms
34	Card Union Technology Co., ltd	China	IT	n. a.	n. a.	Incumbent	2013	Mobile apps, digital platforms
35	Anonymous		Health	n. a.	n. a.	Incumbent	2011	Internet-of-Things
36	Wishberry	India	Finance	n. a.	n. a.	Startup	2012	Digital platforms
37	Apple	USA	IT	$ 265.595.000.000	132,000	Incumbent	2008	Mobile apps, digital platforms
38	Anonymous		Manufacturing	n. a.	n. a.	Incumbent	n. a.	Internet-of-Things, digital platforms, data analytics
39	Rubicon Global	USA	Services	$ 450.000.000	381	Startup	2008	Digital platforms
40	Mohawk	USA	Manufacturing	$ 300.000.000	550	Incumbent	2010	Cloud computing, digital platforms
41	GoGet	Australia	Mobility	n. a.		Startup	2006	Product-service-systems, digital platforms
42	IBM	USA	IT	$ 80.000.000.000	350,600	Incumbent	2003	Software technology
43	THA Group	USA	Health	n. a.	100	Incumbent	2001	Internet-of-Things
44	Business	Germany	Media	200.000.000 €	1000	Incumbent	n. a.	Digital platforms
45	Technology	Germany	Media	3.000.000.000 €	12,000	Incumbent	n. a.	Digital platforms
46	Games	Germany	Media	300.000.000,00 €	1500	Incumbent	n. a.	Digital platforms
47	Knowledge	Germany	Media	n. a.	70	Startup	n. a.	
48	Printing	Germany	Media	n. a.	20	Startup	n. a.	
49	Education	Germany	Media	n. a.	8	Startup	n. a.	

Appendix C. Case coding

See Tables C1-C2.

Table C1
Coding scheme.

		Category	Abbreviation	Code	Explanation
Sense: Antecedents	*Organizational antecedents*	*Business model limitations*	*BM limit*	1	BM is a limiting factor
				0	BM is not a limiting factor.
		Resource utilization	*Resource util.*	1	Existing resources are utilized.
				0	Existing resources are not utilized.
		Financial need	*Fin. Need*	1	The firm is facing a financial need.
				0	The firm is not facing a financial need.
	Environmental antecedents	*Competitive pressure*	*Comp. pressure*	1	Strong competitive pressure
				0	No particularly strong competitive pressure
		Customer need	*Cust. Need*	1	Changing customer needs must be addressed
				0	Changing customer needs do not need to be addressed in particular.
		Technology innovation	*Tech. innovation*	1	Capitalized on new technology
				0	Did not capitalize on new technology
Seize: Outcome		*BMI type*		1	Evolutionary business model innovation
				2	Adaptive business model innovation
				3	Focused business model innovation
				4	Complex business model innovation

Table C2
Case coding as input for the csQCA.

No	Case	Organizational antecedents			Environmental antecedents			Outcome
		BM limit.	Resource util.	Fin. need	Comp. pressure	Cust. need	Tech. innovation	BMI type
1	Progressive Corporation	0	1	0	0	0	1	1
2	China United Telecommunication Corporation	0	0	0	0	1	0	3
3	Anonymous (Ericsson)	0	0	0	1	0	1	2
4	Anonymous	0	0	1	0	0	0	3
5	Suning Appliance Company Limited	0	0	0	1	1	0	4
6	Uber	0	0	0	0	1	1	3
7	Edeka	0	0	0	0	0	1	1
8	100percent	1	0	0	0	0	0	3
9	Anonymous	0	1	0	0	1	1	3
10	Cyberlibris	0	0	0	0	1	0	1
11	Apple	0	1	0	1	1	0	2
12	Philips	0	0	0	0	1	0	4
13	Walmart	0	0	0	1	0	0	1
14	Donkey Republic	1	0	0	0	0	0	1
15	Salesforce	0	0	0	0	1	1	4
16	eBay (Kleinanzeigen)	0	0	1	1	0	0	1
17	Schindler	0	1	0	0	0	0	3
18	Lufthansa	0	1	1	1	0	0	1
19	DP World	0	1	0	0	0	0	1
20	Alibaba	0	1	0	0	1	1	4
21	Netflix	0	0	0	0	0	1	4
22	Spotify	0	0	0	0	0	1	2
23	Hilti	0	0	1	0	0	0	4
24	Dow Corning	0	0	1	0	1	0	3
25	Anonymous	0	0	0	1	0	1	2
26	Anonymous	1	0	0	1	0	0	2
27	RTL Television	0	0	0	1	1	0	2
28	Allianz Suisse	0	0	1	1	0	0	1
29	Daimler: Car2Go	1	0	0	0	1	0	4
30	e24	0	1	0	0	0	0	2
31	Endress + Hauser	0	0	0	0	1	1	4
32	Tencent	1	0	0	0	1	0	4
33	Card Union Technology Co., ltd	0	0	0	0	1	0	3
34	Card Union Technology Co., ltd	1	0	0	0	0	0	1
35	Anonymous	0	0	0	0	1	1	1
36	Wishberry	0	0	0	0	0	1	3
37	Apple	0	1	0	0	0	0	4
38	Anonymous	0	0	0	1	0	0	3
39	Rubicon Global	0	1	0	0	0	0	4
40	Mohawk	1	0	1	1	1	0	4
41	GoGet	1	0	0	0	0	0	1
42	IBM	0	1	0	0	0	1	1
43	THA Group	0	0	1	0	0	1	3
44	Business	1	1	0	0	1	0	1
45	Technology	0	1	0	0	1	1	2
46	Games	0	1	0	0	1	0	2
47	Knowledge	0	0	0	0	1	1	1
48	Printing	0	0	0	0	1	1	2
49	Education	0	1	0	0	1	1	3

Appendix D. Truth tables

Abbreviations used in the following tables:
See Tables D1-D4.

Table D1
The truth table for evolutionary BMI.

Cust. need	Fin. need	Resource util.	Tech. innovation	Comp. pressure	BM limit.	OUT	n	incl	cases
0	0	1	1	0	0	1	2	1.000	1,42
0	1	0	0	1	0	1	2	1.000	16,28
0	1	1	0	1	0	1	1	1.000	18
1	0	1	0	0	1	1	1	1.000	44
0	0	0	0	0	1	0	4	0.750	8,14,34,41
0	0	0	0	1	0	0	2	0.500	13,38
1	0	0	1	0	0	0	6	0.333	6,15,31,35,47,48
0	0	0	1	0	0	0	4	0.250	7,21,22,36
1	0	0	0	0	0	0	4	0.250	2,10,12,33
0	0	1	0	0	0	0	5	0.200	17,19,30,37,39
1	0	1	1	0	0	0	4	0.000	9,20,45,49
0	0	0	1	1	0	0	2	0.000	3,25
0	1	0	0	0	0	0	2	0.000	4,23
1	0	0	0	0	1	0	2	0.000	29,32
1	0	0	0	1	0	0	2	0.000	5,27
0	0	0	0	1	1	0	1	0.000	26
0	1	0	1	0	0	0	1	0.000	43
1	0	1	0	0	0	0	1	0.000	46
1	0	1	0	1	0	0	1	0.000	11
1	1	0	0	0	0	0	1	0.000	24
1	1	0	0	1	1	0	1	0.000	40

Table D2
The truth table for adaptive BMI.

Cust. need	Fin. need	Resource util.	Tech. innovation	Comp. pressure	BM limit.	OUT	n	incl	cases
0	0	0	1	1	0	1	2	1.000	3,25
0	0	0	0	1	1	1	1	1.000	26
1	0	1	0	0	0	1	1	1.000	46
1	0	1	0	1	0	1	1	1.000	11
1	0	0	0	1	0	0	2	0.500	5,27
0	0	0	1	0	0	0	4	0.250	7,21,22,36
1	0	1	1	0	0	0	4	0.250	9,20,45,49
0	0	1	0	0	0	0	5	0.200	17,19,30,37,39
1	0	0	1	0	0	0	6	0.167	6,15,31,35,47,48
0	0	0	0	0	1	0	4	0.000	8,14,34,41
1	0	0	0	0	0	0	4	0.000	2,10,12,33
0	0	0	0	1	0	0	2	0.000	13,38
0	0	1	1	0	0	0	2	0.000	1,42
0	1	0	0	0	0	0	2	0.000	4,23
0	1	0	0	1	0	0	2	0.000	16,28
1	0	0	0	0	1	0	2	0.000	29,32
0	1	0	1	0	0	0	1	0.000	43
0	1	1	0	1	0	0	1	0.000	18
1	0	1	0	0	1	0	1	0.000	44
1	1	0	0	0	0	0	1	0.000	24
1	1	0	0	1	1	0	1	0.000	40

Table D3
The truth table for focused BMI.

Cust. need	Fin. need	Resource util.	Tech. innovation	Comp. pressure	BM limit.	OUT	n	incl	cases
0	1	0	1	0	0	1	1	1.000	43
1	1	0	0	0	0	1	1	1.000	24
1	0	0	0	0	0	0	4	0.500	2,10,12,33
1	0	1	1	0	0	0	4	0.500	9,20,45,49
0	0	0	0	1	0	0	2	0.500	13,38
0	1	0	0	0	0	0	2	0.500	4,23
0	0	0	0	0	1	0	4	0.250	8,14,34,41
0	0	0	1	0	0	0	4	0.250	7,21,22,36
0	0	1	0	0	0	0	5	0.200	17,19,30,37,39
1	0	0	1	0	0	0	6	0.167	6,15,31,35,47,48
0	0	0	1	1	0	0	2	0.000	3,25
0	0	1	1	0	0	0	2	0.000	1,42
0	1	0	0	1	0	0	2	0.000	16,28

(continued on next page)

Table D3 (*continued*)

Cust. need	Fin. need	Resource util.	Tech. innovation	Comp. pressure	BM limit.	OUT	n	incl	cases
1	0	0	0	0	1	0	2	0.000	29,32
1	0	0	0	1	0	0	2	0.000	5,27
0	0	0	0	1	1	0	1	0.000	26
0	1	1	0	1	0	0	1	0.000	18
1	0	1	0	0	0	0	1	0.000	46
1	0	1	0	0	1	0	1	0.000	44
1	0	1	0	1	0	0	1	0.000	11
1	1	0	0	1	1	0	1	0.000	40

Table D4
The truth table for complex BMI.

Cust. need	Fin. need	Resource util.	Tech. innovation	Comp. pressure	BM limit.	OUT	n	incl	cases
1	0	0	0	0	1	1	2	1.000	29,32
1	1	0	0	1	1	1	1	1.000	40
0	1	0	0	0	0	0	2	0.500	4,23
1	0	0	0	1	0	0	2	0.500	5,27
0	0	1	0	0	0	0	5	0.400	17,19,30,37,39
1	0	0	1	0	0	0	6	0.333	6,15,31,35,47,48
0	0	0	1	0	0	0	4	0.250	7,21,22,36
1	0	0	0	0	0	0	4	0.250	2,10,12,33
1	0	1	1	0	0	0	4	0.250	9,20,45,49
0	0	0	0	0	1	0	4	0.000	8,14,34,41
0	0	0	0	1	0	0	2	0.000	13,38
0	0	0	1	1	0	0	2	0.000	3,25
0	0	1	1	0	0	0	2	0.000	1,42
0	1	0	0	1	0	0	2	0.000	16,28
0	0	0	0	1	1	0	1	0.000	26
0	1	0	1	0	0	0	1	0.000	43
0	1	1	0	1	0	0	1	0.000	18
1	0	1	0	0	0	0	1	0.000	46
1	0	1	0	0	1	0	1	0.000	44
1	0	1	0	1	0	0	1	0.000	11
1	1	0	0	0	0	0	1	0.000	24

Out	*Output value*	Indicates whether the configuration leads to the outcome (e.g., evolutionary BMI) and fulfills the defined threshold criteria
n	*Number of cases in configuration*	
incl	*Sufficiency inclusion score*	Equals consistency: the proportion of cases yielding the outcome represented by the configuration (Greckhamer et al., 2018)
cases	*Case ID*	Case identifier based on Table B-1

Outcome: BMI Type = Evolutionary.

Outcome: BMI Type = Adaptive.

Outcome: BMI Type = Focused.

Outcome: BMI Type = Complex.

Appendix E. Antecedents

See Table E1.

Table E1
Explanation of sensed antecedents.

		Category	Explanation
Sense: Antecedents	*Organizational antecedents*	*Business model limitations*	*Business model limitations* as an antecedent for change. This implies firms recognize that their business model was unsuitable for further growth or the future business environment. For example, firms noticed that their business model was copied by competitors, not scalable to international markets, or at risk of being depreciated.
		Resource utilization	Firms leveraged their specific capabilities and knowledge to exploit opportunities for a digital BMI. Drawing from the resource-based view of the firm Barney (2016), we named this antecedent *Resource utilization.* Whether a firm already possessed the resources, knowledge, or capabilities for the new business model, or whether they created, hired, or acquired them, we

(*continued on next page*)

Table E1 (*continued*)

	Category	Explanation
		separated this antecedent into *Consuming* and *Creating*. For example, Apple had strong hardware and software development capabilities before creating the iPod and iTunes. Nevertheless, one case ("Gaming") from Mezger (2014) actively sourced new employees to bring new knowledge and capabilities into the firm.
	Financial need	We observe three sub-categories for this antecedent. First, *decreasing profitability* was sensed, such as higher costs or lower prices that can cause financial trouble. Second, *stagnation* of sales and customer demand prevents firms from achieving strategic goals. Third, the top management can actively create antecedents, such as *financial goals* that aim to make the firms more profitable.
Environmental antecedents	*Competitive pressure*	*Competitive pressure* threatens a firm's business model. We observe incumbent firms competing to maximize their value capture or a sudden rise of competition caused by a new entrant or substitutional business model.
	Customer need	This behavior change can either be a changed, previously different need: for example, the need to have access to a car or computational resources everywhere and every time instead of owning the product. Or it can be a new, previously non-existent need. For example, the need to have informative or entertaining content available free of charge and mobile. While a *customer threat* puts a firm's business model at risk, a *customer opportunity* provides the chance to extend the business model to serve these customers.
	Technology innovation	New technology provides a way to rethink the firm's business model. For example, cloud computing-enabled business models provide hardware or software services on a usage basis.

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The Interdependencies between Customer Journey, Business Model, and Technology in Creating Digital Customer Experiences – A Configurational Analysis at the Example of Brick-and-Mortar Retail

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Abstract

As brick-and-mortar retail increasingly disappears while online retail flourishes, the customer experience (CX) becomes a critical source of competitive advantage. Customers expect the same information, personalization, and availability in a brick-and-mortar store as they do online. While digital technology enables such CXs and enhances the advantage of the physical experience, brick-and-mortar retailers struggle with the complexity of these digital transformations. We analyze 38 cases of retailers implementing digital transformations to create digital CXs by conducting a qualitative comparative analysis. In eight expert interviews, we refine our understanding of CX in retail and discuss the validity and generalizability of the three resulting configurations: value chain innovation, seamless purchase experience, and personal experience. They provide actionable pathways to digital CX representing individual transformation initiatives. Since the configurations overlap strongly, we discuss the necessity to combine the three configurations to implement digital CX across all phases of the customer journey and business model.

Keywords: customer experience, digital transformation, retail, QCA.

1. Introduction

Digital marketplaces such as Alibaba or Amazon are overtaking brick-and-mortar retailers, causing disruptions in the retail industry. Artificial intelligence, the internet of things, mobile commerce, and extended reality have become ubiquitous and eventually unavoidable for retail (Grewal et al., 2020). The question has long since ceased to be whether brick-and-mortar retailers need to undergo a digital transformation but how to do it.

Digital technology, for example, implemented to create digitally augmented stores, can help attract, support, and engage customers in their customer journey. Digital mirrors that, for example, virtually change the color of a shirt or personalize prices and complementary products, rather than just buying and consuming the product or service, create a digital customer experience (DCX) that ensures customers move through the various stages of this journey (Lemon & Verhoef, 2016; Roggeveen & Sethuraman, 2020).

DCX is about fulfilling the customer's desire for an experience supported by digital technology. Since customers want different experiences at different stages of their customer journey, the business model (BM), which describes all company activities to create and capture value for and from customers, must fulfill these desires. DCX thus emerges at the intersection of digital support for the customer journey and digital innovation of the BM (Lemon & Verhoef, 2016).

The ways digital technology can be used to create DCXs have become a significant source of competitive advantage in retail (Keiningham et al., 2020). However, firms struggle to create DCX because they do not view DCX as an integrated construct of the customer journey and BM that takes into account changing customer expectations along their journey and the experience offered across the various BM elements. For example, Procter & Gamble wasted great investments in their digital distribution systems to have their products available to the customer at all the times, thus ensuring the transition from the pre-purchase to the purchase stage. However, as part of the BM, their key partners and retail customers were not ready for these systems, which then failed (Grewal et al., 2020). From a different perspective, Macy's once rejected the TV shopping BM idea that spawned QVC and a significant competitor because they did not understand the customer journey of willingly buying a product that was just comfortably presented to customers on the couch.

The literature already selectively addresses these challenges, such as the benefits of digital technologies and their usage along the customer journey (Roggeveen & Sethuraman, 2020) or in BMs (Böttcher, Li, et al., 2021). Thus, we know how digital technology can innovate either the customer or the firm perspective on DCX. Although both sides are necessary, one of the two implementations may not achieve the desired result of improving DCX, as the example of Procter & Gamble shows, and convince customers to continue their journey satisfied or return because of the positive DCX. Such focused research does not provide integrated recommendations for creating DCX that coherently addresses the two-sided challenge of creating a digital customer journey and digital BM innovation (Grewal et al., 2020; Keiningham et al., 2020).

To make such recommendations that address the interactions between the customer journey, the BM, and digital technology, we seek to find configurations that explain what experiential value represented in the BM is presented to the customer along the customer journey when using digital technology that creates such DCX in retail. These configurations demonstrate how retailers digitally transformed their customer journey and BM in alignment to create DCX. We propose the following research question: *What are the configurations of using digital technology across the customer journey and the BM to create digital customer experiences?* Brick-and-mortar retail provides an appropriate research context because changes in consumer behavior impact retailers early on, requiring an early response from retailers who are now using digital technologies to create DCX (Hagberg et al., 2017). As such, the industry serves as a pathfinder for other consumer-facing industries. Brick-and-mortar retail is of particular interest because consumers are increasingly shopping online, and offline retailers need to counteract this trend by offering experiences that convince consumers to shop in offline stores (Brynjolfsson et al., 2013).

We follow a three-step research approach, combining a case survey with qualitative comparative analysis (QCA) and refining the resulting configurations with expert interviews. Based on 38 case studies on digital transformations of brick-and-mortar retailers, we identify three set-theoretic configurations creating DCX. We refine our understanding of these configurations, namely digitally innovated supply chains, seamless purchase experiences, and personal experiences, with eight expert interviews. The findings propose three individual DCX initiatives to transform the customer journey and the BM digitally. Besides the interdependencies between the customer journey, the BM, and digital technology, the QCA also reveals interdependencies between the three configurations. Hence, all three configurations must be combined to create a holistic DCX. This guides practice to implement digital technology to effectively create DCX by digitally transforming the customer journey and the BM in alignment with each other.

2. Theoretical Background

2.1. Digital Customer Experience

Holbrook and Hirschman (1982) introduced the idea that consumer consumption involves experience factors rather than viewing consumers as purely rational actors. Experiences employ hedonic, symbolic, and aesthetic characteristics of the customer journey. Later, Pine and Gilmore (1998) referred to the emergence of the *Experience Economy* as the next step in economic value progression, replacing the agricultural, industrial, and service economies. Building on these initial findings, the existing literature describes customer experience (CX) as the interplay between a company's physical performance and the aroused emotions of customers, intuitively measured at each contact with customer expectations (Shaw & Ivens, 2002). Therefore, CX is a "multidimensional construct focusing on a customer's cognitive, emotional, behavioral, sensorial, and social responses to a firm's offerings during the customer's entire [customer] journey" (Lemon & Verhoef, 2016). Due to the holistic nature of CX, this endeavor is also notably challenging to replicate, in contrast to various product or service improvements (Berry et al., 2002).

To provide an immersive CX and enhance and promote competitive advantage, retailers must leverage today's digital technologies. We refer to CX as the overall concept of experiences provided to the customer and to DCX if this CX is created by using digital technology, thus digital technology is critical for the CX. However, the sole use of technology is no longer a fascination point for consumers but a base expectation (Stephens & Pine, 2017). Technological stimuli are increasingly becoming essential to creating a memorable CX (Bustamante & Rubio, 2017). Creating DCXs, for example, by guiding a customer in the store using augmented reality or smart monitors is becoming a prerequisite for competitiveness as retail is rapidly evolving due to changes in consumer behavior (Grewal et al., 2020; Piccinini et al., 2015). DCX provides value for retailers by either attracting customers who value such experiences and are willing to pay more for a DCX or digitizing human services such as customer consultations or self-checkout payments (Sethuraman & Parasuraman, 2005).

To assess how digital technology creates value in DCXs, firms must consider when technology is used in the customer's journey (Roggeveen & Sethuraman, 2020). The customer journey refers to "a series of touchpoints, involving all activities and events related to the delivery of the service from the customer's perspective" (Patrício et al., 2011) and is considered an integrative and vital part of CX (Voorhees et al., 2017). These touchpoints (i.e., interactions) are divided into the three stages, pre-purchase, purchase, and post-purchase, and into direct and indirect interactions (Lemon & Verhoef, 2016). For example, intelligent warehouses create value pre-purchase by providing customers information about how many product items are available in a particular store or by enabling data analytics for improved stock levels. They also add value after the purchase, such as handling customer returns, offering follow-up services, or making new purchases based on the previous CX. Direct interactions mainly happen during the purchase stage, the use, and the receipt of goods and services. The indirect contact consists of interactions pre-and post-purchase, such as depicting a company's product, reviewing recommendations or criticism, services, brands, advertising, reports, or news (Meyer & Schwager, 2007).

2.2. Business Models

To fully leverage the potential of digital technology for DCX, the technology must also be embedded in the BM. Firms need to gauge the impact of technologies on DCX in terms of additional revenue when new BMs are enabled or cost savings when a given BM can be optimized (Böttcher & Weking, 2020; Jocevski et al., 2019).

The term "BM" is defined as the "logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value" (Teece, 2010, p. 179). Thus, the BM is the architecture linking interdependent activities to create, deliver, and capture value (Zott & Amit, 2010). It consists of three main components: the value proposition (i.e., the offered products and services), the value chain (i.e., all processes and activities and the necessary resources, capabilities, and coordination to achieve the value proposition), and the revenue model (i.e., cost structure and revenue streams) (Zott & Amit, 2010). Digital technology is relevant for all these elements. Once it fundamentally alters the elements, the BM is considered a digital BM (Veit et al., 2014).

Consciously integrating DCX in the BM offers new perspectives for firms in renewing their BMs. Firms frequently conduct BM changes based on their perception of what the market will accept and believe will achieve their business objectives. Nevertheless, the literature has ignored DCX's implications for BMs (Keiningham et al., 2020). Both topics overlap strongly since a new BM typically influences customer perceptions of their experiences with a company. DCX can also be viewed as a potential enabler for creating new digital BMs by capitalizing on opportunities that customers want and are willing to alter their category spending (Weill & Woerner, 2018). Digital technology is the catalyst for bringing these concepts together.

2.3. An Integrated Perspective on DCX

Based on the overlap of the presented elements of DCX, customer journey, digital technologies, and BMs, we propose an integrated socio-technical perspective on DCX presented in Figure 1 (Bostrom & Heinen, 1977). This socio-technical perspective highlights the integrated and interdependent nature of the concepts related to DCX.

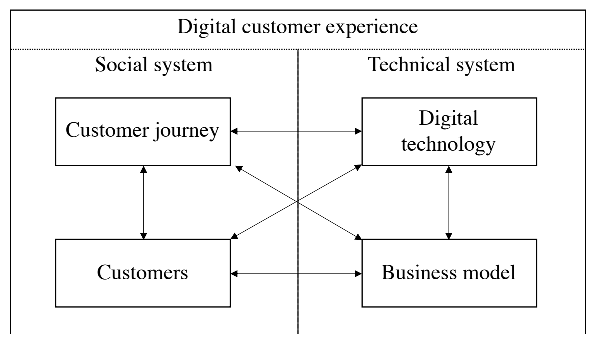

Figure 1. A socio-technical perspective on CX

As the value of technology increases when embedded in a salient BM, retailers need to consider the opportunities that digital technology offers to innovate the BM (Teece, 2010). The BM presents a technical system articulating "the processes, tasks, and technology needed to transform inputs to outputs" (Bostrom & Heinen, 1977, p. 17), or the activities to create, deliver, and capture value (Zott & Amit, 2010). It creates affordances to use digital technologies to introduce novel activities that add customer value and incorporate part of that value as profit (Teece, 2010). The integration of DCX provides possibly more than just an incremental improvement in a firm's current BM; it can help organizations innovate, allocate resources, and transition from an old BM to a new one based on newly created customer demand (Norton & Pine, 2013).

Further, DCX can be captured in the three stages of the customer journey and its touchpoints between the retailer and the customer. Roggeveen and Sethuraman (2020) argue that digital technology provides value in the different stages of the customer journey and creates, changes, or enhances the associated touchpoints. Firms need to acknowledge the affordances related to implementing digital technology in the different customer journey stages and assess how, why, and when it can create value for the customer, thus improving the DCX.

In summary, firms' affordances to create a DCX are the potential technology implementations to support the customer journey (i.e., activities in the pre-purchase, the purchase, or the post-purchase stage) and to change the BM (i.e., the value proposition, or the value chain).

3. Methodology

We conducted a three-step research method depicted in Figure 2. In step one, we followed the case survey method (Larsson, 1993) to collect a case sample on retailers implementing DCX initiatives. We coded these cases using a coding scheme grounded in theory from a structured literature review. In step two, we analyzed this coded case sample with crisp-set QCA (csQCA) to derive configurations of DCX initiatives (Rihoux & De Meur, 2009). In step three, we refined our understanding of these configurations with industry experts in semi-structured interviews and developed a model of effective use. This combination of methods allowed us to benefit from the advantages of each of the three methods while compensating for their disadvantages through the combination of methods.

3.1. Case collection

We scanned the extant literature to identify cases for our case sample (Larsson, 1993). To identify a comprehensive set of case studies about DCX in retail, we searched for case studies about digital transformation initiatives in retail. We can include cases that present DCX initiatives (i.e., transformation projects creating or changing DCX) but do not focus on DCX explicitly but on digital transformation, digital BMs, or digital retail in general. We included peer-reviewed academic, practitioner- and education-oriented outlets. We did not filter for publication date, research method, or publication type. Also, we did not exclude any retail sectors (e.g., food, fashion, and furniture). Initially, we identified 80 case studies relevant to our research. We analyzed these case studies using inclusion and exclusion criteria to ensure quality, relevance, and topic fit for our research purpose. We included cases if (1) the case context was brick-and-mortar retail and (2) the case narrative provided a detailed description of the firm and its digital transformation efforts. We excluded cases if (1) we could not identify any instances of technology and BM consistent with our research purpose and (2) if too little information was reported. After the application of selection and rejection criteria, 38 cases remained. For non-anonymous case studies, we triangulated the information with publicly available information, such as the firm websites and news articles.

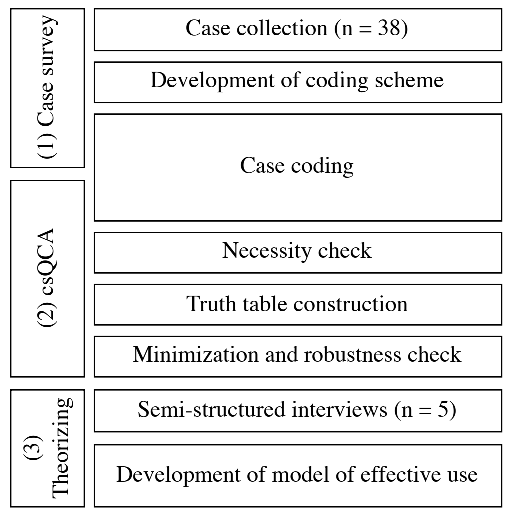

Figure 2. Three-step research method

3.2. Coding scheme

We developed a coding scheme grounded in theory. It is based on the literature review and our socio-technical view of DCX. Thus, the coding scheme is organized in the three meta-characteristics digital technology implementation along the customer journey, BM change through the implementation, and improved DCX as the outcome. For the meta-characteristic digital technology implementation, we used the framework by Roggeveen and Sethuraman (2020). The framework categorizes digital technology along the three customer journey stages based on their primary influence. We could combine the information about which of the three customer journey stages uses digital technology and the information about which digital technology is used.

The BM change refers to the BM element whose change was enabled or supported by the technology implementation. Initially, we used four variables to describe the BM elements: value proposition, customer, value chain, and profit mechanism (Gassmann et al., 2019). However, during the coding process, we summarized the value proposition and customer and the value chain and profit mechanism since we could not differentiate the two aggregated variables (e.g., value proposition and customers). The reason for this was either limited availability of information or double coding where both variables were coded as present, for example, when digital technology was introduced to change the value proposition and target a new customer segment. DCX served as an outcome variable and was therefore described by one variable expressing whether or not the changes enabled by digital technology along the customer journey or in the BM improved DCX.

We coded all variables binary, indicating whether the variable applies to a specific case. For example, Home Times has implemented digital walls that allow customers to see their desired furniture and décor in a virtual home setting. This supports the decision-making of which furniture to buy. Thus, we coded the pre-purchase stage to "1." The coding was performed in collaboration by two of the authors.

Besides the variables in our coding scheme, we recorded additional control variables. These control variables include the firms' retail sector, age, size, headquarter location, and internationalization. We used these variables in the data analysis to check if one or more control variables bias any configurations.

3.3. Configurational analysis

To analyze the coded case sample, we applied csQCA. QCA was first introduced by Ragin (1987) and has been further developed and refined into multiple so-called "flavors," such as fuzzy-set QCA, csQCA, or multi-value QCA. As our coding was binary or "crisp," we applied csQCA. QCA bridges qualitative and quantitative research methodologies, increasing confidence in the results (Duşa, 2007). QCA identifies combinations of conditions that are sufficient to achieve the outcome. Based on the socio-technical perspective on DCX, the customer journey and BM changes are interdependent. Thus, they need to be assessed in combination. Hence, the configurational approach of QCA is a suitable method for our research since we aim to find the combinations of when (customer journey) and how (BM) digital technology is used to improve DCX in brick-and-mortar retail.

The csQCA comprises four main steps: First, a data set is constructed that summarizes whether the causal conditions and outcome are present or absent for each case. We did this step in coding our cases, coding whether a variable is present for every case. Second, conditions are tested for necessity. Necessary conditions are conditions that are always present if the outcome is observed. We tested for necessity using a minimum coverage threshold of 0.6, a consistency threshold of 0.95, and a relevance for necessity of 0.5 (Schneider & Wagemann, 2012). No combinations were found with the specified cut-off thresholds for both the presence and the absence of the outcome. Hence, we assume no necessary conditions for the outcome. Third, the coded data table is converted into a truth table. The truth table lists all logically possible combinations of conditions. Fourth, the truth table is minimized using Boolean minimization to identify sufficiency relations that explain the observed outcome. We derived the intermediate and the parsimonious solution to identify core and peripheral conditions (Fiss, 2011). Based on our medium sample size, the coverage threshold, which determines how many cases must be included in a configuration as a minimum, was set to 1. We set the consistency threshold, which determines how consistent the configuration is with the input data, to 0.8 to ensure empirically valid configurations.

3.4. Refinement and interpretation

The final step in QCA is to interpret and theorize from the resulting configurations (Park et al., 2020). We conducted semi-structured interviews to refine our understanding of the csQCA results . We interviewed five retail experts from a global technology consultancy to understand the context of the configurations in retail. We selected the experts based on their experience with digital technology and DCX, particularly in retail. To validate the generalizability of our findings, we interviewed three CX experts from a global software firm that operates more than fifteen CX centers worldwide to support their sales process. By validating the configurations with these experts, we could ensure their practical relevance and empirical reasoning . Also, it allowed us to add in-depth practical insights to our analysis. Thereby, we address a limitation of the case survey method: the case studies analyzed were not initially written for our specific research purpose. To avoid bias in the validation, we did not present the results of our csQCA to the interviewees. Our questions targeted the technology trends in the retail and the software industry, experiences in technology implementation, and the success factors of DCX implementations.

4. Results

4.1. Case sample

Our final case sample consists of 38 retail firms. The sample contains primarily large and established companies rather than start-ups or small and medium-sized firms. All retail sectors contain a reasonable proportion of cases, although Fashion and Food & Grocery are more strongly represented. The firms are equally distributed around the USA, Europe, and Asia.

The sample also contains an equal amount of international and locally operating retailers.

4.2. Configurations

Table 1. Configurations for enhancing CX

		Solution		
Configuration		[1]	[2]	[3]
Customer journey	PREP	●	●	⊗
	PUR		●	⊗
	POST			
BM	VPROP			•
	VCHAIN	●		
Unique consistency		1.000	1.000	1.000
Unique coverage		0.273	0.152	0.091
Solution consistency		1.000		
Solution coverage		0.788		

Table 1 displays the results of the csQCA. The analysis revealed three configurations, leading to a DCX. Following the notation of Fiss (2011), black circles indicate the presence of a condition; crossed circles indicate the absence of a condition. Large circles indicate core conditions; small ones indicate peripheral conditions. Blank spaces indicate irrelevance to the outcome. The overall solution indicates consistency of 1.000. Thus, the configurations fully explain the outcome. The solution coverage of 0.788 indicates an explained variance of 78.8% of our analyzed cases. Thus, our solution is a good fit for our cases, similar to other applications of QCA in information systems research (e.g., Park & Mithas, 2020). The unique consistency and coverage indicate each configuration's consistency and coverage individually. The unique coverage reveals how much variance of the solution coverage is explained solely by this configuration. Since the sum of the individual coverages does not equal the solution coverage, there is an overlap in explained variance between the three configurations, as illustrated in Figure 3. The dark areas in the middle of Figure 3 illustrate the overlap of the configurations.

4.2.1. Configuration 1 "Value chain innovation." Solution 1 represents technology implementation in the pre-purchase stage and changes the BM's value chain. Thus, digital technology implemented in the pre-purchase stage is not sufficient to increase DCX but needs to be combined with an optimized value chain, bridging the gaps between the customer journey stages. The value chain is specifically relevant because it consists of the processes and activities and the involved resources and capabilities to build and distribute the value proposition. Saving cost, enabling fast logistics, managing and storing data to streamline internal processes, and forecasting to ensure product availability seem to be a success factor for companies. An innovative supply chain can manage peak times and ensure availability, which significantly impacts DCX.

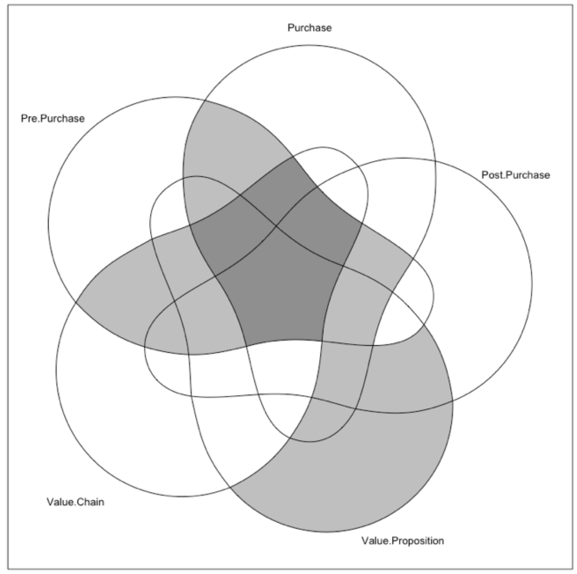

Figure 3. Venn Diagram of the QCA Solution

For example, the beauty retailer Sephora enabled its supply chain to provide free two-day shipping. This improved supply chain is essential to convince customers to move from the pre-purchase stage to the purchase stage. Otherwise, if the product they want is not available in the store or cannot be delivered to their home immediately, the customer might enjoy the DCX Sephora created with chatbots, personalized alerts, digital screens, and augmented reality, but then buy online from any other online retailer to deliver the product quickly.

Stock and inventory management and forecasting are critical elements for a fast value chain, ensuring availability in-store or enabling quick deliveries. Therefore, data analytics plays a key role as retailers such as Target and Walmart implement to improve planning accuracy and forecasting. This also reduces supply chain costs, augments productivity, and ensures the availability of products that will, in turn, serve the customer and enhance the DCX.

Based on the digital optimization of supply chains, the retailers can create omnichannel experiences combining the benefits of online and offline experiences. The offline experience of touching and feeling is still valuable to customers. Thus, many online-first retailers, such as Warby Parker or Bonobos, are opening showrooms to enter the offline world. However, sold products are fulfilled via home delivery just as online sales, improving both realized demand and operational efficiency. As an outcome, the retailers created DCXs by “providing assistance by stylists for better customer interaction” (Bhatnagar, 2018, p. 2). On the other side, brick-and-mortar retailers are moving online, thus changing their value chain. J.C. Penney, for example, has realized the potential of their stores also becoming distribution points for their online retail. Moreover, Home Times uses gamification, digital catalogs, digital walls, and virtual showrooms to attract customers in the pre-purchase stage. Besides the DCX in offline stores, an omnichannel experience creates awareness and brand legitimacy to attract customers to the online channel and transfer them to the purchase stage.

4.2.2. Configuration 2 "Seamless purchase experience." Solution 2 combines technology implementation in the pre-purchase stage and the purchase stage. We find no link to the BM elements in this solution. Pre-purchase technology engages customers and encourages them to interact with businesses before committing to any purchases. The technology inspires potential customers, enabling them to experiment with the idea of transacting with a business. Once committed to the purchase, technology invested in the purchasing phase makes the journey from commitment to exchange seamless. For example, the McDonald’s digital kiosk goes beyond reducing the time spent waiting in a line to order; it allows customers to interact with the menu and create customized burgers. Once customers found the right combination, it enabled the creation to become a real burger. The combination of pre-purchase and purchase technology complement each other to bring greater customer engagement and convenience, thus creating DCX through the digital interface.

In the fashion industry, Nordstrom, for example, invested in pre-purchase technology such as digital self-service kiosks to find products quickly and digitally. Tablets in changing rooms can be used to call for personal assistance or pay directly via mobile payment. Moreover, Nordstrom deploys technology such as cloud computing and endless aisle and uses a store app for geotargeting (e.g., routing the customers to the nearest store).

Overall, the DCX decreases the barriers between the pre-purchase stage and the actual purchase. It helps addressing individual customers more personalized, create a convenient experience in brick-and-mortar stores that is known from online retail, and ensures a personal connection between customers and sales assistants.

4.2.3. Configuration 3 "Personal experience." Solution 3 indicates low technology need to create CX due to the combined absence of technology implementations in the pre-purchase and purchase phases. However, the retailers used other means to enhance the value proposition to create CXs. Instead of DCXs, these retailers focus on the strengths of offline retail: the personal, physical CX.

For example, Casper Sleep, a retailer selling sleep products, attracts “more traditional shoppers who would not purchase a mattress without trying it out” (Tangirala & Purkayastha, 2018, p. 7) by demonstrating mattresses’ cooling functionality and simulating bedrooms to test and experience the products before buying. Nike flagship stores create happenings with DJs causing customers to stay longer in the store just to enjoy the musical experience. By increasing the value of the retailers’ bundle of products and services to the customer, thus the value proposition, a better CX can be achieved. Other opportunities to create personal CXs are marketing campaigns, such as giveaways included with the purchase, or attractions in the store, such as the DJ, with positive word-of-mouth effects.

5. Discussion

In the wake of the digital transformation, customers expect a memorable experience in brick-and-mortar retail that provides some benefits compared to online retail (Grewal et al., 2020). Digital technology provides one way to achieve a superior DCX. However, both the customer journey and the BM need to be considered to maximize the benefits of DCX (Keiningham et al., 2020; Lemon & Verhoef, 2016). We conducted a case survey of 38 retailers to address the resulting challenge of complex interdependencies and analyzed their initiatives to create DCXs. The csQCA revealed three configurations to create DCX with strong overlaps. We refined and validated the configurations with eight expert interviews from a technology consultancy and a software firm.

First, digital technology enables *value chain innovation* to create superior DCX in the pre-purchase stage, which helps convince the customer to proceed to the purchase stage. Second, digital technology innovates the customer journey and creates a *seamless purchase experience* from the very beginning when a customer identifies a need until the purchase is completed. Third, retailers should look outside digital technology and consider the *personal experience* and the non-digital interactions with customers that create a superior DCX.

However, while the configurations are sufficient to create DCX in set-theoretic terms, neither of the configurations alone is enough to create a holistic DCX that should be targeted. As the overlaps in Figure 3 show, all three configurations and all elements of the customer journey and the BM are needed. The sweet spot is right in the middle of Figure 3. For example, intelligent mirrors suggesting matching pants to a shirt (i.e., configuration 2) do not create a beneficial DCX if these pants are unavailable in this store (i.e., configuration 1). Personal experiences, such as in-store events (i.e., configuration 3), do not create additional benefits if the customers are not convinced to buy anything, a process supported by DCX (i.e., configurations 1 and 2).

The creation of DCX thus needs to address the entire customer journey and the BM. It needs to merge online and offline experiences. In retail, customers have nearly complete information about products and prices. The DCX in offline environments, such as brick-and-mortar retail but also in business-to-business relationships like enterprise software, needs to provide a benefit (i.e., the experience) customers cannot obtain from the internet or from looking at publicly available presentations, reviews, or price lists (Piccinini et al., 2015). In online retail, customers are used to product recommendations based on previous purchases or the current shopping cart. Combining digitally innovated value chains and seamless purchase experiences makes similar DCXs possible in brick-and-mortar retail. For example, augmented reality makes it easier to identify vegan or organic food in a grocery store. Interactive displays or smart mirrors can inform the customer about the farm the meat comes from or match shirts to selected pants. Again, this also translates to other industries. For example, based on a firm's current enterprise software architecture, or the usage thereof, software firms can suggest optimal additions to the architecture improving business processes or enabling new BMs.

During the customer journey, brick-and-mortar retailers need to find ways to support customers by digitalizing the value chain. Implementing digital technology in the value chain improves the DCX by bridging the gap between online and offline. The store is no longer the only point of interaction as customers start the customer journey already at home online (Brynjolfsson et al., 2013; Jocevski et al., 2019). For example, if the customer knows a product is available in-store, it is more likely they will go to the store to buy the product there. Similarly, if a firm knows a new software is compatible with its existing architecture, chances are it is open to implementing it. Digital technologies support the connection between the pre-purchase and the purchase stage. The technology eases the transition between the two stages and increases the chances of customers buying the product or service (Roggeveen & Sethuraman, 2020).

Besides all benefits of digital technology, the third configuration highlights social interactions. This builds on the notion that a DCX includes emotional and social components (Lemon & Verhoef, 2016). In retail, these DCX are created through event-like experiences such as live music, pop-up stores, or social reputation. Customers plan to visit a store not because they want to buy something first but because they want to enjoy the experience. In other industries, such as enterprise software, social experiences are created through personal meetings, such as customized workshops demonstrating the software's potential for a customer, meeting the board members of the software vendor, or invitations to events at unique locations. These social experiences are beneficial not in the way that it helps to transition customers through the customer journey stages but in the way it creates a customer engagement effect. Customers will remember the experience and eventually return based on past experiences.

5.1. Contributions to research and practice

The theoretical contributions of this research are threefold. First, we demonstrate three configurations of initiatives creating DCX. These configurations represent individual and separate elements of DCX. However, our analysis also reveals that these three elements must be combined to create a holistic DCX. Thus, we find support for previous research arguing that CX needs to be considered across the customer journey and the BM. We extend this argument by drilling it down to the three identified configurations presenting pathways to implement DCX. Thereby, we address several calls for research to provide actionable guidelines to implement the potential of digital technology in retail (Grewal et al., 2020; Lemon & Verhoef, 2016; Roggeveen & Sethuraman, 2020). Combining the case survey method with the configurational approach of csQCA shows how digital technology can be effectively used to create DCXs. The configurational approach enables us to acknowledge the complexity and interdependencies of the socio-technical model in retail, comprising digital technology, the customer journey, and the BM.

Second, we find personal experiences (i.e., configuration 3) creating social and emotional experiences as a relevant element even for DCX. While digital technologies support the customer journey and help transition the customer from one stage to the following, personal experiences, not relying on digital technology, are a critical element of the CX.

Third, our findings based on 38 cases of brick-and-mortar retailers are generalizable to many industries. We use examples from the enterprise software context we learned during our interviews to demonstrate how DCX supports software vendors' sales and consulting process. This applies to almost any industry, such as hospitality and tourism, automotive and logistics, or government services.

For practice, our model provides guidelines to create DCXs in retail and other industries, leveraging digital technology. The three configurations can serve as guidelines to structure DCX projects and drill them into more manageable and focused initiatives. Firms can refer to these configurations when making strategic decisions about digital technology implementations. In combination with the framework by Roggeveen and Sethuraman (2020), the actualizations provide practicable guidelines on how digital technology can be implemented to create a superior DCX throughout the customer journey and the BM.

5.2. Limitations and Future Research

Despite its contributions, our research faces some limitations. First, our primary data sources are published case studies about digital transformation in retail. While we employed a rigorous case selection procedure to select information-rich and purposeful publications, the case studies were not written for our research purpose (Larsson, 1993). Thus, the information provided in the individual case studies may not be complete. However, we tried to address this limitation by validating the configurations with expert interviews that supported our case analysis. Second, the reliance on these case studies does not allow us to quantify the effect of the changes on the improved DCX. As reflected in the binary coding of the case data, we only collected data if a customer journey stage or a BM element were changed by digital technology. However, we cannot differentiate if changing the pre-purchase stage influences the DCX stronger than the value proposition.

In future research, scholars can build on our findings to quantify the effects of the three configurations. Through quantitative surveys, scholars can assess the retailers' and customers' perspectives on the effect of digital technology on DCX throughout the customer journey. A large sample and differentiated item scales allow for fuzzy-set QCA, which can further differentiate the importance of individual elements in the configurations leading to improved DCX. This could also validate our claim for generalizability if such large-n studies include multiple industries despite retail.

Additionally, COVID-19 heavily impacted the retail industry (Böttcher et al., 2022). In our interviews, the experts highlighted the increasing demand of retailers for digital technologies, especially cloud computing, that serves as a base for further technology implementations. Hence, the pandemic may be a trigger to kick-start digital transformations in retail (Böttcher et al., 2022). For research, this provides a unique setting to analyze the digital transformation of the retail ecosystem (Böttcher, Rickling, et al., 2021) after a shock, to analyze the digital transformation of late movers or small and medium-sized retailers that did not engage in digital technology before COVID-19, or to look into the implementation and usage of digital technology, such as virtual reality or digital platforms, to provide digital DCX.

6. Conclusion

Creating and improving the DCX is a significant competitive advantage in retail and other customer-focused industries. Customers want to enjoy the shopping experience. Firms create DCXs by implementing unique, enjoyable experiences so that customers like to spend time in the store or make it as convenient as possible, eliminating unpleasant activities in the customer journey. Digital technologies enable both types of DCX, thus providing great potential for retailers. However, DCX is a multidimensional construct. To effectively create a digitally augmented DCX, firms must consider the entire customer journey from the pre-purchase stage to the post-purchase stage. Also, the BM is necessary for DCX, as it articulates how value is created, captured, and delivered to the customer. This research proposes a socio-technical perspective on DCX. It identifies three configurations, value chain innovation, seamless purchase experience, and personal experience, leading to the creation of DCXs and highlighting the interdependencies of the aforementioned customer journey, BM, and digital technology.

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Balancing on the Triple-Bottom-Line: Tensions in the Success Factors of Digital Business Models for Sustainability

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Abstract

We need innovations that enable sustainable economies and sustainable private consumption to meet the grand challenges of the UN Sustainable Development Goals. As an essential source of innovation, startups play a crucial role in improving sustainability by creating innovative and sustainable products and services as part of their business models (BMs). Since BMs are at a firm's core, BMs are a decisive factor that influences whether startups fail or thrive; we analyze the success factors of sustainable BMs. We interviewed 16 experts from 15 startups implementing sustainable BMs based on digital technologies and one incubator specializing in sustainability. We identify six success factors representing tensions in digital BM design that entrepreneurs need to address. Our analysis shows how the design of sustainable digital BMs differs from regular digital BMs and how the tensions affect the success of startups. For established firms, the results guide BM design and technology use.

Keywords: sustainability, business model, entrepreneurship, success factors, tensions.

1. Introduction

The global economy is expected to experience a loss of 3% in the year 2050 and up to 4.4% in 2060 due to climate change. Hence, the UN's sustainable development goals (SDGs) include the economy as a central dimension of a sustainable world (United Nations, 2015). Sustainable development can only be fostered by transforming our economy (Schaltegger, Lüdeke-Freund, et al., 2016). Therefore, we need firms to create sustainable offerings to private and corporate customers. However, firms struggle with changing their business model in general, and towards sustainability in particular (Lokuge et al., 2021; Teece, 2010).

Digital technologies, such as robotics, artificial intelligence (AI), and machine learning, already foster digital innovations that disrupt value creation logic (Teece, 2018; Weber et al., 2021). Also, they can enable sustainable innovations (Dean & McMullen, 2007). For example, Delicious Data predicts the number of needed food portions in canteens to reduce food waste using AI. Besides, digital technologies also enable innovative business models (BMs), such as the data-driven business model of Delicious Data (Baecker et al., 2021; Böttcher & Weking, 2020; Jabłoński et al., 2020).

Sustainable startups designing new BMs for sustainability (BMfS) fostering social and environmental change play a key role in innovation for sustainable development (Gregori & Holzmann, 2020). They incorporate sustainability as a distinctive factor in their business models and drive sustainable development by changing old patterns through sustainable and innovative processes or products that change markets and consumption habits (Schaltegger, Lüdeke-Freund, et al., 2016). In business-to-business (B2B) settings, these startups are vital, as they enable other firms, such as multi-national incumbents, to become more sustainably by adapting the startups solution, thereby levering their sustainable impact. They serve as catalysator and forerunners of the sustainable transformation of the economy other firms can use and draw inspiration from.

However, sustainable startups face particular tensions: To create sustainable impact, sustainable startups must scale and eventually disrupt the current industry logic, but sustainable (e.g., environmentally friendly) products are often more expensive in production, with notable exceptions such as cheaper frugal innovations or savings from the use of recycled resources. Thus, sustainable startups must maintain financial efficiency to keep prices low and attract mainstream customers (Gregori & Holzmann, 2020). They need to balance on the triple-bottom-line, managing economic, environmental, and social value creation to become successful.

Research in entrepreneurship, management, and information systems has focused on different types of value creation, such as ecological value creation (Bocken et al., 2014), economic value creation (Amit & Zott, 2001), and digital value creation (Steininger, 2019). While scholars recognize that BMfS must balance economic, environmental, and social value creation for lasting sustainable impact, little research has been done on the role of digital technology for sustainable value creation and the arising tensions in BMfS. However, we observe digital startups, such as Delicious Data, implementing BMfS that enable this transformation. To analyze how successful B2B startups implement BMfS leveraging digital technology, we propose the following research question: *What are the entrepreneurial success factors for sustainable digital B2B business models?*

To answer this research question, we conducted an exploratory qualitative approach and interviewed 16 experts from 15 B2B startups with successful digital BMfS, and one incubator focused on sustainable entrepreneurship. We identify six success factors for BM design and discuss the tensions that startups need to address, and how digital technology can support the resolution of these tensions. The success factors and tensions highlight the differences between the BM design of sustainable and regular startups and guide early design decisions for BMfS.

2. Related Work

2.1 Sustainable Entrepreneurship

Sustainable development means balancing the three dimensions social, environmental, and economic development (United Nations, 2015), so that the present needs can be satisfied without limiting future generations in satisfying their needs (United Nations General Assembly, 1987). The term "Triple Bottom Line" also refers to these three dimensions (Elkington, 1998). Sustainable entrepreneurs have sustainable development as their core mission and thus strive to positively contribute to social and environmental challenges with their business activities (Hall et al., 2010). This can include more sustainable ways of producing goods or offering a more sustainable substitute for a product, for example. This means they simultaneously create a positive environmental and social impact while taking advantage of market opportunities through new BMs (Schaltegger, Lüdeke-Freund, et al., 2016).

2.2 Business Model

A BM is not purely a business's financial model but rather shows how the business is constructed conceptually (Teece, 2010). It "articulates the logic and provides data and other evidence that demonstrates how a business creates and delivers value to customers." (Teece, 2010, p. 173). Thus, it includes the value offered to customers, the way the business creates and delivers this value, and how it monetarizes this value (Teece, 2010). Customer segmentation, company resources, distribution channels as well as streams of costs and revenue are to be described amongst others within the respective areas (Bocken et al., 2014). The BM is seen as one of the most critical determinants of business performance (Al-Debei & Avison, 2010), and an inimitable BM supports greater value creation (Teece, 2010).

The value-based view on BMs articulates three core value dimensions of the BM: the customer value proposition, the value creation and delivery, and the value capture. This conceptualization is similar to the conceptualization of Boons and Lüdeke-Freund (2013). In the context of BMfS, they consider four dimensions: value proposition, supply chain, customer interface, and financial model, whereas supply chain and customer interface are elements of the value creation (Abdelkafi & Täuscher, 2016).

2.3 Digital Business Model

Digital technologies, such as AI and blockchain, can function as a lever for BM design as new opportunities arise regarding how they create, deliver and capture value (Böttcher et al., 2022; Weking et al., 2020). For example, digital platforms as digitally enabled infrastructures create innovation opportunities for connecting various stakeholders (Gregori & Holzmann, 2020; Hein et al., 2019), help cut costs, and/or increase the performance of primary activities of a firm, such as the sales activities through the introduction of digital sales channels. Moreover, digital technology can be the core of the business, for example, if the product is software (Steininger, 2019).

Thus, digital technology can be incorporated into the BM in various ways. Steininger (2019) distinguishes between four types: Technology-facilitated BMs, using digital infrastructure, technology-mediated BM, adding digital customer interfaces, technology-bearing BMs, offering digital products, and purely digital BMs, which have digitalized all elements of the BM. In this paper, we define a digital BM according to this fourth type, if the value is created through a "completely digitized product or service, digitally sold and delivered." (Steininger, 2019, p. 381)

2.4 Business Models for Sustainability

All three dimensions of sustainability, i.e., the social, environmental, and economic perspective, need to be incorporated into the BM to avoid financial instability and foster environmental and social value creation (Gregori & Holzmann, 2020). Conventional BMling is insufficient when aiming to balance the three dimensions of sustainability, which is more complex than focusing on financial value creation (Schaltegger, Hansen, et al., 2016). In literature, this particular form of BMs is often referred to as Sustainability BMs, Sustainable BMs, or BMfS (Gimpel et al., 2019; Schaltegger, Hansen, et al., 2016). These BMs integrate sustainability into their value proposition and their way of creating value for the customer plus the society and the environment (Abdelkafi & Täuscher, 2016). They are designed to solve issues regarding integrating the three dimensions, i.e., social, economic, and environmental, into the BM and thereby foster sustainable development (Lüdeke-Freund & Dembek, 2017).

2.5 Success factors of startups

The success factors of startups have been analyzed extensively in extant research. It is argued that the elements of startup success consist of the entrepreneur, the industry structure, the business strategy (Sandberg & Hofer, 1987), resources, and the organizational processes and systems (Chrisman et al., 1998). For example, the entrepreneur, or the entrepreneurial team, is responsible for identifying profitable opportunities or innovations that create the basis for a successful startup. To leverage these opportunities successfully, research found the entrepreneur's experience, attitude, and managerial skills influential on success (e.g., Cantamessa et al., 2018; Chrisman et al., 1998). The importance of a startup's resources and assets is also argued in the literature (Balboni et al., 2014). Furthermore, the literature suggests that the protection of the digital solution alongside gaining trust due to technology usage is a critical success factor for startups implementing digital BMs.

The BM design is one of the significant failure reasons for startups (Cantamessa et al., 2018). But it can also foster startup success and drive competitive advantage (Zott & Amit, 2007). A startup's growth rate and survival have been the primary measure of success (e.g., Balboni et al., 2014; Weking et al., 2019). However, the recent consolidation in startup funding supports the BM element of efficiency as identified by Amit and Zott (2001). Startups are now expected to create scalably but profitable BMs that can sustain without external funding (Ogrean & Herciu, 2020), even though received funding is often used both as a measure of success (e.g., Böttcher et al., 2021) and a source of success (e.g., Forti et al., 2020).

3. Methodology

We followed a qualitative research approach based on 16 interviews (Bhattacherjee, 2012). This approach provides an opportunity to explore an emerging research field and create novel insights based on qualitative insights.

ID	Digital product	Main Sector	Year founded	Interview duration
I1	Digital products	Agnostic	2017	29:48 min
I2	Deep tech	Supply chain	2016	29:25 min
I3	Software	eCommerce	2019	28:58 min
I4	Software	Agnostic	2006	21:30 min
I5	Digital products	Agnostic	2009	38:27 min
I6	Software	Agnostic	2018	31:25 min
I7	Software	Agnostic	2020	30:13 min
I8	Platform	Supply-chain	2020	33:19 min
I9	Deep tech	Food	2019	44:55 min
I10	Software	Agnostic	2017	24:03 min
I11	Software	Agnostic	2019	21:25 min
I12	Deep tech	eCommerce	2019	43:34 min
I13	Software	Agnostic	2020	25:40 min
I14	Software	Agnostic	2021	~ 25:00 min
I15	Platform	Food	2019	47:44 min
I16	Accelerator		2007	39:28 min

Table 1. Overview Interviews.

We collected our data from expert interviews. Therefore, we searched for startups offering digital solutions supporting sustainable development in a B2B context. We selected only B2B startups, because of their scalable impact on sustainability triggering a transformation from within the industry. Also the challenges of B2B and B2C BMs differ, particularly in their marketing approach, and have to be analyzed seperately. The selection of the startups was based on Eisenhardt (1989); thus, the sample was not set before the data collection process started, but the interviewees were selected along the process to derive the appropriate insights. This approach provided us the flexibility to build theory from an in-depth analysis of emerging concepts (Gioia et al., 2013). Eventually, we interviewed 16 experts from 15 startups and one startup accelerator.

We interviewed experts, such as the founders, board members, or head strategists. We aimed to retrieve detailed insights into the startups' BMs, mainly focusing on their value creation and how they leverage digital technology in the value creation and as part of their value proposition, value delivery, and value capture. The interview with the startup accelerator was used to collect general information about BMfSs and the innovations introduced by startups in this field. We focused on open questions to avoid bias in the answers (Gioia et al., 2013). We iteratively adapted our questions to reveal new insights and new concepts.

The data collection was terminated when no new insights for the emerging concepts were gained (Eisenhardt, 1989). All interviews were conducted online between March and May 2021. We recorded the interviews to assure the correctness and completeness of the collected data.

To prepare the data collected for analysis, the interviews were transcribed using a de-naturalized transcription approach. All interviews were anonymized to make the interviewees speak freely and keep their privacy while allowing them to provide the required transparency for our research.

We analyzed the data following the open coding procedure by Gioia et al. (2013). We first coded open codes in the interview transcripts such as “reusability of code” based on statements such as “if you have created code for something that is actually relevant to something else, that can be adapted and reused to save a bit of resources.” In sum, we created 178 such open codes. Second, we subsumed the open codes to 19 axial codes based on the similarity of codes to identify success factors of digital BMfS. For example, we summarized the open codes "reusability of code," "technological flexibility," and "standardization versus customization" as "scalability of the technology." Finally, we created aggregated dimensions to summarize the coded data, representing the success factors, such as "Using digital technology effectively" based on the axial codes "scalability of the technology," "technology as BM enabler," and "managing technological complexity." Eventually, the data analysis resulted in six aggregate dimensions.

4. Results

By analyzing the 16 experts' experiences and learnings, we identified six overarching aggregate dimensions that influence the development and success of B2B startups implementing digital BMfS.

4.1. Aligning the firm’s and team’s sustainability purpose

A joint and authentic team purpose is fundamental in fostering success for sustainable startups. The team needs to be aligned with their purpose, even more than a "standard startup ."This purpose needs to be authentic as "the authenticity issue is a big one" (i4). It makes a difference whether “I [am] doing this out of conviction or am I just jumping on it because it is the hottest new shit" (i4). In highly competitive markets, the firm's purpose's authenticity becomes a competitive advantage “because it comes from within, because we do not have to fake it, but because that is why we have always had it" (i4).

It seems important not only for the founders to be aligned on a common purpose but also for the whole team with its skills and experience since “people are more motivated by the fact that there is a higher meaning, so to speak, this purpose. So, the team spirit is also greater when everyone is pursuing a purpose” (i5). Some startups even put the employees' purpose above skills and experience, as "knowledge can always be built up. It is probably more the right attitude and the right mindset.” (i6). Ultimately, the engagement of all parties involved in value creation results in better products.

4.2. Understanding customers’ external sustainability motivations

Understanding your customer is always critical. An essential success factor for B2B startups with digital BMfS is understanding the external forces creating customer demand for sustainable solutions. The startups need to acquire knowledge of the market to understand the dynamics customers are exposed to and the motivations driving them to adopt sustainability-promoting products. For example, more restrictive regulations influence the need for sustainable products. Almost all interviewees mentioned that new regulations their customers must comply with constitute a significant creator of customer demand. A solution that makes this compliance easy while providing additional benefits is a central selling argument (i2, i6, i10, i11, i13, i15).

Besides regulatory pressure, customers of our interviewed startups also aim to become more sustainable due to the pressure they sense from their respective customers, both private and corporate. "If the consumers did not ask for sustainable products, nobody would be pushing for sustainable products." (i2). If companies meet these needs for more sustainable behavior, products, and actions, they will "stay in the market and get bigger, because the end consumers want it" (i8). Corporate customers also increasingly demand sustainability from their suppliers along the supply chain. If this pressure from the supply side goes hand in hand with the individual demand side, this "is what works best" (i4).

4.3. Focusing on simultaneous economic, environmental, and social value creation

For the value created by sustainable startups, it is necessary to design the BM to create sustainable impact and economic benefit. "Without the economic aspect, you will not be successful, at least not on the scale, and the challenge is definitely to sell a sustainable digital product in such a way that it also conveys the economic benefit directly in the value proposition" (i3). i9 adds that sustainability benefits are a nice feature but eventually will not be the decisive argument for or against a product: "I am sure they all think it is cool when sustainability is added as a factor. But I do not think that this is something that will have a significant influence on their decision. […] Neither positively nor negatively" (i9). Eventually, cost savings or efficiency gains will influence the final decision rather than increased sustainability indicators (i12). The success factor for digital BMfS is thus to provide value in the form of an efficiency enhancement, meaning cost reduction, time-saving, or revenue increase while providing a more sustainable solution (i2, i3, i6, i8, i9 i12).

However, measuring and demonstrating the value created for the business's customers is complicated. Efficiency-related measures can be measured and communicated, such as reducing processing time by 75% (i13). Other values, such as brand value creation, are more challenging to measure in monetary value. Some startups match internal success measures with their sustainability-related value creation. On the sustainability side, some measure how much revenue they are making and the carbon emission savings provided for their customers using their solution (i12). Startups creating social value track the number of people/employees they reach (i1, i7) or the recurring engagement with their solution (i15). However, many startups do not have metrics to measure their environmental or social impact in place (i2, i3, i7, i8, i10).

4.4. Using digital technology effectively for sustainable value creation

Digital technology is an enabler and lever to maximize sustainable value creation and scale BM growth. However, despite the benefits of digital technology for BMfS, it also poses challenges in managing sustainable startups (i7).

First, technology is considered a "means to an end" in sustainable value creation (i4, i11, i13), implying the BM would not work without the technology. This view is quite prevalent in the statements of the interviewees. Digital technology provides the basis for success, but in the startup space, it is no point of differentiation or source of competitive advantage (i7).

Second, the effective use of digital technology in the BMfS helps startups scale their business. Scaling a business is a significant success factor for all startups. However, in the sustainability context, scaling the business also implies scaling the sustainability impact, which is the ultimate measure these startups are compared against (i1, i9, i14). The flexibility, adaptability, and reusability of digital technology are the crucial characteristics supporting scalability. These properties of digital technologies quickly adopt digital value propositions to new markets or customize to individual customers (i1, i2, i6, i9).

Third, digital technology challenges the startups' management (i7). For example, the user experience must be implemented appropriately from an interface perspective or customer support. The experience must be as convenient as possible to make the complex information provided as simple as possible (i2, i3, i6, i7), which requires much effort on the development side (i7). The success factor is to communicate the value in a user-friendly way, even if the value creation is complex through the use of digital technology.

4.5. Selling the sustainable value in a targeted approach

Ultimately, the startups have to sell their solution to businesses. Several similar approaches have proven successful for our interviewed startups (i4, i10, i11). Approaching the business customers directly is the most common approach. The difference for the digital BMfS is that they get "a foot in the door" with their customers through the sustainability departments. (i12). Their purpose aligns with the startups'; thus, they can connect to the relevant decision-makers (i4, i6, i12). However, depending on the customers' motivations to engage in sustainability and the product or service offered by the startup, customers are also approached through finance, if there is a clear and easy economic benefit or a legal reporting issue that can be resolved, or through the technology and innovation departments, if the solution is very technical and operates mainly in the backend (i2, i4, i10). Nevertheless, in the end, digital BMfS always have to balance the economic and sustainable value creation to convince economically driven management.

Some startups, however, take a different approach targeting consumers as their customers' customers to create external need to engage in sustainability solutions. One interviewee compared this approach to the payment provider Klarna: consumers are used to paying purchases with Klarna as the central payment platform, and "at the end of the day, they stay in the market and get bigger because that is what the end consumers want." (I8) So, if consumers demand traceability or sustainability certificates provided by the startups, they will find customers buying their solution. Hence, this approach centers around brand building and marketing campaigns to engage consumers with the startups' B2B solutions (i3, i7, i8, i9, i15).

Ultimately, network effects appear strong for digital BMfS. Their customers create networks proposing the startups' solutions to partners across their supply chain, for example, to create a transparent end-to-end reporting along with the entire value creation that requires compatible tools for data exchange (i4, i13).

4.6. Finding supportive funding for economic growth and sustainable impact

Finally, another major success factor for any startup is finding investors whose money and expertise help grow the BM. The challenge, thus the success factor, is to choose the right investors (i8, i16). As sustainable startups are the prime target for impact investors, they have more funding options to choose from, making it easier to receive funding overall (i7, i9). These impact investors focus on helping the startups grow to maximize their sustainable impact. Therefore, following the earlier presented importance of aligning the firm's and team's purpose, many of these investors focus on the people and their motivation to create impact "because business models change, markets change, products change, but the people, the team, the founders do not change." (i8)

However, the interviewees also faced problems with impact investors. Some pretend to focus on impact but are only interested in the financial aspects for their good (i8, i13). Impact investors rejected startups because the startups' commercial focus and highly profitable BMs clashed with the social interests of impact investors (i3, i7, i12). Also, the digital focus of our interviewees presents an issue for impact investors because of the complexity of the technology (i3). Instead, traditional investors have focused on complex digital technology in the past and are experts in scaling digital startups. This also helps sustainable startups to scale their sustainable impact (i3, i7, i11, i12). Eventually, there will be hybrid investors, a mixture between impact-driven and classical investors interested in sustainable and economic value creation (i3), or the startup will mix both types in their investment rounds to retain the best of both worlds.

5. Discussion

Startup success is a complex and challenging task. While it is already hard enough for any kind of startup, startups implementing BMfS face several ambidextrous challenges balancing the three elements ecology, economy, and society. We identified six success factors in how 15 B2B startups successfully implement and run digital BMfS supporting the UN SDGs. Figure 1 graphically summarizes these six success factors and reveals their relationships with the three BM elements value proposition, value creation and delivery, and value capture.

These connections demonstrate how the individual success factors influence the startups' BMs. In turn, this also shows how they influence the ambidexterity of balancing social, ecologic, and economic success. Thus, sustainable startups need to address the rising tensions in BM design.

First, an economically and sustainability-driven team-based common purpose based on intrinsic motivation among team members sets the foundation for a successful BMfS. Creating a clear purpose for the startup and aligning the team with it influences startup growth and its funding potential (Balboni et al., 2014). It influences the value proposition, which some define as the "core of a firm's entrepreneurial identity" (Chandler et al., 2014, p. 236). However, an excessive focus on the ecological or social value may be positive only in the short term but potentially harms the business in the long run due to the lacking business focus, such as a missing professional network (Abebe et al., 2020). Therefore, we identify a knowledgeable and experienced team to be a critical resource for fostering the symbiosis of economic, environmental, and social value creation. The startup's human capital and knowledge are crucial, especially regarding technology commercialization, expertise, skills, and alignment among founders (Kirchberger & Pohl, 2016), as missing experience and a mismatch of skills are sources of startup failure (Cantamessa et al., 2018). Consequently, team formation positively influences new ventures' growth and funding potential (Balboni et al., 2014).

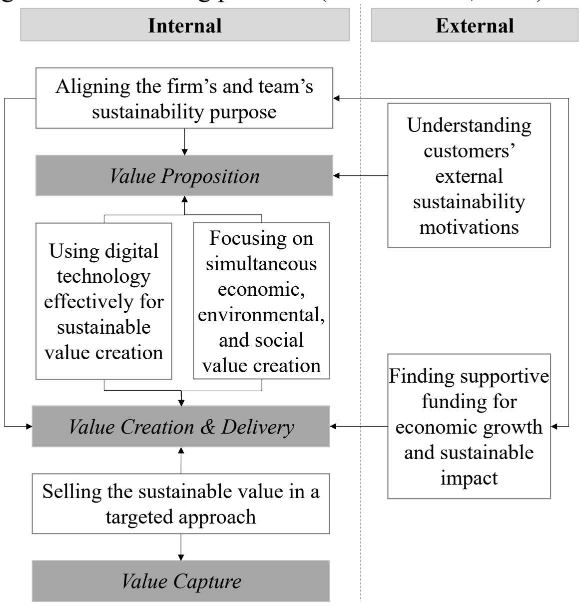

Figure 1. Success Factors for B2B Startups with digital BMfS.

Second, market dynamics regarding regulations, individual demand, and company stakeholders influence the need for sustainable solutions, which must be addressed in a successful value proposition. External motivators for customers create the need for sustainable solutions. Hence, a profound understanding of them is necessary for startup success. Regulatory requirements force firms to introduce solutions enhancing their contribution to sustainable development, which drives demand (Balboni et al., 2014). The marketing effect of sustainability creates demand for corporate customers to increase their sustainability efforts and communication for differentiation from competitors (Chandler et al., 2014). Finally, the interest in consumers' sustainability has been increasing, driving their need for more sustainable consumption and the emergence of BMfS (Gimpel et al., 2019). Understanding the motivations of business customers, their needs must be addressed in the startup's BM. Yet this is an ongoing process of BM evolution, constantly adapting to the market dynamics (Täuscher & Abdelkafi, 2018).

Third, similar to the team capabilities, economic value creation must accompany environmental value creation in the value proposition to drive the success of sustainability startups. The achievement of a BM that merges financial value capture for the startup while simultaneously generating sustainability-related impact is a widely discussed tension that startups have to overcome within building successful BMfS (Gregori & Holzmann, 2020; Lüdeke-Freund & Dembek, 2017). As the BM is designed around customer needs, a value proposition addressing both financial and sustainable needs drives the adoption of respective solutions. Consequently, digital BMfS must include a balanced value proposition for their customers. Moreover, this value needs to be communicated clearly (Chandler et al., 2014).

This leads to fourth, as we find the effective use of digital technology for sustainable value influencing the value proposition and the value creation. In the value proposition, the simplicity and ease of use of digital technologies, enabling the sustainable solution, need to be communicated clearly to the customer to present a critical factor for adopting the solution. This is especially crucial when escaping the sustainability niche and targeting mass markets (Mancha et al., 2021; Vernay et al., 2020). Extant research adds that this communication must be close to existing solutions to clarify differences (Vernay et al., 2020). For value creation, adaptable digital technologies enable scaling and adoption of the BM to changing customer demands. Especially scaling with limited resources is crucial but demanding for startup success (deLange & Valliere, 2020). Digital technology thus presents the lever to scale and adapt with ease. When creating their solution, startups thus need to balance the complexity of digital technology needed to create the value proposition but make it easy to use and scale by standardization and modularization and customize it to individual needs.

Fifth, external support, such as venture capital, positively impacts BMfS if it supports the current focus on economic, environmental, or social value. Investors provide resources for economic scaling, thus positively influencing startup survival (Cantamessa et al., 2018). The financial capabilities influence growth strategies, such as market expansion, innovation growth, and brand assets (Forti et al., 2020). However, for sustainable startups, the interests and purpose of investors have to be aligned for successful funding. Investors of any type operate between the two extremes of maximized social or ecologic value (i.e., pure impact investors) or maximized economic value (i.e., "traditional" investors). Accordingly, they look for startups whose BMs align. For startups, it is critical to select investors accordingly: maximize impact or profit. Depending on the startup stage, the selection of investors may vary and mix differently. For example, while venture capitalist firms help build legitimacy in the economic space, they may negatively influence legitimacy in the impact-driven community (deLange & Valliere, 2020). If startup purpose and investor purpose do not align,

Finally, the startup's sales approach must be targeted to adapt to the individual customer, influencing value creation and value capture. Therefore, the startups need to highlight the sustainable value specifically for the focal customer. This correlates and builds on the understanding of the customers' sustainability motivations. For example, the sustainability department presents a good way to approach potential customers. However, if regulatory requirements drive the startup's value proposition, startups target the financial department. Differentiation also applies to the customers' industries, whether the primary need of the industry is increasing sustainability or improving cost-effectiveness. For digital BMfS, a success factor is the leverage of network effects (Mancha et al., 2021). As customers want integrable solutions along their value chains, the startups profit from the diffusion of their solutions along the value chains. To convert companies to paying customers, the revenue model as part of the BM's value capture must meet the customers' needs (Bocken et al., 2014). On the startup's side, the revenue model depends on the digital technology used for value creation. While subscription models are common for software, they are less found for hardware-heavy value propositions. On the customers' side, the preferred payment model is context-dependent. Thus the startups should be able to adapt their revenue models or offer several different models to choose from. A value-oriented revenue model specific for sustainable startups in which customers pay for the created sustainable value. This lowers the risk for customers and builds trust. Yet, measuring the sustainable value remains a difficult task as there are limited measurement mechanisms for the value creation of BMfS .

5.1 Implications for Theory and Practice

This paper contributes to research on digital innovation, entrepreneurship, and sustainability. As IS research is only starting to focus on sustainability (e.g., special issues in the Information Systems Journal and the Journal of the Association for Information Systems), this paper presents an exploratory approach to the design of digital BMfS.

Based on 16 interviews with B2B startups implementing digital BMfS, we identify six success factors of BM design. These success factors reveal tensions in the BM designs that need to be addressed by sustainable startups to balance economic, ecological, and social success. The findings present a framework of success factors and their tensions in BM design for digital innovation and entrepreneurship. As the achievement of the UN SDGs requires profound shift in firms value creation towards sustainability as particularly argued in SDG9, we present a foundation for future research on digital BMfS that is especially relevant for entrepreneurs. We also show that digital technology is critical in navigating these tensions as it allows for balancing the three elements of sustainability. For research on (digital) sustainability, we discuss how the integration of sustainability in the BM alters the design and the success factors of entrepreneurial BMs, demonstrating how the BM concept supports research supporting the UN SDGs by combining economic, environmental, and social value creation.

For practice, especially for entrepreneurs engaging in sustainability, this paper presents lessons from 15 startups implementing digital BMfS. Entrepreneurs can benefit from these lessons by considering the success factors and their tensions in their early BM design. By knowing these arising tensions, entrepreneurs can address them early and design their BM and strategy accordingly. Especially, the role of digital technology in BM design is essential so that entrepreneurs build their technological infrastructure accordingly, for example, allowing for flexible pricing or value measurement. As the different types of venture capital create tensions, investors as well as policy decision-making needs to adapt their practices and goals to support startups' success of achieving the UN SDGs combining economic, ecologic, and social value and benefit.

5.2 Future Research

As our identification of success factors for digital BMfS in the B2B context is explorative, it provides several avenues for future research. We will continue this work by further detailing the results. We will collect more startup data to create a medium-sized sample allowing for a configurational analysis. The configurational analysis will help us detangle the different factors regarding digital technology, BM, and sustainability and create a configurational theory on startup success in implementing digital BMfS. Our research can also be extended through quantitative analysis. In addition to our configurational approach, scholars can gather larger sample sizes to analyze the proposed success factors in variance-based statistical models. Such a quantitative analysis may allow for a detailed data-based comparison of differences and similarities between sustainable and not explicitly sustainable BMs. In addition, longitudinal research on BM's influence on startup success remains scarce. In the sustainability context, this proposes added value, as the sustainable impact can only be achieved through the persistence and success of the startups offering such sustainable solutions. Sustainable solutions have to stay successful and become adopted throughout to have a lasting impact on the world's sustainability.

Lastly, we explicitly mentioned network effects as influencing startup success in sales. We did not analyze ecosystem embeddedness in our analysis. However, all our interviewed startups stem from the same vibrant entrepreneurial ecosystem, finding support in numerous accelerating programs, such as the one we interviewed. As any firm cannot solve the sustainability challenge alone, collaboration, value co-creation, and social networks are needed. Scholars should analyze how ecosystem embeddedness and the related inter-start-up-relations influence the economic and sustainable success of digital BMfS.

5.3 Limitations

The conducted inductive qualitative research brings limitations that need to be considered. Even though the underlying approach provides the generation of valuable new insights into the investigated field of research (Gioia et al., 2013), the sample is restricted to 16 experts of digital B2B BMfS. First, this limits the results to B2B specific determinants, and findings may differ for B2C startups. Second, even though the experts deeply understand the investigated topic, failed startup perspectives may have delivered further insights. As the interviews were completed within a limited timeframe, the determinants for success in digital BMs are identified at a specific time.

Consequently, the context is set to the current situational characteristics, and development over time is not considered in the data analysis - neither for the BM development nor the future successful development of the companies. Furthermore, the results are limited concerning the startup development stages. Even though new ventures with different lifetimes are included in the study to get a diverse picture of the challenges and successful strategies along the way, the data is not analyzed related to the startup development stage.

6. Conclusion

We must promote sustainable development to limit the negative consequences of environmental challenges and support the UN SDGs with practicable research. Digital innovation and entrepreneurship enable great opportunities for BMfS to create innovative solutions that help combat these grand challenges. As firms significantly influence sustainable development, the success factors of digital BMfS of B2B startups presented in this paper support startups to foster economic, ecologic, and social success in symbiosis. We call for future research on how digital technology enables sustainable development, as we argued digital technologies enable the adoption, diffusion, and scalability of sustainable impact to achieve a more sustainable economy.

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Enter the Shark Tank: The Impact of Business Models on Early Stage Financing

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Abstract. Investments are the necessary fuel for startup development. However, new ventures face difficulties in obtaining financial investments. The investors aim to invest in startups with high success chances and quick return on investment. The business model (BM) of a startup was proven to be a determinant of its success. However, there is a lack of research on the influence of the BM on the amount of received seed funding. This study analyzes the BMs of 72 startups and the amount of received seed investment. We applied Pearson's product-moment correlation tests to calculate the correlation between these variables. Our research shows a correlation between the BM and the amount of received seed investment. We identify the patterns Two-Sided Market, Layer Player, and Freemium to have a significant positive effect on the investment sum. This research guides entrepreneurs in BM design and contributes to the discussion of success factors for startup success.
Keywords: business model, startup, financing.

1 Introduction

"*It's a unique idea there's no question, the question is it a good idea, and if the Sharks hear a good idea, they'll fight each other for a piece of it*." - Phil Crowley on Shark Tank [1]

Entrepreneurs face a chicken-egg-problem in the early stages of founding a new startup: They need money to finance their early-stage tasks of market evaluation, product development, and market entry. The chances of success depend heavily on this initial funding [2], since they do not qualify for bank loans. However, as they do not have much to present to potential investors but their value proposition and the plan on how to create and capture this value, which is articulated in the business model [3], getting this early-stage financing is a tough task [4, 5]. On the other side, investors take significant risks when investing in early-stage startups. They cannot rely on early market success, sales figures, or other prominent investors' involvement. They need to evaluate the potential success based on the entrepreneurs' business model [6, 7]. Consequentially the available capital for such investments is also scarce [6]. Thus, identifying a good, success-promising business model is crucial for either side.

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Considering that 90% of the new startup ventures fail, investing in startups comes with very high risk [8]. Thus, investors seek ways to evaluate the quality of startups to reduce these risks and increase their chances of receiving a return on investment [8]. However, screening early-stage ventures is a highly noisy process, and evidence on the plausibility of their methods from empirical studies is inconclusive [9]. Due to a variety of challenges, such as limited data at the time of founding and a comparatively small number of successful ventures, the question about the prediction of a startup success remains an open topic of the research [10].

Both sides, entrepreneurs and investors, spend much effort in finding each other and maximize their profit. To evaluate this fit, the business model has emerged recently [11]. It represents a formal, conceptual model of the firm's strategy in terms of its value proposition, value creation, and value capture [12]. For startups, it captures the business idea and the set of activities to create value [13], that can be presented to potential investors [14].

A growing body of scholars has studied the correlation between startup performance and its selected business model [15-18]. The startup performance was measured by outcomes such as startup survival [17] or growth against revenue [15]. Both qualitative and quantitative research show that there is a correlation between a startup's business model and its performance. While research on established firms shows, that unique business models are a source of competitive advantage and even disruption [12, 19, 20], and research on startups in later stages shows that it is a critical factor for survival and success [21-23], research lacks acks investigations in startups' early stages. Even though the early stages of a startup are characterized by ideation and business planning, the influence of the business model on seed investment in startups' early stages is unknown [4]. Therefore, we analyze the relationship between applied business model patterns and the amount of seed investment received by startups. We address the following research question:

RQ: How important is the business model for startups to receive seed investment?

This paper performs statistical analysis about how the amount of startup seed investments correlates with the applied business model pattern. Our research provides an analysis of specific business model patterns and targets whether some business model patterns receive higher or lower levels of seed investment. For this purpose, we use an industry-independent dataset of 72 startups from the USA. The startups are categorized according to the 55 business model patterns developed by Gassmann, Frankenberger and Csik [24]. We performed a point-biserial correlation to test whether the applied business model pattern influences the seed funding amount.

We contribute to the business model and entrepreneurship research by showing that the applied business model patterns influence the seed investment received by startups. For entrepreneurs, this provides guidance for business model design. For investors, the results help guide their investment decisions.

The remainder of this paper is structured as follows. The second chapter describes related work, including relevant BM literature. The third chapter details the methodology to create and analyze the dataset. In the fourth chapter, we present the results of the statistical analysis, followed by the discussion and implications of these results in chapter five. The final chapter concludes with the contributions of the paper and avenues for future research.

2 Related Work and Hypothesis Development

In recent years, both academics and practitioners paid much attention to the concept of the business model. Originating in the emergence of e-commerce, digitalization, and digital transformation are key drivers of the concept's popularity. As a formal, conceptual representation of strategy it presents the firm's proposition on how to achieve its goals [14]. It describes how the firm interacts with its environment to create, capture, and deliver value to the customer [12]. Therefore, the business model can be used as a unit of analysis for explaining how firms plan and execute their strategy [25].

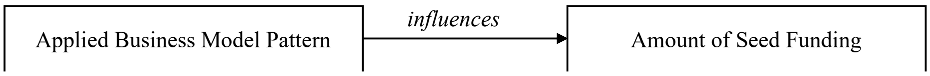
Based on the firm's resource-based view, strategy aligns resources and capabilities to achieve a competitive advantage and superior firm performance [26]. Business model scholars build upon this theory to argue the business model, as an articulation of strategy, influences firm performance [27]. A unique business model imposes a superior value creation and capture strategy. It may even be more influential on the created value than the offered product itself, and the business model's innovations provide greater opportunities than innovations of the product [12, 28]. For example, as we can observe in the platform economy, firms can create a differentiating value proposition and competitive advantage by creating a unique and innovative business model. Still, scholars point out that the business model is no holy grail, and no guarantees of success can be given only based on the business model [29]. However, it provides a mean for strategic planning in complex and digital ecosystems as it illustrates the strategy and forces management to question their options [25].

As these findings mainly rely on qualitative research approaches, recent reviews of the field call for more quantitative research to strengthen and validate the existing findings. Most influential are two studies by Zott and Amit [22, 23] analyzing the effect of efficient and novel business model designs on firm performance. These independent constructs were applied in subsequent studies, e. g. Brettel, Strese and Flatten [30] and Kulins, Leonardy and Weber [31]. In the context of entrepreneurship, the business model was shown to influence startup survival [17, 32]. [33] showed that the novelty of business model designs influences startup investors' decisions. Kulins, Leonardy and Weber [31] revealed how business model design influences entrepreneurial firms' market value after they went public.

Based on the qualitative and quantitative researches on the business models, there is a connection between the selected business model and the probability of a startup’s success. We argue that the business model of a startup is already influential in its initial phases. Considering that investors need to rely partly on the presented business model and aim to invest in companies with higher success chances and survival rates, to earn a high rate of return from their investments [34], we put forward the hypothesis that the applied business model pattern influences the amount of seed investment a startup receives, visualized in **Figure 1**.

Hypothesis: The applied business model pattern influences the amount of seed investment received by a startup.

Figure 1. Theoretical Model



3 Dataset and Research Method

Our dataset is based on data from Crunchbase (www.crunchbase.com). This platform provides company insights, including early-stage funding data of startups and their value proposition [35]. To ensure recency, yet avoid any effects linked to the expected decline in venture capital due to the COVID-19 pandemic [36], we looked at seed funding rounds in the fourth quarter of 2019. To obviate inconsistency with investment levels among different countries, we only selected startups founded in the US. A total of 593 startups matched our selection criteria.

Out of these, we randomly selected a sample of 100 startups. Following Böhm, Weking, Fortunat, Mueller, Welpe and Krcmar [15], we coded 55 binary values representing the 55 business model patterns developed by Gassmann, Frankenberger and Csik [24]. The binary values indicate whether a pattern was applied (1) or not (0). This coding resulted in a vector, as illustrated in Table 1, for each startup.

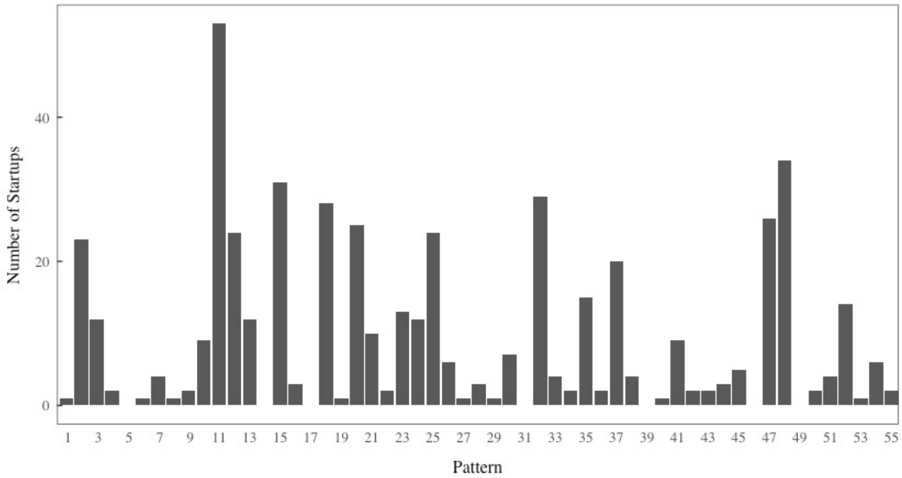
Table 1. Example of encoding table of business model pattern applied by startup

BMP	1	2	3	4	…	52	53	54	55
Appl.	0	0	0	1	…	0	1	1	0

The business model patterns are labeled 1 to 55 in alphabetical order. To gather the required information for coding, we analyzed the startups based on their Crunchbase profile, their website, and other publicly available information such as news, press reports, and founders' interviews. To ensure reliability, the encoding was performed by 2 of the authors in regular meetings. The coding was done between May and June 2020. During the coding process, 28 of the 100 sampled startups had to be removed from the sample, since the applied business model patterns could not be confidently identified based on the available data.

Figure 1 visualizes the coverage of business model patterns in our dataset of the remaining 72 startups. Out of 55 patterns, 48 were applied by at least one of the startups in the dataset. The five most frequently applied patterns were #11 *Digitalization* (73,6%), #48 *Subscription* (47,2%), #15 *Flat Rate* (43,1%), #32 *Open Business Models* (40,3%) and #18 *Freemium* (38,9%). Overall, the dataset shows a bias towards patterns linked to digital products and services despite being unbiased with regards to the industry.

Figure 2. Coverage of Business Model Patterns



To test our hypothesis that the applied business model patterns influence seed funding, we performed point-biserial correlation tests. This equals Pearson's product-moment correlation with one variable represented as interval/ratio data and one dichotomous variable on a nominal/categorical scale [37]. The point-biserial correlation tests provide a coefficient as a measure of strength and direction of the correlation. In our case, the received seed funding (in US dollar) provides our ratio data, while the dichotomous variable indicates the use of the analyzed business model pattern. This allows us to analyze the seed funding received by startups that applied the business model pattern under investigation and compare it with those startups that did not apply it. We have minimized outlier effects caused by small sample sizes by limiting our analysis to these business model patterns where both comparison groups (pattern applied / not applied) contained at least 10 startups. This reduced the number of analyzed patterns from 55 to 17.

After analyzing the impact of all 55 patterns, we used the hierarchical taxonomy by [38] that identifies the following high-level business model patterns*: merchant odel* groups wholesalers and retailers of goods and services [39]. *Multi-Sided Platforms* serve two or more interdependent customer segments, where both segments are required to make the business model work [38]. Besides, we generalize focus on a particular *Customer Group* or market segment and use of a specific *Pricing Model* or *Revenue Stream* and group pattern that change the *Value Network* or the way it is interacted with and ones that offer certain products or services (*Value Proposition*) or develop an offering in a certain way (*Value Proposition Development*) [17].

Table 2 shows the mapping of the original pattern to the high-level generalization. Whenever the original patterns were not as frequent, we grouped startups that applied at least one of them to analyze the high-level pattern's impact. For example, the patterns *Orchestrator* (2,8% of the total sample) and *Self Service* (6,9% of the total sample) were rather infrequent individually. However, we used them when analyzing startups that applied at least one *Value Network* pattern (45,8% of the total sample). Besides, the high-level patterns enabled in-group comparisons (e.g., *Subscription* and *Pay-per-Use*).

Table 2. High-Level Pattern Mapping

High-Level Pattern	Business Model Pattern
Merchant Model	Direct Selling, E-Commerce, Shop-in-Shop, Supermarket
Multi-Sided Platform	Affiliation, Peer-to-Peer, Two-Sided Market
Customer Group	Aikido, Long Tail, Target the Poor, Ultimate Luxury
Pricing Model	Add-on, Auction, Barter, Fractional Ownership, Freemium, No Frills, Pay What You Want, Robin Hood
Revenue Stream	Cash Machine, Crowd Funding, Flat Rate, Franchising, Hidden Revenue, License, Pay-per-Use, Performance-based Contracting, Rent Instead of Buy, Subscription
Value Network	Integrator, Layer Player, Orchestrator, Revenue Sharing, Self Service
Value Proposition	Cross Selling, Customer Loyalty, Experience Selling, Guaranteed Availability, Ingredient Branding, Leverage Customer Data, Lock-In, Make More Of It, Mass Customization, Razor and Blade, Reverse Innovation, Solution Provider, Whitelabel
Value Proposition Development	Crowdsourcing, Digitalization, From Push to Pull, Open Business Models, Open Source, Reverse Engineering, Trash to Cash, User Designed

4 Results

The results from Pearson's product-moment correlation tests on our original patterns, where our analysis indicates the effects of applying individual patterns on seed funding, are shown in *Table 3*. Positive and negative correlation coefficients (r_{pb}) respectively indicate an increase or decrease in received funding when the specific pattern is applied, while a coefficient of zero indicates no correlation. The *p*-values serve as indicators for statistical significance, representing the probability of observing the data seen in our analysis if applying a particular pattern does not affect seed funding [40].

Out of the 17 patterns that were applied by at least n = 10 startups in our dataset, nine revealed a correlation coefficient with a magnitude larger than 0.1. For *Two-Sided Market*, *Layer Player,* and *Freemium*, our data indicated the strongest correlations with larger than 0.2 correlation coefficients. *Direct Selling* and *Aikido* were the only patterns that showed negative correlations. However, only the patterns *Two-Sided Market* and *Layer Player* resulted in a p-value < 0.05 indicating significance. Since the p-value for the Freemium pattern is only slightly above this 0.05 threshold with a $p = 0.0592$, but below the $p = 0.1$ threshold, we consider this correlation significant.

Table 3. Pearson's Product-Moment Correlations

Business Model Pattern	N	r_{pb}	p-value
Two-Sided Market (*)	14	0.2657	0.0241
Layer Player (*)	12	0.2464	0.0370
Freemium (+)	28	0.2234	0.0592
Integrator	13	0.1566	0.1890
Direct Selling	24	-0.1309	0.2731
Open Business Model	29	0.1251	0.2952
Pay Per Use	15	0.1203	0.3141
Aikido	12	-0.1054	0.3782
Digitization	53	0.1034	0.3875

+p < 0.10; *p < 0.05; **p < 0.01

Exemplary, *Figure 3* visualizes how the correlation effects of the *Freemium* pattern (r_{pb} = 0.2234) are manifested in our data. The interquartile range for the received seed funding of startups that applied the *Freemium* pattern (n = 28) begins at $1M and ends at $4.23M with a median of $2.46M. For startups that did not apply the pattern (n = 44), the 25th percentile is $0.67M, and the 75th percentile is $2.84M, with a median of $1.58M.

Figure 3. Boxplot for Freemium Pattern

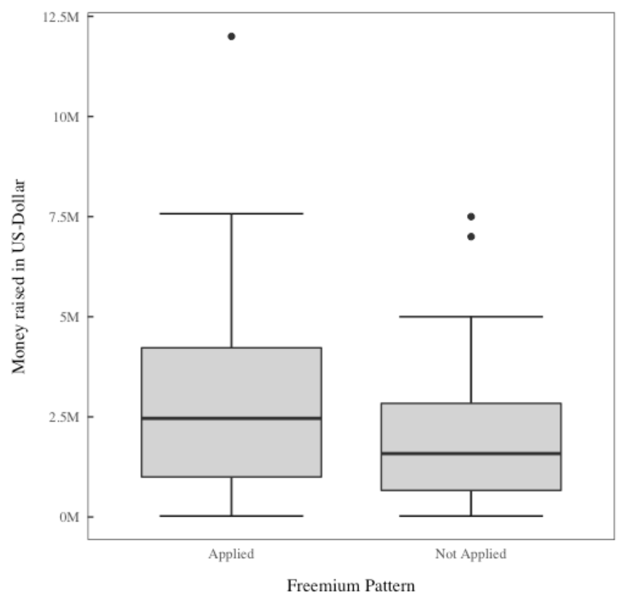


Table 4 shows the results of our correlation analysis for high-level patterns. The data indicate that specifying a *Value Network* pattern correlates with higher seed funding at r = 0.3149, yet with a low p-value of 0.007. Applying *Pricing Model*, *Revenue Stream*, *Multi-Sided Platform,* or *Value Proposition* pattern also correlates with a slight increase

in seed funding. Conversely, using *the Merchant Model* pattern correlates with a slight decrease.

Table 4. Pearson's Product-Moment Correlations for High-Level Patterns

Business Model Pattern	n	r_{pb}	p-value
Value Network (**)	33	0.3149	0.0071
Pricing Model	35	0.1769	0.1370
Revenue Stream	59	0.1269	0.2880
Multi-Sided Platform	33	0.1264	0.2900
Merchant Model	25	-0.1198	0.3161
Value Proposition	53	0.1117	0.3504

+p < 0.10; *p < 0.05; **p < 0.01

5 Discussion

Business model research argues that the business model has its share of influence on firm performance. By applying the concept of business model patterns on a sample of 72 US-startups, we analyzed the correlation between seed funding and business models. First, we showed the effects of 55 patterns elaborated by Gassmann, Frankenberger and Csik [24]. Second, we grouped our original patterns to analyze eight high-level patterns based on research from Weking, Hein, Böhm and Krcmar [38]. We identified three business model patterns (*Two-Sided Market, Layer Player & Freemium*) and one higher-level pattern (*Value Network*) that lead to significantly higher seed funding.

Multiple other studies have investigated the impact of the business model in various economic contexts and for different types of firms [22, 41-44]. However, in organizational research, many factors interrelate and emerge towards firm performance [45, 46]. Researchers' difficulty is to account for these interrelations of complex business ecosystems [47, 48]. Unlike other fields, e. g. medical research, experiments where these factors can be isolated are seldomly persuadable. With this study, we chose the context of early-stage startups. We argued that in this stage the business model is of higher importance since it highlights the startups' plans about their unique value proposition, value creation and capture mechanisms as well as their in this stage activities to implement them [3]. Even though this does not isolate the business model from other influences such as personality traits of founders or previous entrepreneurial experience, it increases its impact on the outcome.

We found the strongest correlational effect for the business model pattern of two-sided markets. This pattern is also known as the platform business model that became increasingly popular through digital innovation, created the so-called "platform economy" and disrupted many industries such as mobility, retail, and sports. This popularity, caused by several highly successful startups such as Uber, Amazon, and Urban Sports Club, leads to investors' high expectations. As we noted earlier, early stage investors need to rely on the idea of the startup. Applying a business model that has been successful in other industry contexts provides an opportunity for a successful startup. However, research on digital platforms finds that such markets are often characterized by winner-takes-all markets and first-mover advantages [49]. A startup trying to establish its digital platform either in a new market or as a competition to another platform needs to scale fast. The network effects that can and need to be achieved in these markets require the early investment and early success of the platform. If this success is not achieved, it is more likely for the startup to fail. In their study on startups' chances for survival Weking, Böttcher, Hermes and Hein [17] found this negative correlation between the two-sided market pattern and startup survival. Also noting the relatively low number of startups applying this pattern in our analysis, we see the high-risk early-stage investors take when investing in a two-sided market startup. Hence, if they do so, they invest more to increase the chances that the startup can leverage network effects and gain early market success.

Similarly, the Layer Player pattern profits from economies of scale. The pattern describes companies that add single activities to the value creation in a value chain. Therefore, they engage in multiple ecosystems. Just like a digital platform, that needs to leverage network effects and grow fast, a Layer Player needs to establish its service in multiple industries quickly and scale its operations. As seed investors often supply more than just money, e. g. their network, the startups profit from the investment to use the money and the network to establish their services. Connecting the startup in their network shows the trust an investor has in the idea. This trust then manifests in the amount of investment. In their study Weking, Böttcher, Hermes and Hein [17], found that this pattern correlates with startup failure. They argue that it is difficult to establish the service in different industries, as they are often dominated by established players. As their study did not account for the role of investors for startup survival, our findings may propose future research on the influence of seed investment on survival after a specific time.

For the Freemium pattern, we found that the median investment is nearly one million US$ higher for startups applying this pattern. Like the previously discussed patterns, the Freemium pattern also has gained popularity through the digital transformation. We observe this pattern in almost all areas of digital services such as media (e. g. Spotify), cloud storage (e. g. Dropbox), cloud computing (e. g. AWS) or productivity (e. g. Endnote). The idea behind this pattern is to provide free basic and paid premium services, where the premium customers cross-finance the free offering. Unlike the previous two patterns, this pattern is not centrally related to the value proposition but the value capture. Based on previous research, users are more likely to buy a service or product after being able to test it for free. The challenge for startups applying this pattern is to convert as many users to the premium service as possible. The seed funding helps to create an appealing premium service early, e. g. by providing the most popular music, and to establish the customer base. If the startup succeeds with this, research indicates a higher chance of survival, thus a return on investment for the investors [17].

One may assume that high funding results in higher chances for startup success. However, for the patterns *two-sided market* and *layer player*, our results and the results of Weking, Böttcher, Hermes and Hein [17] do not support this assumption. While our results show higher seed funding for these patterns, their research indicates lower chances of survival of startups. As argued above, the two patterns engage in highly competitive ecosystems. The funding is needed to establish the startup and capture its share of the value. The popularity and success of connected and integrated business models like digital platforms, e. g. Uber, Amazon, and Urban Sports Club lead to high expectations, thus high investments. However, the lower chances of survival indicate that high early-stage funding does not correlate with startup survival in these ecosystems. Investments in such business models take a high risk in the hope that they will also yield a high reward.

On a higher level, patterns related to the value network are of particular interest for investors. These patterns describe business models that add value-creating activities to a network, participate in the value capture, and generally have close interaction with other business models in their network [38]. For example, we observe such close interactions in digital platform ecosystems, where platform owners, sponsors, complementors, and customers have close interaction. The platform owner is especially interested in keeping his network connected to create lock-in effects to avoid users switching to other platforms. For investors, startups participating in such an interacting network seem worth an investment as they often integrate into existing profitable networks.

5.1 Contributions to Research

Our paper makes three theoretical contributions. First, we contribute to business model research. As an articulation of a firm's strategy and the planned activities to implement this strategy, the business model provides a novel lens to analyze different strategies' performance. Our results show that the business model influences the amount of seed funding received by a startup. The findings contribute to acknowledging that the business model is a source of competitive advantage and superior firm performance [50-53]. We address several calls for research [16, 54, 55]. We provide quantitative, industry-independent results to demonstrate business model performance, thus achieve generalizability. The identification of specific, tangible business model patterns supports the understanding that the business model is a source of competitive advantage.

Second, we contribute to entrepreneurship research by providing further explanations of startup performance. Our results show how startups with different business models receive different amounts of seed investment. In particular, we identify three business model patterns (*two-sided market, layer player*, and *freemium*) that significantly increase the investment sum. As funding is an essential factor for startup success [2], this contributes to the discussion about the influence of the business model on startup success [56].

Third, we contribute to research on ecosystems. Driven by the rapid development of digital technologies, today's business environment is characterized by complexity and uncertainty [47]. Firms become more and more intertwined, and value is created by firm networks rather than value chains [57]. For these networks, the theory of the ecosystem has emerged recently [58]. We show that investors invest more money in platform business models (two-sided market) that try to create a new platform ecosystem and in layer players that add services to complex firm networks. This supports the business model as a unit of analysis to analyze how firms create and capture value in ecosystems [59, 60].

5.2 Contributions to Practice

For practice, we provide insights from both the startup and the investor perspective. Our research provides indications for entrepreneurs when designing their business models. The knowledge that some business models receive higher startup funding than others highlights the importance of business model design. We argue that the identified patterns two-sided market, layer player, and freemium also require a higher investment, in the beginning, to get the business started and establish the startup's value proposition in the respective market. For investors, we observe a preference for business models integrated into their ecosystem. The results provide guidance for investment decisions. Depending on their risk aversion, different patterns, that we showed to receive more funding, provide higher chances of receiving a return on investment. As we discuss that the identified patterns require more capital to become successful and full commitment of the investor is needed in the early stages of the startup, early-stage investors can decide whether they can provide this investment and commitment.

5.3 Limitations

While this paper provides first insights on the effects of business model patterns on early-stage financing, it is subject to some limitations. First, the identified patterns are not the perfect way to receive seed investment. As earlier research highlights, there is no one successful business model [51, 61]. Designing a business model is as much art as systematic [12], so creativity and innovativeness play an essential part for startups to succeed. Second, the business model is a dynamic construct, thus changes over time [62]. Our research only provides a static snapshot of the business model at the time of our coding. Thus, the result may only be valid for a specific time frame, and the successful patterns in different macro-economic context may change. Third, our sample size of 72 startups limits generalizability. Even though we were able to identify significant correlations, the analysis should be repeated on a larger sample. We also focused on US startups only to account for differences in the available capital for seed investment. Thus, our results may be limited to US firms and may be compared with analysis for different markets.

6 Conclusion and Future Research

The importance of startups for an economy is often highlighted in entrepreneurship research. Startups produce innovations, create jobs, and drive economic growth. However, only a few startups survive. Seed investment is crucial for many startups, as capital is a valuable but missing resource. Also, startups can profit from the knowledge and network of their investors. This research provides an analysis of the influence of the business model on the received early-stage investments. Based on a sample of 72

US-startups, we identify three business model patterns that lead to higher seed investments: *two-sided market, layer player,* and *freemium*.

Further research should elaborate on the relationship between business models, startup funding, and startup survival [7]. The business model, need for external financing, and related firm performance change during the different stages of business development [56]. To cope with the challenge of startup success, time-series data, and control variables that account for ecosystem complexity may provide insights into this relationship and its development in different stages of the startup. Through longitudinal time-series, the evolution, adaptions, and various influences of the business model may become observable and provide a better understanding of the success and failure of startups and clarify the paradoxes in research.

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Why Incumbents Should Care–The Repercussions of FinTechs on Incumbent Banks

Completed Research Paper

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Abstract

Startups play a significant role in the digital transformation of ecosystems. In the financial ecosystem, these startups are called FinTechs, a term representing the combination of financial services and digital technology. Technological innovations, such as artificial intelligence and blockchain, enable disruptive innovations in the financial ecosystem, potentially replacing incumbent firms. Based on this disruptive potential, we hypothesize negative repercussions of FinTech success on incumbent banks. We conduct an event study of 152 European FinTech funding rounds in 6 years to test our hypotheses. We test the repercussions of these events on the market capitalization of 30 incumbent European banks. The results support our hypothesis that FinTechs' funding rounds have negative repercussions on incumbents' market capitalization. Our quantitative results show that the success of FinTechs challenges investors' expectations of the future success of incumbents. Hence, incumbents must invest in digital services themselves or collaborate with FinTechs.

Keywords: FinTech, digital transformation, event study, banking

Introduction

The common goal of FinTechs (startups leveraging digital technology in the financial industry) is to transform the financial services and products offered by incumbent banks and other financial institutions (Puschmann 2017; Zavolokina et al. 2016). Enabled by digital progress, they simplify and speed up long-grown and dusty financial services. For example, FinTechs such as TradeRepublic or

Robinhood offer cheap, easy, and, not least, purely digital stock trading. Neobanks such as Revolut or N26 offer bank accounts with additional services for digital customers, for example, by value-adding services such as financial data analyses or partner offers. In many cases, they genuinely fulfill disruptive innovations' criteria (Christensen et al. 2015). Thus, they pose a clear threat to incumbents in the financial ecosystem.

Although FinTechs will not replace banks themselves, they will undoubtedly change the way banks operate in the future (Basole and Patel 2018). FinTechs design their products and services to connect consumers' finances with technology for ease of use and convenience (Basole and Patel 2018). Hence, the customers would naturally be more inclined to use them instead of the traditional methods provided by incumbent banks (Basole and Patel 2018). Customers enjoy the digital perspective, characterized by a nearly complete immediacy and availability of information, technological devices such as smartphones and tablets, and other trends such as the Internet of Things (Nicoletti 2017). Incumbent banks should monitor the development of FinTechs that currently focus on private consumers (Basole and Patel 2018). However, more FinTechs targeting corporate banking emerge, thus threatening the core business of incumbent banks.

Extant research has mainly focused on single roles in the financial ecosystem, such as FinTechs or incumbent banks. However, it lacks an inter-organizational view on mutual interdependencies between the individual roles (Basole and Patel 2018; Puschmann 2017). Only a few, such as Riasanow et al. (2018) and Muthukannan et al. (2020), have taken an inter-organizational view. This inter-organizational view is needed to understand the digital transformation in an ecosystem that goes beyond the transformation of the single firm. This implies that the digital transformation of one firm influences other firms in the ecosystem (Fitzgerald et al. 2013; Riasanow et al. 2020; Vial 2019). Thus, a successful digital transformation of one firm also affects the performance of other firms in the ecosystem. In this study, we take on the inter-organizational view to investigate this performance dependency. We use FinTechs as cases of digital transformed firms in the financial ecosystem and measure their success using their funding. We ask whether the digital transformation triggered by FinTechs impacts the performance of incumbents. We propose the following research question: *Do funding rounds of FinTechs have repercussions on the share price of incumbent European banks?*

Our research analyzes whether the announcement of a new FinTech funding round influences the stock performance of incumbent banks. We conduct an event study investigating the announcement of new funding rounds as events (Bromiley et al. 1988; MacKinlay 1997; Peterson 1989). We use statistical analyses to test our hypotheses that those events impact the share price performance negatively. Additionally, we look at the moderating effect of the funding round's size.

The paper is organized as follows. First, we analyze related literature on the digital transformation in the financial industry and the role of FinTechs and develop two hypotheses. Second, we describe our methodology, which is a quantitative event study. Third, we present the results of quantitative analysis showing that FinTechs influence incumbent banks. Finally, we discuss the results and their implications, present our future research plan, and conclude the paper.

Theory and hypothesis development

FinTechs are successful as they occupy attractive relative positions (Basole and Patel 2018; Porter 1991). Compared to incumbents, they follow both decompositions of competitive advantage: lower cost for customers and a differentiating value proposition through the digital business models (Gomber et al. 2017). Digital technologies enable startups to enter previously capital-intensive industries, such as banking, where money needs to be somehow available before a bank can lend it to customers on loan (Böttcher and Weking 2020). Through peer-to-peer loans or crowdsourcing, FinTechs bypass this hurdle (Berger and Gleisner 2009). Once they entered the market, they become strong competitors (Robinson and McDougall 2001). Their digital value propositions are attractive, especially for young and technology-savvy customers (Gomber et al. 2017). Moreover, their value proposition may be fundamentally different, thus substituting traditional banking services (Gomber et al. 2017). Again, peer-to-peer loans or crowdsourcing is an example of lowering the demand for bank loans.

However, FinTechs are not necessarily a threat to incumbents. Collaboration and value co-creation are observable in many digital settings, such as digital platform ecosystems (Böttcher et al. 2021b; Hein et al. 2020; Hein et al. 2019). Hence, FinTechs and incumbent banks can also collaborate in a customer-supplier relationship (Basole and Patel 2018; Eisenhardt and Schoonhoven 1996). Instead of building up their knowledge and employing skilled FinTech specialists themselves, incumbent banks can co-create digital services with FinTechs (Drasch et al. 2018; Hornuf et al. 2020). For example, FinTechs providing data analytics services can provide immense value for banks that sit on vast amounts of data.

Whether incumbents compete or collaborate with FinTechs, the technological innovations introduced to the financial ecosystem by FinTechs have a strong influence on the business models of incumbents (Puschmann 2017). Still, the financial industry was never severely threatened by technological innovations. The technology-enabled introduction of direct banking or online banking influenced incumbents, but it only caused growth and increased efficiency of a resilient industry (Arnold and van Ewijk 2011; Gozman et al. 2018; Madura et al. 1991; Sufian and Majid 2009). However, the ubiquity of mobile and cloud computing, combined with the pervasiveness of data analytics and distributed ledger technology, shakes up the core of the financial ecosystem (Basole and Patel 2018; Palmie et al. 2020; Weking et al. 2020).

Extant research shows that the digital business models introduced by FinTechs pose a severe threat for incumbents (Alt and Ehrenberg 2016; Basole and Patel 2018). Incumbents lose competitiveness and face a decline in their financial performance (Berman et al. 2021; Du 2018). In contrast, FinTechs leverage digital technologies to improve their strategic positions and competitiveness (Berman et al. 2021; Böttcher and Weking 2020; Weking et al. 2020). For example, FinTechs attack bank loan businesses with peer-to-peer loan services (Jagtiani and Lemieux). FinTechs remove intermediaries, increase transparency, personalization, and integration between various services offered by multiple FinTechs (Gozman et al. 2018; Riasanow et al. 2018). The services offered by FinTechs are not only enhancements or simplifications but replacements of traditional finance services (Alt and Ehrenberg 2016; Gozman et al. 2018). Consequently, FinTechs arguably disrupt the financial ecosystem, forcing incumbents to adapt their business models or otherwise push them out of the market (Basole and Patel 2018; Du 2018; Gozman et al. 2018; Palmie et al. 2020). This disruption of the financial ecosystem, further driven by the pace of digital innovation and the growing amount of FinTechs entering the financial ecosystem (Basole and Patel 2018), leads to symbiotic relationships between FinTechs and incumbents (Muthukannan et al. 2020). Thus, while business model renewal can be an opportunity (Böttcher and Weking 2020; Soto Setzke et al. 2021), incumbents adapting to the FinTech disruption will most likely lose their market position to FinTechs (Berman et al. 2021; Madura et al. 1991; Palmie et al. 2020).

The more FinTechs are successful and establish themselves in the financial ecosystem, the stronger the disruptive effect on incumbents. The success of young companies, such as FinTechs, is often measured in the funding they receive from investors (Böttcher et al. 2021a; Chang 2004). Investors invest in startups they believe will be successful in the future and will provide a return on the investment (Baum and Silverman 2004; Shepherd et al. 2000). In turn, the funding money enables startups to grow, such as investing in new and better services or products and spending more money on marketing, increasing the chances of success and attracting new investments. This upward spiral then leads to a rising impact on the ecosystem and hence on incumbents. Therefore, we propose our first hypothesis:

Hypothesis 1: The announcement of funding rounds of FinTechs negatively impacts the stock price of incumbent banks.

As most incumbent banks are listed on stock exchanges, we use stock prices to measure this impact (Henry 2008; Solomon 2012). The announcement of a funding round provides an exact date, thus enabling us to measure stock price reactions quickly on the first day or the day after the event's announcement.

Furthermore, we argue that the size of the announced funding round moderates this impact. The bigger the monetary value a FinTech receives, the greater is the tendency for growth, quality improvements, and marketing. Hence, the chances for increasing market success are improved for the focal FinTech, thereby hurting the incumbents' success. Therefore, we devise a second hypothesis:

Hypothesis 2: The size of the announced funding round moderates the impact on incumbent banks' stock price.

Methods

To test our hypotheses, we conduct an event study. The event study methodology measures the effect of an event, such as strategic decisions (e.g., business model innovations, mergers, and acquisitions), exogenous shocks (e.g., the COVID-19 pandemic, the global financial crisis), or other events potentially impacting the subject of interest (e. g. announcement of dividends, annual results) (McWilliams et al. 1999). It is a suitable methodology for analyzing effects that occur shortly after the causing event (McWilliams et al. 1999). We measure the effect of funding announcements on stock prices. Hence, we define the event as the publication of an announcement of a new funding round by a FinTech. As stock markets respond pretty fast to news, we deem the methodology suitable for our research.

Sample Frame

Our research context is the European financial industry. Europe is a suitable setting, as it has a historically strong financial industry. Global financial hubs are located in London, Paris, and Frankfurt. The finance industry is an economic cornerstone of European countries such as Switzerland and Luxembourg (European Banking Federation 2020). 22 of the 109 FinTech unicorns (startups with a market valuation above US$1 billion) originate from Europe (CBInsights 2021). The FinTech adoption rate is above or at the global average (64%) in many European countries, such as the Netherlands (73%), the United Kingdom (71%), or Germany (64%). This adoption rate has increased significantly by up to five times since 2015 (EY 2019). In summary, Europe offers a strong, established financial ecosystem, a robust FinTech ecosystem, and high user adoption rates driving FinTechs' success and potential impact on incumbent banks.

Consequently, we collected funding rounds of European FinTechs. Due to the high failure rates of startups, we wanted to make sure the selected FinTechs are mature and successful enough to have a potential impact on incumbents. Therefore, we limited the search on funding rounds with a minimum volume of US$50 million. We used the Crunchbase database (crunchbase.com) as the data source for this data collection. We searched for funding rounds announced between 01/01/2015 (US$200 million Debt Financing announced by Monedo on 01/22/2015) and 12/22/2020 (US$93 million debt financing announced by Liberis). We chose 01/01/2015 as the start date for our data collection, as in 2015, investments in FinTechs kickstarted with 16 funding rounds above US$50 million compared to 16 funding rounds before 2015. Thus, FinTechs became significant players in Europe's startup and financial ecosystem. The initial data collection resulted in 152 funding rounds. We include the complete list of collected funding rounds in Appendix B.

To test our second hypothesis, we grouped the funding rounds according to their monetary volume. We grouped each funding amount in ranges of US$25 million. For example, we grouped US$52 million and US$54 million into the group US$50–74 million. This resulted in 21 groups ranging from US$50 million to more than US$1 billion.

We collected the 50 largest banks in Europe that serve as our incumbent sample for our dependent variable. We include the complete list of all 50 banks in Appendix A. We excluded 15 banks that are not listed in European stock exchanges, as we use the change of market capitalization as the dependent variable. Thus, our sample of incumbent banks consists of 35 cases.

Time Frame

The selection of the relevant time frame of the effect is a critical issue in an event study (Koh and Venkatraman 1991). Therefore, the time frame of the event must first be clarified. Our definition of the event, the publication of an announcement of a new funding round by a FinTech, unambiguously specifies the date of an event and thus does not allow for event timing variations. Two funding rounds were announced on each of 13 days. We have thus reduced the 152 funding rounds to 139 event dates.

Subsequently, it is necessary to define the time frame of the onset of the effect. Previous research using event studies indicates that the event effects are most significant on the first day (Eastman et al. 2010; Solomon 2012). Thus, we used a two-day time frame: the day of the event and the subsequent day.

Effect Size

To measure the impact of the funding rounds on incumbent stock prices, we collected the daily stock prices of the selected 35 banks between 01/21/2015 and 12/23/2020 using Python. We calculated the percentage change of every day in our analysis period for every bank with these daily stock prices. This average percentage change per bank served as the daily returns. With these daily returns as the baseline, we can analyze if a particular event (i.e., funding round) significantly impacts the stock price even considering a current trend. An adverse reaction of the stock price may or may not be significant when the stock price is rising or sinking recently.

To measure the effect of the events, we extracted the stock prices in our defined time frame: on the 139 event days and the respective day after. We then calculated the percentage change between these two days for each bank and event. From this change, we derive a simplified estimate of the abnormal returns caused by the events. The statistical comparison with the daily returns allows us to identify the events that impacted the stock price. We included all changes in Appendix A.

Statistical Tests

We conducted two separate statistical tests to test our hypotheses. To test our first hypothesis, we conducted a one-tailed t-test (Ruxton and Neuhäuser 2010). The percentage changes after the funding rounds were announced, and the daily percentage changes over our six-year period allow for a paired t-test because the data are in the form of two-part pairs. Essentially, we compare the means from the same group under two separate scenarios. Based on the p-value, our null hypothesis that the mean difference between the two groups is equal to zero can either be rejected or approved (Ruxton and Neuhäuser 2010). Our hypothesis assumes that the mean difference is smaller than zero because of our assumption that the percentage changes are more minor on days after the financing round announcement than the usual changes. Thus, the one-tailed t-test is more suitable to detect an effect in one direction (negative in this study).

To test our second hypothesis, we performed a linear regression (Montgomery et al. 2021). The funding amount serves as the independent predictor variable. The average percent change is the dependent outcome variable. We use this to test whether the null hypothesis that the coefficient equals zero is valid; that is, the funding amount does not affect the banks' average percentage changes (Montgomery et al. 2021). At a standard significance level of 5%, we can infer whether funding volume is a meaningful addition to our model since changes in the independent variable are related to changes in the dependent variable.

Results

We collected the share prices for 35 incumbent European banks at the event dates with the described data collection methods. The event dates of funding rounds were stored together with the information about the banks' share prices. The red bars in Figure 1 show how the 35 banks' share prices changed on average within one day after the announcement of a FinTech's funding round. Most banks show a negative impact of 0.2%–0.4%, whereas some outliers show positive effects, and other outliers show much higher adverse reactions. The bank that exhibits the highest positive percentage change is the Norwegian DNB bank. By contrast, Banca Monte dei Paschi di Siena had the most negative percentage change on average. It previously needed massive help from the Italian government to avoid bankruptcy due to its mismanagement and structural problems in the Italian economy. The negative pressure of the FinTech financing rounds had an even more substantial impact. HSBC, the largest European bank, performed more positively than most of the other banks. However, generally, a negative impact of FinTechs' funding round announcements on most banks' stock price performance is observable.

The blue bars in Figure 1 show the average percentage change on regular days during the whole six-year period. Most banks show an average daily percentage change close to. However, it might be due to noticeable vanishing changes; for example, a percentage change of −1% on one day neutralizes the percentage change of +1% on another day. In this scenario, the overall percentage change would be zero. Generally, we did not observe any negative trend on the stock prices of European banks. However, there is a negative effect on days with funding round announcements of FinTech companies.

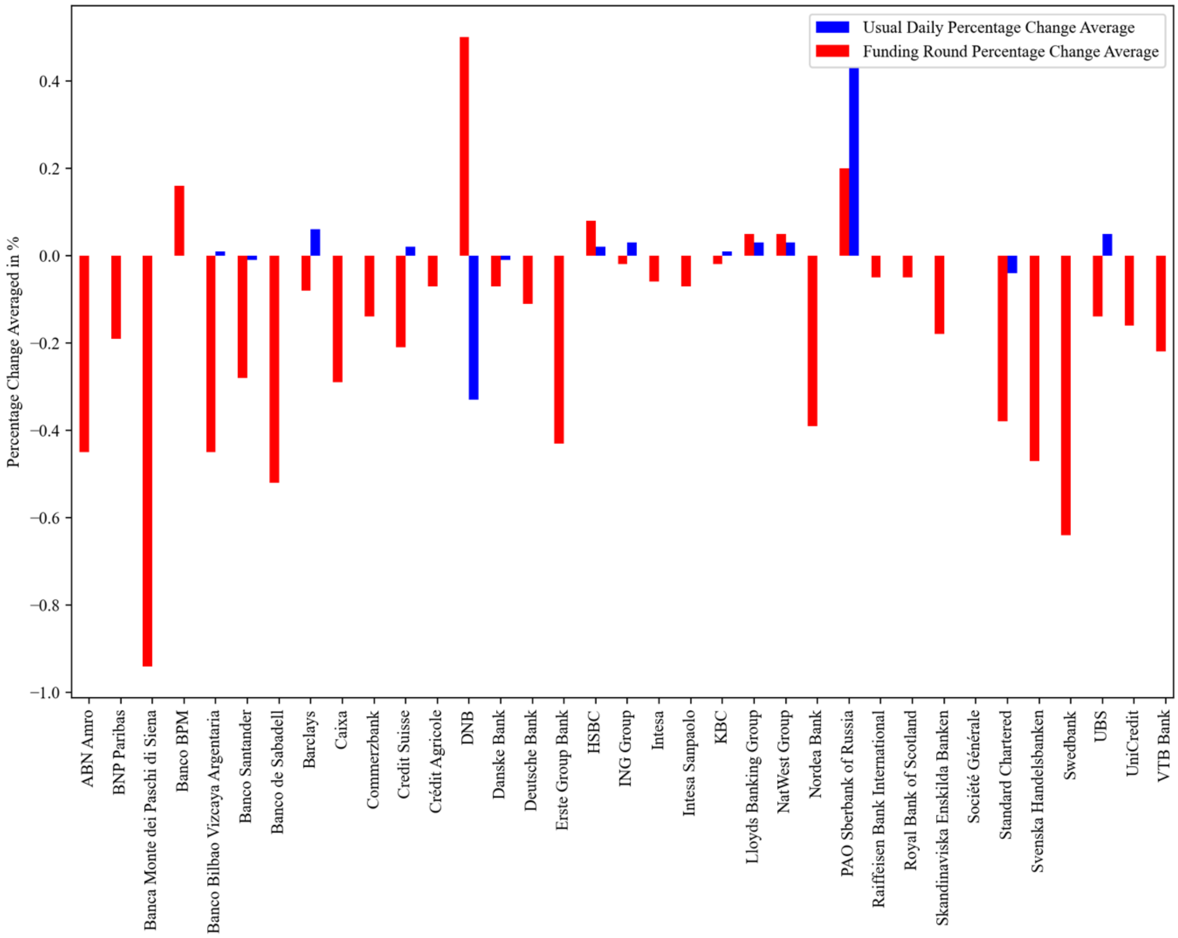

Figure 1 Percentage changes of incumbent banks on event-days (red) and on regular days (blue)

Table 1 Statistical results of the one-tailed t-test

Daily returns = mean on regular days	+ 0.0074 %
Abnormal returns = mean on event days	- 0.1728 %
t-value	-4.0195
df	34
p-value	0.0003062
95 percent confidence interval:	[-0.26357959; -0.08156327]

Fehler! Verweisquelle konnte nicht gefunden werden. displays the result of the one-tailed t-test. The statistical analysis using a one-tailed t-test resulted in a t-value of −3.9436 and a p-value of 0.0002. The t-value measures the magnitude of the variance relative to the change in the sample data (Ruxton and Neuhäuser 2010). Thus, it represents the calculated variance in standard error units. The larger the t-value, the more evidence there is against the null hypothesis. Moreover, the p-value shows strong significance; therefore, we reject the null hypotheses, indicating that the difference between the paired samples is less than zero. Hence, a significant correlation exists. Thus, hypothesis 1 is supported: FinTechs' announcements of new funding rounds negatively influence incumbent European banks' stock prices.

Since our first hypothesis is supported, we continued to test our second hypothesis. We hypothesized an influence of the funding amount on the stock price. The regression model is defined by the input of the funding round amount a_i and the output as the average percentage change of the banks stock price c_i:

$$c_i = f(a_i) = \beta_0 + \beta_1 * a_i$$

The regression function points in a slightly negative direction. This points towards a negative correlation between increasing funding round amounts and decreasing percentage changes in performance. However, the corresponding p-value using ordinary least squares regression equals 0.628. This concludes that we fail to reject the null hypothesis. Thus, hypothesis 2 is not supported because there is no significant evidence of a correlation between these two variables.

Discussion

In this research, we examined the repercussions of European FinTechs on the biggest banks in Europe by conducting an event study. We covered 152 funding rounds from January 2015 to December 2020, covering six years. We computed the abnormal percentage changes for every bank on those events and compared them with the daily returns. This method allowed us to test for statistical significance in the variance of average stock price changes. The one-tailed t-test confirmed our first hypothesis, claiming that FinTechs' funding round announcements negatively affect incumbent banks' stock prices. However, the linear regression model did not confirm our second hypothesis; that is, the funding amount moderates this effect.

Generally, this shows the FinTechs' influence on incumbents. Nowadays, the stock price represents the expectation of future performance more than the current performance (Alexy and George 2013; Fosfuri and Giarratana 2009). For example, Tesla's market capitalization compared with incumbent car manufacturers such as Toyota or Volkswagen is not based on current revenues or firm assets but on the fast growth and expected future revenue. Thus, investors closely monitor the FinTech ecosystem for profitable, future-oriented investments. A decrease in stock prices implies that investors sell their shares of a firm. Usually, they do this because they do not expect profits from these shares in the future anymore and want to sell with maximum profits. Our results show that this happens more severely on days when a FinTech announces a new funding round.

This can be explained by the investors' observation that these FinTechs' increasing success harms the invested incumbents' success. Mainly young customers are attracted by FinTechs that offer "boring" financial services in a digital, more fun, and more straightforward format (Krivkovich et al. 2020; Statista 2021). Thus, most customers may ultimately switch from incumbent business models to novel, innovative business models as offered by FinTechs today (Navaretti et al. 2018). Similar developments can be observed in other industries, most dramatically in retail, where startups such as Alibaba and Amazon became the industry's major players reaching significant and still growing market share (Fortune 2017; Reinartz et al. 2019). Their market valuation is multiple times higher than that of incumbents such as Walmart that used to be the highest valued company in the world (Francois 2020). In the financial ecosystem, a FinTech, for example, a NeoBank such as Revolut, that gains more customers for their digital bank account eventually draws customers from incumbents. If these NeoBanks continue to grow, they eventually can offer equivalent services such as real estate financing, thus becoming equal competitors to incumbents.

However, the daily returns show no constant negative development of incumbents' stock prices. While we observe an increase in venture capital for FinTechs, and negative repercussions on incumbents' stock prices caused by new funding rounds, we cannot observe a continuous decrease of incumbents' market valuation. Thus, the disruptive potential of FinTechs, eventually replacing incumbents, argued in extant research cannot be observed yet. FinTechs leverage digital technology to enter the financial ecosystem, that used to have high entry barriers. The negative repercussions of FinTech success on incumbents show that the new entrants have severe impact on the financial ecosystem. Hence, FinTechs are serious competitors for incumbents.

For incumbents in the financial ecosystem, the rise of FinTechs has to be their strategic focus area in the future. Taking the market positioning view, we showed how FinTechs influence the financial ecosystem. One way is treating these startups as partners and complementors to their own business model. Combining both worlds' strengths and investing in FinTech offers incumbents possibilities to co-create digital self-renewal of the financial ecosystem rather than being entirely replaced by FinTechs.

Contributions to theory

This paper makes contributions to research on FinTechs, digital entrepreneurship, and behavioral economics. First, we show that startups in the financial ecosystem impact the performance of incumbent ecosystem actors. A company's success, especially the expected success in the future, is represented by the stock price (Alexy and George 2013; Fosfuri and Giarratana 2009). Therefore, our quantitative results show that startups and the digital innovation they bring to the table play an essential role in the financial industry's digital transformation. Second, our results hold implications for behavioral economics (Kahneman and Tversky 2013). The abnormal drop in incumbent share prices shows that the digital innovations being introduced into the financial ecosystem by FinTechs are selling signals for investors. Hence, investors are loss-averse and expect a loss on their investment in incumbents when new information about FinTechs' success becomes available.

Contribution to practice

The results of the present study hold implications for both entrepreneurs and managers and shareholders of incumbents. For entrepreneurs, we show that the role of startups in the financial ecosystem is significant and vital. Meanwhile, for managers of incumbents, incumbent banks should not rely on their financial power. We recently observed how easily the stock market could be manipulated, and long-build market capitalization can rise or fall. FinTechs' influence on incumbent banks shows that the digital transformation in the financial industry is only starting. Moreover, the impact of FinTechs' IPOs on incumbents is potentially even higher. Western banks struggle because of low interest levels, whereas FinTechs provide solutions to leverage the potential of digital technologies and thereby attract new customers. Hence, the digital business strategy of incumbents must consider the disruptive potential of startups in their ecosystem (Markides 2006; Markides and Oyon 2010; Palmié et al. 2020; Tanriverdi and Lim 2017). Our results show why this attention on startups is needed. However, incumbents can leverage the same disruptive potential for their digital business strategy to gain a competitive advantage over other incumbents and compete with FinTechs (Park and Mithas 2020; Yeow et al. 2018).

Limitations

Despite our contributions, our research still has some limitations, which we will cover more in-depth. First, despite taking the biggest banks headquartered in Europe, some banks had missing data because of their relatively short presence in the stock market. We omitted them not to misrepresent the average that we were calculating for both scenarios for the lacking information. It would have certainly been more expressive and informative in that case. Second, our analysis does not involve other external factors and confounding variables negatively impacting the banks' share prices on those specific dates. However, analyzing multiple banks and using data gathered over a more extended period minimize those factors, allowing for a more valid result. Also, comparing those specific dates' percentage changes with the daily percentage changes allowed a paired test statistic to be conducted and false positives, such as a bank performing poorly, to be excluded, thereby avoiding misrepresentation of the percentage change that happened on specific event dates.

Future research

This research aimed to determine whether FinTechs influence incumbent banks. As we found support for this hypothesis, future research is needed to make a full theoretical contribution and establish causality. Therefore, although our research proved the case, the why and how needed for good theory are still missing. As a future research agenda, researchers can look further into why and how startups, FinTechs, influence their ecosystem's incumbents. Research can use the business model as the conceptual lens and take a configurational approach, for example, using fsQCA. Previous research has shown that the business model influences the performance and competitive advantage of the focal firm (Böttcher et al. 2021a; Weking et al. 2019). We argue that if the business model influences the focal firm, it may also influence firms' performance in the ecosystem. By analyzing the business model configurations of the FinTechs at the time of the funding rounds, we find the influencing factor of FinTechs on the incumbents' stock performance. The configurational approach allows researchers to find asymmetric relationships in variables influencing the outcome. Moreover, it allows researchers to analyze how different components of the business model in the context of its ecosystem play together to affect the success of FinTech and incumbent banks, in the form of funding and stock prices, respectively. The results will show how successful business models of technology startups lead to higher success for digital entrepreneurship. If a startup's goal is to disrupt the incumbent ecosystem, the results will show the role of the business model in this endeavor.

Conclusion

FinTechs are continuously challenging the incumbent banks regarding their traditional business models in a world of rapidly accelerated digitalization. We introduced this paper with the statement that banks will not disappear; however, FinTechs will change the way banks work. Our results show that the success of entrepreneurs influences the incumbents. We conclude two possible outcomes of the digital transformation in the financial industry: (1) FinTechs will continue to rise and eventually disrupt the ecosystem by replacing the incumbents, or (2) incumbents will respond to the disruptive potential. A self-renewal of the ecosystem and hence the way we do finance will be observed.

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Appendix

Appendix A

Bank name	Stock ticker symbol	Changes on normal days	Changes on event days
ABN Amro	AB2.F	0,02%	-0,45%
Banca Monte dei Paschi di Siena	MPIN.MU	0,00%	-0,94%
Banco Bilbao Vizcaya Argentaria	BBVA	0,00%	-0,45%
Banco BPM	BAMI.MI	0,01%	0,16%
Banco de Sabadell	BDSB.F	0,00%	-0,52%
Banco Santander	SAN	0,00%	-0,28%
Barclays	BCS	-0,01%	-0,08%
Bayrische Landesbank	*unlisted*		
Belfius Banque	*unlisted*		
BFA Sociedad Tenedora de Acciones	*unlisted*		
BNP Paribas	BNP.PA	0,00%	-0,19%
Caixa	48CA.F	0,00%	-0,29%
Commerzbank	CBK.DE	0,00%	-0,14%
CrÈdit Agricole	ACA.PA	0,00%	-0,07%
Crédit Mutuel	*unlisted*		
Credit Suisse	CS	0,02%	-0,21%
Danske Bank	DSN	-0,01%	-0,07%
Deutsche Bank	DB	0,00%	-0,11%
Dexia	*unlisted*		
DNB	NBA	-0,33%	0,50%
DZ Bank	*unlisted*		
Erste Group Bank	EBO.DE	0,00%	-0,43%
Groupe BPCE	*unlisted*		
HSBC	HSBC	0,02%	0,08%
ING Group	ING	0,03%	-0,02%
Intesa	IES.DE	0,00%	-0,06%
Intesa Sanpaolo	ISP.MI	0,00%	-0,07%
KBC	KBC	0,01%	-0,02%
La Banque Postale	*unlisted*		
Landesbank Baden-Württemberg	*unlisted*		
Landesbank Hessen-Th√ºringen	*unlisted*		
Lloyds Banking Group	LYG	0,03%	0,05%
Nationwide Building Society	*unlisted*		
NatWest Group	NWG	0,03%	0,05%
Norddeutsche Landesbanken	*unlisted*		
Nordea Bank	04QA.BE	0,00%	-0,39%
Nykredit	*unlisted*		
OP Financial	*unlisted*		
PAO Sberbank of Russia	SBNC	0,43%	0,20%
Raiffeisen Bank International	RAW.DE	0,00%	-0,05%
Raiffeisen Gruppe	*unlisted*		
Royal Bank of Scotland	RYS1.DE	0,00%	-0,05%
Skandinaviska Enskilda Banken	SEBA.F	0,00%	-0,18%
Société Générale	GLE.VI	0,00%	0,00%
Standard Chartered	STAN.L	-0,04%	-0,38%
Svenska Handelsbanken	SVHI.BE	0,00%	-0,47%
Swedbank	FRYA.MU	0,00%	-0,64%
UBS	UBS	0,05%	-0,14%
UniCredit	UCG.MI	0,00%	-0,16%
VTB Bank	KYM1.SG	0,00%	-0,22%
Zücher Kantonalbank	*unlisted*		

Appendix B

Organization Name	Funding Type	Money Raised Currency (in USD)		Announced Date
Monedo	Debt Financing	$	200.000.000,00	22.01.15
TransferWise	Series C	$	58.000.000,00	25.01.15
Saxo Bank	Funding Round	$	82.557.558,00	14.04.15
Funding Circle	Series E	$	150.000.000,00	22.04.15
LANDBAY	Debt Financing	$	383.786.405,00	30.04.15
Prodigy Finance	Debt Financing	$	87.500.000,00	10.08.15
Klarna	Secondary Market	$	80.000.000,00	19.08.15
Saxo Bank	Secondary Market	$	144.520.660,00	21.08.15
iZettle	Series D	$	67.098.407,00	28.08.15
LendInvest	Debt Financing	$	61.218.430,00	01.09.15

Monedo	Series C	$	92.697.254,00	28.09.15
Mash	Debt Financing	$	68.844.366,00	14.10.15
OakNorth	Series A	$	100.416.882,00	11.11.15
Ebury	Private Equity	$	83.000.000,00	18.11.15
Atom Bank	Venture - Series Unknown	$	123.698.338,00	24.11.15
Zopa	Venture - Series Unknown	$	106.477.481,00	11.12.15
Starling Bank	Series A	$	69.836.364,00	11.01.16
LendInvest	Debt Financing	$	58.429.474,00	28.04.16
4finance	Debt Financing	$	112.028.625,00	19.05.16
Cambridge Innovation Capital	Venture - Series Unknown	$	75.000.000,00	19.08.16
4finance	Debt Financing	$	52.723.150,00	23.11.16
Funding Circle	Series F	$	100.000.000,00	11.01.17
ID Finance	Debt Financing	$	50.000.000,00	16.02.17
Atom Bank	Venture - Series Unknown	$	102.065.284,00	03.03.17
Avaloq	Private Equity	$	353.030.769,00	24.03.17
4finance	Debt Financing	$	325.000.000,00	03.05.17
Monedo	Corporate Round	$	119.539.490,00	10.05.17
Eurazeo	Post-IPO Equity	$	890.972.269,00	06.06.17
Bancor	Initial Coin Offering	$	152.300.000,00	12.06.17
Revolut	Series B	$	66.000.000,00	11.07.17
Klarna	Private Equity	$	250.000.000,00	21.07.17
LendInvest	Debt Financing	$	65.202.479,00	05.08.17
Prodigy Finance	Debt Financing	$	200.000.000,00	21.08.17
Neyber	Series C	$	132.887.539,00	12.09.17
Salary Finance	Venture - Series Unknown	$	52.931.197,00	04.10.17
OakNorth	Series B	$	213.548.809,00	12.10.17
BGL Group	Private Equity	$	695.968.947,00	01.11.17
TransferWise	Series E	$	280.000.000,00	02.11.17
OakNorth	Series B	$	117.688.595,00	03.11.17
Monzo	Series D	$	93.533.415,00	06.11.17
Bankera	Initial Coin Offering	$	100.000.000,00	27.11.17
Crypterium	Initial Coin Offering	$	51.600.000,00	05.12.17
BIMA	Secondary Market	$	60.000.000,00	19.12.17
October	Debt Financing	$	245.423.465,00	16.01.18
Lendify	Debt Financing	$	50.429.997,00	24.01.18
Chetwood Financial	Private Equity	$	69.246.802,00	12.02.18
Chetwood Financial	Debt Financing	$	138.839.330,00	13.02.18
Nexo	Funding Round	$	52.500.000,00	01.03.18
Atom Bank	Venture - Series Unknown	$	207.176.366,00	07.03.18
Solarisbank	Series B	$	69.658.537,00	08.03.18
N26	Series C	$	160.000.000,00	19.03.18
Celsius Network	Initial Coin Offering	$	50.000.000,00	26.03.18
Liberis	Debt Financing	$	81.578.566,00	11.04.18
Revolut	Series C	$	250.000.000,00	26.04.18
iwoca	Debt Financing	$	68.854.969,00	30.04.18
PumaPay	Initial Coin Offering	$	117.019.041,00	09.05.18
Moneyfarm	Series B	$	53.073.412,00	29.05.18
Global Processing Services	Private Equity	$	57.962.766,00	19.06.18
Linked Finance	Debt Financing	$	58.019.650,00	21.06.18
Greensill Capital	Private Equity	$	250.000.000,00	16.07.18
Bitfury Group	Venture - Series Unknown	$	80.000.000,00	31.07.18
Zopa	Series G	$	57.222.001,00	03.08.18
Capital on Tap	Debt Financing	$	177.701.056,00	15.08.18
Deposit Solutions	Private Equity	$	100.000.000,00	15.08.18
OakNorth	Series B	$	100.000.000,00	06.09.18
Monese	Series B	$	60.000.000,00	06.09.18
Prodigy Finance	Debt Financing	$	996.823.281,00	24.09.18
Mash	Venture - Series Unknown	$	57.506.230,00	17.10.18
Monzo	Series E	$	108.525.092,00	31.10.18
TransferWise	Debt Financing	$	84.311.454,00	09.11.18
Banco Bilbao Vizcaya Argentaria	Post-IPO Debt	$	169.627.419,00	14.12.18
N26	Series D	$	300.000.000,00	09.01.19
Nutmeg	Series E	$	58.302.012,00	22.01.19
Lendify	Debt Financing	$	110.315.734,00	29.01.19
Raisin	Series D	$	114.000.000,00	05.02.19
Tink	Series D	$	63.649.961,00	06.02.19
OakNorth	Venture - Series Unknown	$	440.000.000,00	08.02.19
Starling Bank	Series C	$	96.413.420,00	13.02.19
iwoca	Debt Financing	$	168.005.541,00	18.02.19
GoCardless	Series E	$	75.000.000,00	18.02.19
Bynk	Venture - Series Unknown	$	54.439.359,00	19.02.19
Starling Bank	Grant	$	130.530.069,00	22.02.19
wefox	Series B	$	125.000.000,00	06.03.19
Pagantis	Series B	$	73.182.869,00	11.03.19

LendInvest	Debt Financing	$	261.221.760,00	08.04.19
Klarna	Private Equity	$	93.000.000,00	08.04.19
Checkout.com	Series A	$	230.000.000,00	02.05.19
Greensill Capital	Venture - Series Unknown	$	800.000.000,00	13.05.19
Pleo	Series B	$	56.000.000,00	14.05.19
TransferWise	Secondary Market	$	292.000.000,00	21.05.19
Fnality International	Series A	$	63.318.229,00	03.06.19
LendInvest	Debt Financing	$	327.421.555,00	10.06.19
Lendify	Debt Financing	$	159.308.761,00	10.06.19
Monzo	Series F	$	143.399.377,00	25.06.19
Soldo	Series B	$	61.000.000,00	08.07.19
LANDBAY	Debt Financing	$	1.233.649.932,00	08.07.19
Curve	Series B	$	55.000.000,00	15.07.19
SumUp	Debt Financing	$	369.992.488,00	16.07.19
N26	Series D	$	170.000.000,00	17.07.19
Atom Bank	Venture - Series Unknown	$	62.361.557,00	22.07.19
Klarna	Private Equity	$	460.000.000,00	06.08.19
LendInvest	Debt Financing	$	242.261.103,00	12.08.19
Spendesk	Series B	$	68.500.000,00	04.09.19
Sonovate	Venture - Series Unknown	$	135.803.642,00	09.09.19
Deposit Solutions	Venture - Series Unknown	$	55.226.345,00	19.09.19
Rapyd	Series C	$	100.000.000,00	01.10.19
Tide	Series B	$	74.010.023,00	06.10.19
Greensill Capital	Venture - Series Unknown	$	655.000.000,00	28.10.19
Pollinate Networks	Series A	$	77.631.212,00	31.10.19
Flender Peer-to-Peer Finance	Debt Financing	$	83.668.005,00	31.10.19
Hastee	Debt Financing	$	250.000.000,00	01.12.19
Zopa	Series H	$	167.860.845,00	01.12.19
Funding Circle	Post-IPO Debt	$	323.495.197,00	02.12.19
Setcoin Group	Private Equity	$	90.000.000,00	05.12.19
wefox	Series B	$	110.000.000,00	11.12.19
Tink	Venture - Series Unknown	$	99.868.506,00	20.01.20
Qonto	Series C	$	115.403.607,00	20.01.20
Currencycloud	Series E	$	80.000.000,00	27.01.20
Klarna	Corporate Round	$	200.000.000,00	29.01.20
Starling Bank	Venture - Series Unknown	$	77.496.851,00	10.02.20
Revolut	Series D	$	500.000.000,00	17.02.20
iwoca	Debt Financing	$	109.965.031,00	27.02.20
Tandem	Venture - Series Unknown	$	78.440.600,00	09.03.20
Onfido	Series D	$	100.000.000,00	15.04.20
Trade Republic	Series B	$	67.324.419,00	16.04.20
Bought By Many	Series C	$	97.566.439,00	04.05.20
N26	Series D	$	100.000.000,00	05.05.20
Monzo	Series G	$	75.500.758,00	16.06.20
Checkout.com	Series B	$	150.000.000,00	22.06.20
Solarisbank	Series C	$	67.407.020,00	30.06.20
Scalable Capital	Series D	$	57.823.723,00	22.07.20
Revolut	Series D	$	80.000.000,00	24.07.20
ComplyAdvantage	Series C	$	50.000.000,00	28.07.20
Thought Machine	Series B	$	125.000.000,00	28.07.20
TransferWise	Secondary Market	$	319.000.000,00	29.07.20
iwoca	Debt Financing	$	130.780.155,00	03.08.20
Fund Ourselves	Funding Round	$	96.500.000,00	03.08.20
Mollie	Series B	$	105.902.038,00	08.09.20
MarketFinance	Debt Financing	$	65.800.000,00	08.09.20
Factris	Debt Financing	$	59.122.620,00	10.09.20
Klarna	Private Equity	$	650.000.000,00	15.09.20
Bitpanda	Series A	$	52.000.000,00	29.09.20
October	Debt Financing	$	302.463.672,00	30.09.20
Molo	Series A	$	345.609.845,00	05.10.20
Lendify	Debt Financing	$	115.000.000,00	21.10.20
PrimaryBid	Series B	$	50.000.000,00	26.10.20
SaltPay	Venture - Series Unknown	$	149.632.852,00	13.11.20
Satispay	Series C	$	110.268.224,00	20.11.20
Tink	Venture - Series Unknown	$	102.975.757,00	11.12.20
GoCardless	Series F	$	95.000.000,00	17.12.20
Lydia	Series B	$	85.695.048,00	17.12.20
Liberis	Debt Financing	$	93.682.331,00	22.12.20

The Good, the Bad, and the Dynamic: Changes to Retail Business Models during COVID-19

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Abstract Crises, such as the COVID-19 pandemic, challenge the economy and require firms to become resilient to external change. During COVID-19, the retail industry faced double-edged consequences. While brick and mortar business models (BMs) were discontinued, online retail thrived. Extant BM research has investigated several crises; however, it still lacks an explanation of how BM change increases resilience to cope with crises. We analyze the BMs of 45 European retailers and the BM changes implemented during the COVID-19 pandemic and their influence on the retailers' revenue. We identify three types of retailers implementing different strategies to cope with the crises: the »good,« the »bad,« and the »dynamic.« These represent resilient BMs, un-resilient BMs, and BMs becoming resilient enabled by digital technology. We show how BM change creates resilience and performance benefits. For practice, we show how retailers adapted their BM to a crisis leveraging digital technology.

Keywords: Business model, resilience, COVID-19, innovation, retail.

1 Introduction

COVID-19 has had a severe impact on industries like tourism through the imposition of travel restrictions. In contrast, others, such as home entertainment and software, have benefitted immensely from people having to stay at home. One industry that has experienced various reactions to the crisis is retail. Especially, brick-and-mortar retailers have faced various governmental actions restricting their business operations. For example, retail was closed completely, opened with limited opening hours, or with limited customer capacity, excluding infected, untested, and unvaccinated customers. On the contrary, online retailers were thriving.

While a crisis can have detrimental effects on businesses, it also creates opportunities and potential for innovation (Chisholm-Burns, 2010). Innovation in a time of crisis is necessary for a firm's long-term survival and building resilience (Floetgen et al., 2021; Wenzel et al., 2020). One way of improving resilience and gaining a competitive advantage during a crisis is to adapt the business model (BM) (Ucaktürk et al., 2011).

The BM describes how a firm creates and captures value and impacts its performance (Zott & Amit, 2007). BM research provides insights into how a firm can cope with a crisis and sustain its performance. Extant BM research covers crises such as the dot-com bubble and the 2008 global financial crisis and several natural disasters. This research shows how differences in BMs within a focal industry affect financial performance during and after a crisis (Hryckiewicz & Kozłowski, 2017; Ritter & Pedersen, 2020). Additionally, BM change provides a gateway towards creating resilience and even securing a long-term competitive advantage (Ucaktürk et al., 2011; Wenzel et al., 2020).

However, BM research primarily analyzes individual case studies and lacks generalizability (Lambert & Davidson, 2013). Moreover, since the emergence of the BM concept, there have only been three major economic crises, which further limits our knowledge of BM change and its impact in times of crisis. Thus, research lacks an explanation and practical guidance about how BM change can improve a firm's resilience to crisis. Hence, we propose the following research question: *What are BM changes in retail to cope with COVID-19?*

We conduct a qualitative case survey analysis (Larsson, 1993), collecting a sample of 45 large, publicly listed European retailers. Based on publicly available data, we analyze their BM changes implemented during the pandemic and identify twelve BM changes, primarily based on digital technologies. We identify three types of retailers through qualitative comparison of these changes, their pre-COVID-19 BMs, and their financial performance during the pandemic. The three types allow us to derive successful resilience strategies that support trends in retail and thus will probably prove successful even after the pandemic. We contribute to research on BM resilience, BM change, and digital retail. We identify resilient and non-resilient BM patterns that cause firms to either cope well or not so well with the COVID-19 crisis. We also identify BM changes that improve retail firms' coping with the crisis. We show how retailers gain resilience through BM changes and suggest digitalization strategies for future success in digital transformation. For practice, we provide tangible BM changes and practical examples of which BM changes were implemented and proved to improve retailers' resilience and revenue performance successfully.

2 Theoretical background

2.1 Business models during economic crises

Changing BMs in times of crisis is a new line of research based on the continuing importance of BMs (Massa et al., 2017). The two global crises BM literature covers are the 2008 financial crisis and the dot-com crash of the early 2000s. However, during the COVID-19 pandemic, scholars have placed renewed attention on the role of BMs during crises (Breier et al., 2021; Ritter & Pedersen, 2020; Seetharaman, 2020). Crises create tense situations endangering various parts of society. However, they also present opportunities for innovation. For example, the car radio, the supermarket, and even the Monopoly board game were all invented during the great depression (Chisholm-Burns, 2010). More recent examples such as WhatsApp, Airbnb, and Uber were founded during the 2008 financial crisis. The rise of Internet firms and the parallel emergence of BM research (Amit & Zott, 2001) was followed in the early 2000s by the dot-com crash. This resulted in a backlash to the BM concept that saw its viability questioned and condemned firms for focusing solely on their online business and losing sight of their business as a whole (Porter, 2001). However, it also spawned increased research into the BM and its importance (Ritter & Pedersen, 2020). Roughly a decade later, government deregulation and consequent excessive risk-taking by banks led to a financial crisis that soon took on global economic proportions (Crotty, 2009). Relevant BM literature mainly focused on financial institutions, but it also generated research on BMs in general in times of crisis. The BM influences a firm's performance before, during, and after a crisis (Böttcher, Bootz, et al., 2021; Curi et al., 2015; Hryckiewicz & Kozłowski, 2017; Weking et al., 2019). Along with the focus on financial performance, BM resilience emerged. Research now concentrated on differences in BM resilience (Mora & Akhter, 2012) and the reasons for organizational resilience, such as management awareness (Ritter & Pedersen, 2020) and inter-firm partnerships (Birchall & Ketilson, 2009). On a BM level, customers favored low-cost offerings such as low-cost airlines (Štimac et al., 2012) during a crisis. Ultimately, the financial crisis in 2008 had such a severe impact on the airline BM that it can still be felt today. Consequently, BM innovation during a crisis is a source of resilience that can even produce a competitive advantage after the crisis (Ucaktürk et al., 2011). On the downside, the failure of firms to adapt their BMs during a crisis is one cause of bankruptcy (Beqiri, 2014). To innovate or adapt a BM, firms first need to understand their current BM (Böttcher & Weking, 2020; Chesbrough, 2007). From there, they can either innovate their BM to possibly even thrive during a crisis or decide to retrench parts of it to limit the negative repercussions (Ritter & Pedersen, 2020). For example, Uber's drivers faced low incomes, as transportation in lockdowns is seldomly required. Uber assisted them by adapting the BM from transporting people to transporting medicines and enhancing its food delivery BM (Scheepers & Bogie, 2020). In the hospitality industry, firms primarily rely on financial aid from the government. However, BM changes, such as delivery services or meal pick-ups, help to limit financial losses (Breier et al., 2021).

2.2 Business models in retail

Since the turn of the millennium, the rise of the Internet has ushered in retail's digital age. While, at first, the rise of online business resulted in the dot-com bubble, the digital age manifested itself in the declining importance of brick-and-mortar retail due to the inexorable rise in the importance of e-commerce. Frequently, retailers no longer serve as intermediaries but as multifaceted digital platforms (Sorescu et al., 2011). Due to the rapid pace of digital innovation, retailers now have to constantly adapt their BMs (Böttcher, Rickling, et al., 2021; Frew, 2017; Gavrila & de Lucas Ancillo, 2021). Multichannel retail, which consists of offline and online channels, has also developed alongside pure e-commerce (Kumar et al., 2019). This concept is currently being developed further into omnichannel retailing. Omnichannel retailing, too, is based on multiple sales channels, for example, brick-and-mortar stores, online stores, and digital applications (Brynjolfsson et al., 2013). However, in omnichannel retail, the different channels are seamlessly integrated and enhance each other rather than existing in parallel (Cao, 2014; Liao & Yang, 2020). The omnichannel BM aims to create a superior digital customer experience (Verhoef et al., 2009). A successful digital retail BM is enhanced by engaging with customers, for example, through social networks or websites, to support their experience even when not shopping (Grewal et al., 2017). In addition, digital BMs allow customer data to be collected, leveraging this data for personalized content or offers tailored to the customer and creating personalized experiences (Baecker et al., 2021; Böttcher, Li, et al., 2021). In summary, the retail industry is amidst a digital transformation. Moreover, being an industry that is significantly exposed to the kind of closures and social constraints caused by COVID-19, primarily offline retailers have faced constraints to their BM that they have had to address to survive the economic crisis.

3 Method

We conduct a case survey to obtain generalizable, cross-sectional insights from qualitative data (Larsson, 1993). We collected our case sample from Crunchbase. Crunchbase is a comprehensive firm database that includes financial ratios and descriptive attributes, as well as descriptions of organizations' value propositions. We have filtered based on three criteria. First, firms need to be assigned to the retail industry. Second, to ensure that the available data on financial performance was reliable, we only included publicly listed firms. Third, firms had to be headquartered in Europe to establish comparability across firms. The initial search resulted in 183 firms. According to our criteria, we excluded firms from this initial sample that were not retailers (n = 65), that did not provide sufficient (n = 23) or comparable financial information (n = 47), and that did not operate in Europe (n = 13). Eventually, our final case sample consisted of 45 firms, whose 2019 and 2020 were then collected from their annual reports.

To analyze the pre-COVID-19 BM, we coded their pre-COVID-19 BM using 19 retail-specific BM patterns by Remane et al. (2017). Following Böhm et al. (2017), we coded each firm according to whether it applied a pattern or not in its BM. For this coding, we used information collected from their websites and annual, semestrial, and quarterly reports published before March 2020. This resulted in binary vectors for each firm, that defines their pre-COVID-19 BM. To identify BM changes during COVID-19, we used the same sources, adding recent news articles and firm statements. We followed an inductive coding procedure to identify patterns of BM changes through open, axial, and selective coding (Strauss & Corbin, 1998). After coding which retailers implemented BM change, we qualitatively analyzed the pre-COVID 19 BMs, the BM changes, and revenue performance to identify patterns of retailers' actions and performance during the pandemic.

4 Results

4.1 Business model changes

In response to COVID-19, we found 265 individual BM changes, grouped into 12 BM changes presented in the following. On average, firms implemented 5 BM changes during COVID-19. Most common were home delivery (n = 20), click and collect (n = 19), omnichannel and social responsibility (both n = 18). Generally, most firms were found to be accelerating the process of digitalization, and a trend towards *omnichannel* was apparent. Omnichannel refers to the concept of reaching a customer on as many touchpoints as possible. It creates a seamless customer experience, in which the lines between the different channels are blurred. Many of the BM changes contribute to omnichannel retailing. However, due to COVID-19, efforts have been accelerated. For example, ICA Gruppen accelerated their online shop rollout and added such services as click and collect, and they also developed a mobile app.

Online channels have been on the rise since the inception of the Internet and following the creation of pure-play online retailers. The COVID-19 pandemic limited mobility and customers spent more time at home and ordering online. This has forced retailers to adapt or improve their online channels. For instance, Cafom, a home furnishings retailer, created dedicated websites for each of its stores to assist customers in obtaining information about store opening times, what products are available, and what services are provided. Others, such as M.Video, a consumer electronics retailer, added online shops to digital platforms, despite already having their online channels.

Click and collect refers to ordering products online and picking them up at the store in person. Due to COVID-19, click and collect has increased drastically. We observe deviations from the regular in-store collection by enabling pick-up independent of opening hours. For example, Axfood and X5 Retail Group, both grocer retailers, and M.Video offer order collection from locker storage. Similarly, Dunelm and Teknosa offer a drive-through click and collect service.

Home delivery is another example of a service that has been offered before but gained new attention during the pandemic. Retailers added delivery services to their BMs and lowered the usage barriers, such as minimum order value. Furthermore, subscription services, well known from digital services, were introduced to various retail BMs. For example, Carrefour created a weekly food box delivery subscription service. Others, such as Ahold Delhaize, ICA Gruppen, and Matas, a drugstore chain, offer premium customer subscriptions with unlimited free delivery and special promotional offers.

Express delivery fulfills customers' need to receive products immediately rather than wait a few days. In this sense, express delivery fulfills the same need as click and collect, where customers order online and receive products as fast as possible. For example, the X5 Retail Group created an express delivery platform to connect their store network and manage their orders for express delivery options. The express delivery options increase convenience and allow firms to differentiate from competitors.

During COVID-19, retailers increasingly invested in *app development* to offer additional convenience services and engage remotely with their customers. On the one side, firms, such as ICA Gruppen, developed apps for new BMs, such as the delivery of pre-cooked meals from professional cooks whose restaurants were closed. On the other side, they incorporated functions to engage with their customers digitally. For example, M.Video added a video call function to their app to enable customers to call consultants in-store for assistance in online shopping.

New payment services support *new digital services by retailers*. While contactless payment was already well underway, COVID-19 increased the need for contactless or other payment options, such as self-checkouts. Magnit and Ozon have even developed their payment services enabling cashback on purchases. This aims to retain customers, collect customer data, and encourage repeat purchases.

By introducing *virtual shopping experiences* (VSEs), retailers have implemented new digital formats to present their products to customers. Carrefour and Axfood piloted voice-controlled shopping using intelligent home assistants, such as Google Nest. Magnit offers customers digital tours of their stores, while Dunelm offers one-on-one shopping with sales assistants present in a store using video calls. Hugo Boss, a luxury clothing brand, used TikTok to create challenges and even revealed their newest collection in a live stream on the video platform.

Social responsibility refers to a firm's involvement in supporting local communities. COVID-19 hit small firms particularly hard, as they often do not possess the resources and capabilities to implement digital BMs. Larger retailers have, in many cases, taken the responsibility to support small local firms. For example, Ahold Delhaize and Axfood started buying from local producers who generally sold to restaurants, whose demand plummeted due to restrictions. Online retailers, like Cnova, offered product placements for free and Ozon offered their digital knowledge to support small firms to create a digital presence.

Partnerships played a critical role due to the urgency of implementing these changes. Partnerships with specialists, such as delivery services like Deliveroo or Uber Eats, and even taxis or technology providers fastened the implementation, especially when the retailers did not possess the required capabilities before. For example, Carrefour partnered with a SaaS startup focusing on grocery retail to implement their express delivery service. They also partnered with a live-streaming platform to implement their VSEs. Partnerships also enabled the implementation of the aforementioned express delivery.

Of course, not all retailers implemented the changes mentioned above. Most pure online retailers were able to continue their *business as usual.* Also, following a cost leadership strategy, low-cost retailers continued the BM successfully, as customers favored cheap products. Finally, some retailers had retrenched parts of their business. Retailers in *retrenchment* had to close stores, cut down on staff, and negotiate rent with their landlords to manage expenditures. For example, Hugo Boss and Geox had to postpone future investments in new stores and launch new collections.

4.2 The good, the bad, and the dynamic

Changes in revenue range from an increase of +81.60% (e.g., Farfetch, a luxury fashion retail platform) to a decrease of -63.37% (e.g., Dufry, a duty-free retailer operating in airports, on cruise ships, etc.). The Shapiro-Wilk normality test reveals a normal distribution of the revenue change data ($p > 0.05$). To analyze the differences in revenue change among our case sample, we divide the sample into three subsets, comprising retailers who can continue their business as usual ($n = 11$), retailers who have to retrench their operations ($n = 12$), and all the others, i.e., those who are trying to manage the pandemic by implementing various BM changes ($n = 22$). The »*good*« retailers continued their business-as-usual. Their average revenue increase amounted to +36.92%. Thus, in relation to their peers, they profit from the pandemic. As they do not change their BM, apart from adding some functionality to previously existing online channels, the source of their good financial performance is their pre-COVID-19 BM, usually pure online or low-cost BMs. The »*bad*« retailers had to retrench parts of their BMs. Their average revenue increase amounted to -35.29%. While the retailers in this subsample tried to adapt their BM to cope with the pandemic, primarily focusing on online channels to implement an omnichannel BM, we observe no overall pattern in their responses. However, we do observe two patterns in their pre-COVID-19 BMs. First, high-quality retailers focusing on superior customer experiences in their stores failed to transfer these experiences into an online environment during lockdowns and store closings. Second, franchise retailers who frequently build on customer loyalty lost major revenue. The »*dynamic*« retailers changed their BM to manage the crisis successfully. They show a higher average revenue change (+ 7.66%) and slightly higher median (+ 5.84%) than the overall sample. Regarding their pre-COVID-19 BM, these firms build on customer loyalty and customer relationship management. In contrast to the »*bad*« sample, »*dynamic*« retailers supported their customer engagement through BM changes by leveraging new mobile apps, new payment services, and express delivery. They also build new digital relationships with their customers. Due to their satisfactory financial performance, they could also engage in social activities to engage in social responsibility activities.

5 Discussion

Due to COVID-19, research and practice increasingly discussed how firms could become more resilient to major and minor environmental changes. The BM is shown to be an influencing factor for firm performance (Böttcher, Al Attrach, et al., 2021; Böttcher, Bootz, et al., 2021; Weking et al., 2019). BM changes are a relevant source of innovation and, if implemented by competitors, can create significant changes in the competitive environment of a focal firm (Böttcher, Phi, et al., 2021; Böttcher & Weking, 2020). Thus, the BM can be a source of disruption and increase firms' resilience. Retail has been affected particularly strongly by social restrictions due to COVID-19. Therefore, we analyze the BMs before, and BM changes implemented during COVID-19 of 45 European retailers and compare the revenue performance of these firms.

We identify twelve patterns of BM changes and three types of retailers, the »*good*,« the »*bad*,« and the »*dynamic*,« with different performance outcomes demonstrating different types of resilience. The »*good*« retailers performed exceptionally well during the pandemic, grounding their performance in their pre-COVID-19 BM. The e-commerce and low-cost retailer patterns thrive in the current situation. While their offline competitors were forced to close their stores, e-commerce retailers profited from the fact that people stayed at home and ordered online, which reduced competition from the offline world. On the other hand, the economic crisis led to decreased consumer confidence. Economic uncertainty, reduced income, and the increasing threat of job loss led to increased price sensitivity. Thus, retailers employing the low-cost pattern benefited from the pandemic. Compared to the pre-COVID-19 period, the »*bad*« retailers lose revenue. On the one hand, these are premium retailers offering superior customer experiences in their stores. However, they could not transfer this experience to the online world when stores had to close. Additionally, customers avoided making any expensive investments due to the aforementioned economic uncertainty. On the other hand, we observe that franchise retailers suffer in the crisis. Such franchise stores are often located in highly frequented places, such as malls or city centers. During the COVID-19 lockdowns, malls were closed, and people avoided potentially crowded places. Additionally, the headquarters had no direct influence on franchise stores through the franchise organization. Thus, it was up to the franchisees to respond to the crisis by changing their BM (e.g., offering click and collect), making a unitary response difficult. In comparison, we observe resilient BMs on the one hand and non-resilient BMs on the other hand. The COVID-19 pandemic, societal lockdowns, and significant economic downturn reveal how resilient a BM is. Such BM resilience is crucial to whether a firm can survive or even thrive in times of crisis. In addition to BM resilience, our results also show another form of resilience. The »*dynamic*« retailers demonstrate the opportunities of BM change in response to the pandemic. Retailers leveraged digital technology, such as mobile apps or new digital payment services. They also built up resilience based on customer relationships. Using mobile apps, VSEs, online channels, etc., these retailers began to engage more with their customers. As the customers' needs shifted in the pandemic, dynamic retailers changed their BM. For example, customers started buying building materials from hardware stores. Using apps and video calls, hardware stores could assist and advise their customers. The implemented changes support the overall trend in retail towards omnichannel BMs (Keiningham et al., 2020; Sorescu et al., 2011). The BM changes we observe during COVID-19 are necessary to their future survival (Bell et al., 2014). Now, as customers have experienced how the integration of online and offline can work, these BMs will become the norm rather than temporary (Breier et al., 2021; Seetharaman, 2020).

5.1 Contributions to research and practice

This paper shows how a BM influences how firms cope with the COVID-19 crisis. We also show how a change to the BM helps firms build resilience. Hence, this paper contributes to research on BMs, especially BM change and BM resilience. First, we show how retailers changed their BM during the COVID-19 pandemic and gained resilience. As the pre-COVID-19 BMs could not be continued during the pandemic, retailers needed to adapt. In this respect, we contribute to the scant research on BMs during economic crises (Ritter & Pedersen, 2020). Second, we contribute to the emerging stream of research on BM resilience (Niemimaa et al., 2019) and performance implications of BMs (Spiegel et al., 2016). We show resilient BMs that outperform others (the »*good*«) and point out BMs that are particularly prone to underperform (the »*bad*«). The BM changes improve and especially digitalize the customer experience to create BM resilience and improve performance, highlighting the importance of the digital transformation in retail. We show how retailers leverage BM change and digital technology to enable them to evolve towards omnichannel BMs by seamlessly integrating online and offline channels (Brynjolfsson et al., 2013; Hansen & Sia, 2015). Omnichannel BMs and digital customer experience are set to be the new normal, and the COVID-19 pandemic is only accelerating this development.

5.2 Limitations and future research

There are some limitations to this research. First, our analysis is limited to European and publicly listed retailers. While our case sample provides a cross-section of retailers covering different areas from groceries to luxury fashion, it is limited to large firms. Small or medium-sized retailers with limited resources may adapt their BMs differently. Second, we did not account for long-term developments that began before the onset of COVID-19. Third, our research relies on publicly available information reported by the firms and relevant news outlets. Therefore, we may not have captured all the details of the BM changes. Future research can build on our findings to analyze the long-term effects of BM changes implemented during the pandemic. The BM changes leading to superior short-term performance identified in this paper primarily improve the customer experience by creating digital experiences for customers, supporting extant research. Future research can verify whether the BM changes identified to improve the digital customer experience are substantial and whether they also lead to improved business performance in the long term. This could provide further insights into the claims that COVID-19 served as a catalysator for digital transformation, forcing even reluctant firms and industries to engage in digital transformation initiatives.

6 Conclusion

In this paper, we analyze the BMs of 45 European retailers and changes to BMs and performance during the COVID-19 pandemic. We find two types of resilient BMs and two types of non-resilient BMs. In addition, retailers that use digital technologies to affect BM's chance of connecting with their customers in difficult times are coping better than others.

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