Dec 14th, 12:00 AM

The Impact of Digital Transformation on Incumbent Firms: An Analysis of Changes, Challenges, and Responses at the Business Model Level

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Completed Research Paper

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Abstract

The digital transformation has become a key concern for incumbent firms in traditional industries. However, the impact of digital transformation on the business model of such firms has been insufficiently investigated so far. Particularly, existing research lacks a cross-industry overview of the impact of digital transformation on the overall business model of incumbent firms in traditional industries, including detailed elaborated dimensions and characteristics of this impact. This paper aims to address this specific research gap by analyzing the impact of digital transformation, which we conceptualize as changes, challenges, and responses, on each business model element of incumbent firms in traditional industries. By conducting in-depth multiple case study research in incumbent firms across four major traditional industries, we contribute to the literature of digital transformation by providing new insights on changes within the business model, resulting challenges, as well as potential organizational responses on how to react to these challenges.

Keywords: Digital Transformation, Incumbent Firms, Business Model Change, Case Study Research, Qualitative Research

Introduction

The phenomenon of digital transformation remains one of the most relevant topics for both researchers and practitioners alike. Digital transformation can be described as "*the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes*" (Hess et al. 2016). The central message of this and other definitions is that digital transformation is triggered by digital technologies and comprises of major changes within the business model of firms (e.g., Fitzgerald et al. 2013; Matt et al. 2015; Hess et al. 2016). Especially for incumbent firms, which we define as firms, that (1) are positioned in a traditional industry, (2) were established before the digital revolution, and (3) whose business models were not originally based on the use of digital technologies, these changes are needed to compete in an increasingly digitalized world. Traditional industries thereby can be defined as industries, whose focus is mainly on producing and selling physical goods. Without undergoing changes through digital transformation, these firms would lose market share to new firms with business models based on the use of digital technologies entering traditional industries. It is not uncommon that such firms can better adapt to fast-moving market conditions and changing customer needs (Sebastian et al. 2017). However, even though significant changes are needed to improve the business and subsequently to compete in a digitalized world, these changes encompass major

challenges for incumbent firms, including the need to exploit existing capabilities while also explore new (digital) capabilities and the adaption of these new capabilities to the firm's existing infrastructure (Gregory et al. 2014; Svahn et al. 2017). Furthermore, incumbent firms in traditional industries are particularly strong affected by digitalization challenges as their core products usually cannot be completely digitized (Hanelt et al. 2015). Consequently, executives of incumbent firms need to drive changes within their existing business models, while also being prepared to find ways to react on resulting challenges.

Prior research has started discussing digital transformation in relation to business models; however, its scope is limited to specific business model elements or to specific industries (e.g., Lucas et al. 2013; Barrett et al. 2015; Hansen and Sia 2015; Piccinini et al. 2015). Most existing literature primarily focus on customer- and product-centric elements of the business model. For example, Barret et al. (2015) have found that digital technologies enable the creation of new value propositions that rely increasingly on the provision of services. Additionally, firms use digital technologies to augment the sales of physical products with the sales of services or even replace physical products by services (e.g., Porter and Heppelmann 2014). Other researchers, like Hansen and Sia (2015), focus on marketing and sales channels and show that firms use digital technologies to digitize their distribution and sales channels. However, because the different elements of a business model are interrelated and therefore cannot be examined in isolation, the impact of digital transformation should be additionally investigated on the overall business model.

Additionally, there is a lack of clarity regarding the impact of digital transformation on incumbent firm's business models. In existing literature, this impact is mainly associated with changes through the use of digital technologies (e.g., Agarwal et al. 2010; Majchrzak et al. 2016). However, it is not clear whether the impact of digital transformation is not even more far-reaching. In this context, by analyzing extant definitions of digital transformation, Vial (2019) show that the bulk of literature conflates the concept of digital transformation and its impact. Furthermore, he found that digital transformation primarily has an impact on a firm's organizational level. This is reflected in operational efficiency (i.e., automation and improvement of process performance as well as costs savings) and organizational performance (e.g., innovativeness, financial performance and competitive advantage). However, while the author gives insights on the impact of digital transformation on an overall firm-level, it remains unclear how this impact can be conceptualized at the business model level and how it differs regarding the specific business model elements of incumbent firms.

Overall, there is a lack of a comprehensive and cross-industry overview of the impact of digital transformation on the overall business model of incumbent firms, including detailed elaborated dimensions and characteristics of this impact. This paper aims to address this specific research gap by analyzing the impact of digital transformation, which we conceptualize as changes, challenges, and responses, on each business model element of incumbent firms in traditional industries. Therefore, the underlying research question is as follows: *How does digital transformation impact the overall business model of incumbent firms in traditional industries?* In order to answer this research question, we conducted an exploratory case study based on the guidelines of Yin (2014). In our data collection, we conducted in-depth semi-structured expert interviews with senior management executives of incumbent firms of four different traditional industries: (1) automotive, (2) pharmaceutics, (3) industrial products, and (4) consumer & retail. In addition, to get a more comprehensive overview, we conducted further interviews with consultants and partners of a major international consulting firm who have longstanding experiences within the relevant industries. Since existing research already indicates that digital transformation primarily comprises changes within a firm's business model (e.g., Hess et al. 2016), the business model concept provides a solid basis for exploring the impact of digital transformation on incumbent firms and therefore serves as the main theoretical lens for the subsequent data analysis. In this context, the business model canvas, introduced by Osterwalder and Pigneur (2010), is considered to be a well-accepted and detailed description of a firm's business model. The results of our study provide new insights on changes, challenges, and responses regarding the digital transformation of incumbent firms at the business model level.

In order to provide sound theoretical foundations and to gain valuable insights regarding our research question, this paper is structured as follows. Starting with the theoretical foundations, we introduce digital transformation and business models as the main concepts of our paper. Secondly, we introduce the methodological foundation of the conducted case study. Thirdly, we present findings of the case study. Fourthly, in the context of a discussion, limitations of our study and implications for research and practice are presented. Finally, the conclusion summarizes the most important findings.

Theoretical Foundations

Digital Transformation of Incumbent Firms in Traditional Industries

The rapid pace of development in information technology (IT) has significantly shaped the turbulent economic environment and societal disruptions we face today. In the last decade, we saw the advent of so-called digital technologies, which had a severe impact on the way we live, and the way business is done across various industries (Hess et al. 2016; Nambisan et al. 2017). Digital technologies can be conceptualized as technologies that combine information, computing, communication and connectivity technologies (Bharadwaj et al. 2013). More specifically, digital technologies can be characterized by using the acronym SMACIT, which refers to social, mobile, analytics, cloud computing, and internet of things (IoT) (Sebastian et al. 2017). Other technologies, such as artificial intelligence, blockchain, robotics, and virtual reality are also implied when referring to SMACIT (Sebastian et al. 2017). Previous research has shown that digital technologies have the potential to enable the development of new products, services, or even business models (Yoo et al. 2012; Fichman et al. 2014; Lyytinen et al. 2016).

The use of digital technologies to enable major business improvements (such as enhancing customer experience, streamlining operations, or creating new business models) can be described as digital transformation (Fitzgerald et al. 2013). Digital transformation is a relatively new concept in IS research and its implications for firms reach far beyond process automation and resource digitization. Rather, it has the potential to (re)define a firms' value propositions(s) and to change its whole identity (Wessel et al. 2020). Therefore, digital transformation can be seen as an evolution of the concept of IT-enabled transformation, which deals with the use of digital technologies to support already existing value propositions and to reinforce a firms' existing identity (Vial 2019; Wessel et al. 2020). Existing research on digital transformation has dealt with novel strategic concepts, especially Digital Business Strategy (DBS) and Digital Transformation Strategy (DTS). Whereas a DBS can be defined as an organizational strategy that aims to create differential value by leveraging digital resources (Bharadwaj et al. 2013), a DTS represents the central concept to coordinate, prioritize, and implement the process of digital transformation within a firm, leading to a desired future state of being digitally transformed (Matt et al. 2015). Other research on digital transformation, which did not primarily focus on such strategic concepts, has been done under a variety of homonymous labels including digitization, digitalization, and DT (Muehlberger et al. 2019).

Especially in incumbent firms across traditional industries, the digital transformation has become a high-level strategic goal on the agendas of executives (Fitzgerald et al. 2013; Hess et al. 2016; Sebastian et al. 2017; Svahn et al. 2017). For a general understanding, in this paper we define incumbent firms as firms, that (1) are positioned in a traditional industry, (2) were established before the digital revolution, and (3) whose business models were not originally based on the use of digital technologies. Traditional industries thereby can be defined as industries, whose focus is mainly on producing and selling physical goods. For incumbent firms in such industries, the advent of digital technologies is not only an opportunity to bring about positive changes to improve the business, but they also pose major challenges. A major challenge of such firms is the fact that their business models are typically based on physical goods that usually cannot be completely digitized (Hanelt et al. 2015). Another challenging endeavor is the emergence of new firms with business models based on the use of digital technologies that enter traditional industries and claim part of the market share (Veit et al. 2014). It is not uncommon that these firms can better adapt to fast-moving market conditions and changing customer needs (Sebastian et al. 2017). To be able to compete in an increasingly digitalized world, it is essential for incumbent firms to undergo a digital transformation. To successfully digital transform their firms, executives need to consider the potential of digital technologies and how they can bring about positive changes in the processes, organizational structures, and business model of a firm (Hess et al. 2016). However, although changes through digital transformation are essential to compete in a digitalized world, executives at the same time have to consider that related changes encompass major challenges, including the need to exploit existing capabilities while also exploring new (digital) capabilities and adapting these new capabilities to the firm's existing infrastructure (Svahn et al. 2017). In this regard, the development of ambidextrous capabilities to address contrasting demands and resolve paradoxical tensions is essential (Gregory et al. 2014). An additional complicating factor is the asset-heaviness of most incumbent firms' business models and the typically high number of established employees (Zhang et al. 2018). Overall, executives of incumbent firms must drive change, while at the same time they need to resolve potential challenges by finding appropriate organizational responses.

Business Models

Since the early 2000s, research on business models gained an increasing popularity across various disciplines, including information systems, entrepreneurship, innovation management, and technology management (e.g., Johnson et al. 2008; Zott et al. 2011; Veit et al. 2014). There exist many different approaches for defining the business model concept. In this paper, we refer to the definition of Osterwalder and Pigneur (2010), who define a business model as a blueprint that describes the basic principles of how an organization creates value and how this value is transferred to stakeholders (e.g., customers, the focal firms, partners). Therefore, the business model concept can be seen as a link between business strategy and business operations. Consequently, the business model concept is an important tool in supporting strategic choices of an organization (Parry et al. 2014; Myrthianos et al. 2014). The definition of Osterwalder and Pigneur (2010) is largely consistent with the definitions provided by other researchers, who also refer to the value-creation functions, delivery functions, and capturing functions of a business model (e.g., Chesbrough and Rosenbloom 2002; Shafer et al. 2005; Zott et al. 2011). Besides many different approaches to define a business model, there are also various approaches to define the individual elements of a business model. For example, Hamel (2000) defines the components of a business model as core strategy, strategic resources, customer interface, and value network. More recently, Osterwalder and Pigneur (2010) introduced the so-called business model canvas, which is independent of industry affiliation and describes the business model of a firm as a combination of four business model pillars, comprising nine elements: (1) value propositions (value propositions of products/services), (2) customer interface (customer relationships, customer segments, channels), (3) infrastructure management (key activities, key resources, key partners), and (4) financial aspects (cost structure, revenue streams). In recent years, the business model canvas has gained increasing attention from both researchers and practitioners alike.

By representing an essential "tool of alignment" to bring together the business strategy of a firm and the operationalization of this strategy, the business model concept is of great importance for research focusing on digital transformation (Al-Debei and Avison 2010). Consequently, researchers already anticipate "the beginning of an academic era in which business models form the central unit of analysis" (Veit et al. 2014). According to various definitions, the digital transformation of a firm is associated with changes in the existing business model of firms or the creation of completely new business models (e.g., Fitzgerald et al. 2013; Piccinini et al. 2015; Hess et al. 2016). By covering the many different aspects that describe the basic functioning of a firm's business in a holistic manner, and typically being independent of industry affiliation, the business model concept provides a solid basis for exploring the impact of digital transformation on incumbent firms across traditional industries in a holistic manner.

Recent literature already shed light on specific changes digital technologies cause in selected elements of the business model of incumbent firms. For example, digital technologies cause changes within customer expectations and demands. In order to remain competitive, firms need to be responsive to supplement or reevaluate their traditional value propositions (e.g., Weill and Woerner 2013; Aversa et al. 2017). Digital technologies also cause a shift regarding the expectations of employees and other interest groups of a firm, which requires significant change within a firm's infrastructure (e.g., Strohmeier 2014; Singh and Dangmei 2016). In general, to gain business benefits from digital technologies and to compete in a digitalized world, firms should rethink every aspect of their traditional business model and must therefore drive change as needed (Westerman et al. 2014; Loonam et al. 2018). Executives across all industries should be prepared to reinvent their business model(s) as needed. According to Westerman et al. (2014), on a firm-level, three main reasons exist to reinvent the traditional business model. First, by reinventing their business model, firms have the opportunity to reorganize value chains and improve their competitive position. Second, firms can create a unique selling proposition. And third, due to ever-emerging new digital technologies, which lead to opportunities and threats, firms of all industries must rethink the way they do business continuously. However, despite these suggestions, Westerman et al. (2014) found that most firms remain with their traditional business model without launching new businesses. Mainly, because they consider it too risky. Thus, firms favor existing models with higher gross margins in order to not threaten the profitability of established business models. However, from a long-term perspective, it seems risky to ignore the potential of new, digitalized business models, because, by trying to protect the status quo, executives hinder experimentation with innovative business model archetypes (Warner and Wäger 2019). Overall, existing literature shows that a major barrier for incumbent firms is the challenge of balancing new learning with existing performance (Itami and Nishino 2010).

Whereas prior research has already started discussing the impact of digital transformation in relation to business models, the focus has mainly been on specific business model elements or specific industries (e.g., Lucas et al. 2013; Barret et al. 2015; Hansen and Sia 2015). However, because the different elements of a business model interrelate and therefore cannot be examined in isolation from each other, it is more appropriate to investigate the impact of digital transformation on the overall business model of a firm. Additionally, a clear conceptualization of the impact of digital transformation on incumbent firm's business models is missing. With this study, we approach these research gaps by providing new insights on the impact of digital transformation on the overall business model of incumbent firms in traditional industries, including detailed elaborated dimensions and characteristics of this impact.

Methodology

To answer the underlying research question, we conducted an exploratory case study. The case study as a research method was chosen because this study deals with a contemporary phenomenon in a real-life context where control over behavioral events is not required (Yin 2014). Furthermore, since the addressed phenomenon is complex and relatively new, we formulated an exploratory "how" research question, which also justifies a case study as an appropriate research method (Yin 2014).

Case Study Setting

Given the investigative nature of this research, we chose a multiple case study design (Yin 2014). The use of a multiple case study was motivated by (i) the possibility to strengthen our findings in light of replication logic (Eisenhardt 1989; Yin 2014), and (ii) the awareness that evidence from multiple cases can lead to more robust conclusions by being more compelling (Herriot and Firestone 1983). As the aim of this research is to get a cross-industry overview of the impact of digital transformation on the individual business model elements of incumbent firms in traditional industries, we decided to conduct the case study within four different industries: (1) automotive, (2) pharmaceutics, (3) industrial products, and (4) consumer & retail. The reason for choosing these industries was that all of them meet our definition of traditional industries, whose focus is mainly on producing and selling physical goods and therefore are strongly affected by digitalization issues. Furthermore, discussions with industry experts and further investigations as part of our pre-study have shown that these industries are particularly well suited to observe the impact of digital transformation on the business model of incumbent firms. Finally, these industries play a major role in the European economy.

Once the industries were defined, we decided to choose at least two firms for each industry as the main units of analysis. This allowed us to validate insights and to perform cross-firm comparisons. We chose the specific firms based on our definition of incumbent firms, i.e., they are all firms that (1) are positioned in a traditional industry, (2) were established before the digital revolution, and (3) whose business models were not originally based on the use of digital technologies. Furthermore, potential firms had to be in the process of digital transformation. The decision to choose the specific firms and industries was additionally discussed with domain experts of a major international management consulting firm as part of our pre-study. The following Table 1 gives a comprehensive overview of the selected firms, which all matched our requirements.

Business	Industry Sector	Field of Activity	Age	Revenue in €
B1	Automotive	Automotive Manufacturer	>80 yrs.	>200 bn.
B2		Automotive Supplier	>140 yrs.	>40 bn.
B3	Pharmaceutics	Pharmaceutical Manufacturer	>180 yrs.	>7 bn.
B4		Pharmaceutical Manufacturer	>130 yrs.	>16 bn.
B5		Pharmaceutical Manufacturer	>350 yrs.	>15 bn.
B6	Industrial Products	Manufacturer of Chemicals	>150 yrs.	>60 bn.
B7		Building Material Manufacturer	>70 yrs.	>0,5bn.
B8	Consumer & Retail	Consumer Goods Manufacturer	>140 yrs.	>20 bn.
B9		Consumer Goods Wholesaler	>50 yrs.	>20 bn.
B10		Apparel Wholesaler	>50 yrs.	>5 bn.

Table 1. Overview of Selected Firms and Industries

As illustrated in Table 1, we selected a total of ten firms, with an average age of more than 100 years and a minimum age of 50 years. The average revenue of the firms is more than 10 billion Euro per year, which justifies the economic relevance of these firms. All firms have their headquarters in Europe.

For each firm, we conducted an interview with a purposefully selected participant. All participants were selected based on their expertise and experience regarding digitalization activities within their respective firms. All of the selected participants were senior management executives with a comprehensive overview of digital transformation activities within the specific firms (e.g., Chief Information Officer (CIO) or Chief Digital Officer (CDO), or management executives in similar positions), since they are key people in the management of digital transformation in their firms.

Moreover, to deepen the industry-specific insights of the senior management executives of the selected firms and to gain further industry-specific information, we additionally conducted interviews with six senior consultants (or partners) of a major international management consulting firm who advise companies of at least one of the four examined industries. For each industry, we conducted interviews with at least one senior consultant (or partner). These senior consultants (or partners) are characterized by the fact that they advise several firms of the examined industries regarding their digital transformation activities. Following a replication logic, this multiple-case design with multiple units of analysis was chosen to generate comprehensive results regarding the underlying research question. The multiple case-design allows us comparisons and cross-case analyses and helps to broaden empirical evidence (Yin 2014). Furthermore, the evidence from a multiple case-design can be considered as more compelling, which makes the overall study more robust (Herriot and Firestone 1983).

Data Collection

The data collection method was in-depth semi-structured expert interviews conducted in 2019. We chose expert interviews as the main data source because an interview focuses directly on the specific case study topic. Furthermore, interviews are an insightful data source, as they provide detailed explanations as well as personal views (Yin 2014). The semi-structured approach was chosen to receive answers to selected predetermined questions and to clarify the reasons behind these answers. Furthermore, in a semi-structured interview, participants may more easily discuss sensitive issues like strategic mechanisms (Yin 2014). Data collection involved a total of 16 interviews with purposefully selected participants. The allocation of the specific interview partners to the four industries, as well as the position of the interview partners, can be obtained from Table 2. The second column indicates whether it is a firm-expert (B1-B10) or a consulting-expert (C1-C6).

Industry Sector	Business (B) / Consulting (C)	Position of interviewed Person	Duration in min.
Automotive	B1	Head of Digitalization	90
	B2	Head of Innovation & Digitalization	30
	C1	Manager	100
	C2	Senior Associate	120
Pharmaceutics	B3	Chief Information Officer	60
	B4	Chief Information Officer	80
	B5	Head of Digital Products	120
	C3	Partner	180
Industrial Products	B6	Head of Digitalization and Ecosystems	80
	B7	Manager, Strategy- and Product Management	95
	C4	Senior Partner	45
	C5	Senior Manager	90
Consumer & Retail *(Short Form: Retail)*	B8	Chief Digital Officer	110
	B9	Chief Information Officer	70
	B10	Head of Investor Relations	70
	C6	Partner	110

Table 2. Overview of Conducted Expert Interviews

A semi-structured interview questionnaire was designed based on the research objective. During the interviews, the participants were asked to provide their background information and an overview of their specific definition of digital transformation. After this, the interviews focused on the impact of digital transformation on each element of the business model canvas within the specific firms and industries the participants relate to. All questions were selected based on a review of relevant literature and background discussions with knowledgeable parties. The interviews were held informally face-to-face and by videoconference and averaged a duration of 60-90 minutes, with a total time of 1450 minutes. All interviews were digitally recorded and transcribed. All participants received a transcript of the interview and were asked to review the specific transcript and to add appropriate comments. Afterwards, the transcripts were uploaded to the qualitative data analysis software MAXQDA to facilitate content analysis. In addition, to minimize potential inaccuracy biases due to poor recall, after each interview, we made further investigations regarding interesting statements of the participants. For this purpose, we analyzed additional documents provided by the interview partners. However, this procedure only served as an informational enrichment of statements already made within the interviews.

Data Analysis

Content analysis was used to analyze the sample of interview transcripts. Already introduced in the theoretical background, the business model canvas (Osterwalder and Pigneur 2010) served as the foundation for data analysis, as it provides a well-accepted, comprehensive, and industry-unspecific description of a firm's business model. Hence, a deductive approach of qualitative content analysis was chosen, where a category system (i.e., the elements of the business model canvas) has been deduced from a theoretical basis (Kaiser 2014). After that, a coding scheme was developed, which represents this category system. The category system has been continually adjusted during the research process. The data analysis was conducted in two major steps. First, the impact of digital transformation on each element of the business model was coded separately for each industry (i.e., case). For each interview within an industry, we coded every statement that refers to the impact of digital transformation and assigned it to one or more affected business model element(s). This has shown us how firms within each industry are affected by digital transformation. In this process, changes, challenges, and responses have emerged as sub-categories. In order to get a cross-industry overview and to strengthen our findings in light of replication logic, within the second step, the results of each industry were compared to those of the other industries. Due to great overlaps within the results, we saw the high potential of generalization across the cases. Therefore, our main findings represent cross-industry phenomena occurring in several industries. Using a dual coder approach, the first researcher coded all transcripts. Afterwards, another researcher verified the codes of the first researcher by checking transcripts and codes. This has ensured that the context and codes are related. To finalize the names of the specific codes, a discussion between the researchers took place.

To assess the rigor of case studies, commonly four criteria are used: construct validity, internal validity, external validity, and reliability (e.g., Campbell 1975; Yin 2014). To ensure construct validity, we used multiple interview partners of multiple firms for each industry within the data collection process. In addition, the data analysis was conducted by a team of researchers, as already mentioned before. During the phase of data analysis, we used pattern-matching and explanation-building to validate the causal relationships and inferences in the conclusions and thus ensuring internal validity (Yin 2014). Testing the results by replicating the findings in various firms for each industry, where the theory has specified that the same results should occur, strengthened external validity. Finally, to ensure reliability within our case study, we used case study protocol and developed a case study database.

Findings

The following Tables 3 - 6 illustrate the findings of our case study. We conceptualize the impact of digital transformation on the individual business model elements of incumbent firms as (1) changes, (2) challenges, and (3) responses. The following findings are divided into (a) value propositions, (b) customer interface, (c) infrastructure management, and (d) financial aspects, which represent the pillars of the business model canvas (Osterwalder and Pigneur 2010). The content of the tables summarizes our findings, which were generalized from insights gained from several interviews across several industries. The results therefore represent cross-industry phenomena. Additionally, the most relevant cross-industry results, as well as outstanding industry-specific findings, are described in more detail below the specific tables.

Value Propositions

The major changes, challenges, and responses regarding the value propositions of incumbent firms can be obtained from Table 3.

BM Element	Changes	Challenges	Responses
Value Propositions	Digital enrichment of products	Pricing of additional value	Higher price or customer data as contribution
		Lack of customer education	Incentivization of retailers
	Service transformation	Uncertain future value proposition	Clear definition of future value proposition
	Increasing Individualization	Need for changes in production processes	Use of appropriate technologies
		Problematic data situation	

Table 3. Changes, Challenges, and Responses regarding the Value Propositions

A major change regarding the value propositions of incumbent firms is ***the digital enrichment of existing physical products***. The enrichment of existing physical products with digital technologies, like mobile or cloud components, or additional digital services improves the customer benefit and can help to build a closer relationship with customers or even to obtain product-specific or customer-specific data (e.g., Automotive: B1). The integration of digital technologies enables new usage possibilities and features (e.g., Automotive: B1; Pharmaceutics: B3; Industrial Products: B6; Retail: B8). For example, cars are increasingly enriched by digital services, like connectivity- and entertainment applications (Automotive: B1). Additionally, in combination with data gathering, integrated digital technologies can ensure the long-term proper functioning of a product, e.g., through predictive maintenance applications (e.g., Automotive: B2; Industrial Products: B7). Furthermore, also data have the potential to form a new intellectual property (IP), which becomes part of the product (Pharmaceutics: C3). For most executives, it is especially challenging to price this additional value (e.g., Automotive: B1). Widespread are the approaches to offer the additional value for free (respectively to gather customer data as an exchange) (Industrial Products: B7; Retail: B9) or to charge the additional value which raises the price (e.g., Automotive B1; Automotive B2). However, across all firms and industries of the sample, no clear solution could be provided. Another challenge concerns the customer education. Especially in industries with a complex distribution system, like the automotive industry, the customers often did not even know anything about the additional value and functionalities. To address this issue, executives consider incentivization strategies for retailers (Automotive: B1).

Across some industries, changed customer needs and changed customer behaviour cause a ***service transformation***. Customers increasingly prefer to pay for services used instead of buying products (e.g., Automotive: B1; Retail: B8). For example, customers increasingly want to consume mobility services, instead of buying cars (Automotive: B1). Manufacturers face the challenge to decide whether their future value propositions should be based on a product or a service offering (Automotive: C1; Industrial Products: B7; Retail: B8). This issue becomes even more complex through the emergence of new low-asset competitors offering competitive services instead of products. A major risk for manufacturers is to fall behind in the value chain, i.e., becoming a supplier for new business models (Automotive: B1). Established manufacturers therefore need to carefully determine their future value propositions.

Driven by new opportunities provided by digital technologies and changed customer needs, firms increasingly focus on the ***individualization of products and services*** (e.g., Pharmaceutics: C3; Industrial Products: C5; Retail: C6). An interviewed consultant gave the example of an international brand that starts offering individualized sports shoes. In flagship stores, feet can be measured with digital sensors on an individual basis. The customers afterwards choose the preferred design and the ideal fitting shoes will be delivered within a few days (Retail: C6). Even within the pharmaceutical industry this change becomes visible. Another consultant mentioned thoughts within the pharmaceutical industry to adapt medicine to a specific person. Based on the diagnosis, medications can be adapted to a specific patient (Pharmaceutics: C3). A major challenge in individualizing products and services is the requirement of completely different material planning and production planning processes (e.g., Industrial Products: C5). However, the use of digital technologies can help optimizing the underlying processes and making the production of individualized products and services more efficient (Industrial Products: C5).

Customer Interface

Table 4 represents the findings regarding the changes, challenges, and responses within the business model elements customer relationships, customer segments, and communication and sales channels.

BM Element	Changes	Challenges	Responses
Customer Relationships	Personalization of Communication	Need for an adequate database	Aligned distribution system
			Data collection activities
		Need for appropriate know-how	Formation of a new sales force
Customer Segments	Forward integration	Need for skipping the retail level	Establishment of own distribution channels
		Privacy issues and legal aspects	Close relationship to intermediaries
Communication and Sales Channels	Digitization of channels	Resistance of customers	Maintaining offline channels in a supportive manner
		Different product specifications	

Table 4. Changes, Challenges, and Responses regarding the Customer Interface

Customer Relationships

By analyzing the impact of digital transformation on customer relationships, a trend towards a ***personalization of communication*** can be observed across all examined industries. Executives and consultants of all industries stated that firms increasingly want to understand their customers as accurately as possible to derive preferences and to finally address every customer in an individual way (e.g., Automotive: B1; Automotive: B2; Pharmaceutics: B5; Industrial Products: B7; Retail: B10). The major aim of this personalization strategy is the development of a stronger customer relationship (e.g., Retail: B9). According to an interviewed consultant, firms usually combine self-gathered customer data with social media data purchased from third-party data vendors to apply data analytics techniques and thereby derive preferences to optimize their personalization strategy (Retail: C6). However, many industries already fail at gathering dedicated customer data, i.e., they currently have a poor data situation. The reasons are many and varied. For example, executives of the automotive industry stated that the three-stage distribution system causes that automotive manufacturers have only limited information about their customers (Automotive: B1; Automotive: C1). Because of that, firms within the automotive industry even try to change the entire distribution structure in order to obtain first-hand customer data (Automotive: B1). Another challenge is the need for appropriate know-how in terms of a customer and market understanding in the digital age and a domain-specific knowledge (e.g., Retail: B9). Many firms create special sales forces to address this challenge (e.g., Retail: B9; Retail: B10).

Customer Segments

A cross-industry phenomenon, we observed from the data, is an increasing ***forward integration***. Via disintermediation strategies, manufacturers increasingly try to build up direct contact with end customers instead of using traditional distribution structures (e.g., Automotive: B1; Pharmaceutics: C3; Industrial Products: C5). Also, the other way around, customers try to build up direct contact with manufacturers (Automotive: B2). By skipping the retail level, producers expect to increase their margin and gain first-hand customer data. Especially for industries with a poor data situation as a result of a complex retail structure (e.g., automotive industry, pharmaceutical industry), this is considered an appropriate way to build up a solid database of customer data for the first time (Automotive: B1). On the other hand, customers expect to get lower prices when purchasing goods directly from the manufacturer. While in some industries the retail level can be skipped easily by building up own (mostly digital) communication and sales channels, in some industries a forward integration to the end customer cannot be realized easily. Especially within the pharmaceutical industry, a range of policies prohibits the producers to directly approach the end customer (Pharmaceutics: C3; Pharmaceutics B4). As a compromise, in highly regulated industries, a close relationship with relevant intermediaries (e.g., doctors in the pharmaceutical industry) is recommended.

Communication and Sales Channels

The major change regarding the design and structure of communication and sales channels is the continuing ***digitization of communication and sales channels***. The digitization of communication channels can be associated with an increasing level of automation (e.g., Retail: C6). By digitizing communication channels, firms can reduce costs, e.g., through the replacement of call centers with chat bots (Retail: C6). A pioneer in the digitization of sales channels is the retail industry with many digital sales channels already implemented (e.g., Retail: C6; Retail: B10). Other industries, such as the automotive industry, still lag somewhat behind (Automotive: B2; Automotive: C1). Communication and sales channels are not only added for providing a better convenience to customers. Digital communication and sales channels also serve as an appropriate way to gather additional customer data (e.g., through mobile apps) (Retail: B10). However, firms should evaluate which types of products are (not) suitable for being offered via digital sales channels. For example, automotive manufactures consider selling selected basic models online, whereas the specifications for other special models are so complex, that no online platform manages this complexity sufficiently (Automotive: C1). Other complex goods like food can be offered easily via digital sales channels, but the shipping of these goods is highly uneconomical and the selling via digital channels is not worthwhile (Retail: B9; Retail: C6). For such products, offline sales channels are indispensable. Another major challenge is the negative predisposition of some customers who defend themselves against the use of digital channels (e.g., Automotive: C1; Retail: B10). Especially for these customers, it is important to maintain offline channels at least in a supportive manner.

Infrastructure Management

The changes, challenges, and responses within a firm's key activities, key resources, and key partners can be obtained from Table 5.

BM Element	Changes	Challenges	Responses
Key Activities	Use of innovative methods in R&D	Structure and work ethics in incumbent firms	Formation of special teams
	Use of new technologies in production lines	Established machine parks	Rebuilding of factories
		Legal aspects	Long planning period
	Shift to cloud computing	World-wide coverage	Cooperation with various partners
		Data security and privacy policies	
Key Resources	Digital technologies as new key resources	Need for appropriate know-how	Formation of special teams
	Emergence of data as a new key resource	Need for an adequate database	Implementation of data collection activities
		Privacy issues	Data governance resources
		Appropriate know-how	Formation of special teams
	Transformation of work force and culture	Need for support of established workforce	Employee Incentivization
		Hiring of new talents	Formation of Tech-Hubs
Key Partners	New partnerships with customers	Privacy issues	Customer Incentivization
			Good data governance
	New partnerships with technology firms	Unresolved profit-sharing situation	Strategic planning of profit-sharing models
	New partnerships with competitors	Difficult competitive situation	Awareness of individual competitive advantage

Table 5. Changes, Challenges, and Responses regarding the Infrastructure Management

Key Activities

Firms increasingly employ ***new innovative methods and technologies in their R&D activities*** to improve their innovative outcome (e.g., Automotive: B1; Pharma: C3; Industrial Products: B7; Retail: B9).

This includes methods like design thinking, agile, and scrum, as well as technologies like artificial intelligence, data analytics, and 3D-printing. However, governance structures and work ethics of incumbent firms often hinder the process of implementing such methods and technologies (e.g., Automotive: C1). Some firms address this challenge by the formation of special teams (e.g., digital labs) outside their core business and detached from deadlocked corporate structures, where digital experts can think outside the box and test new methods and technologies. These teams work in close collaboration with the core team.

The production lines of the examined firms experience change through the ***use of new technologies within the production processes***. The topic industry 4.0, including the high potential of cyber-physical systems and interconnected machines, plays an increasingly important role across industries (e.g., Automotive: B2; Pharmaceutics: C3; Industrial Products: C5). The use of digital technologies, such as artificial intelligence, data analytics, or IoT can help to increase productivity of production lines and thereby increases profitability. Additionally, according to consultants of the industrial products industry, especially the advent of the 3D-print technology will revolutionize production lines (Industrial Products: C5). With 3D data, production processes can be simplified, and an individualization of products can be realized more easily. Furthermore, the complexity of spare part production and sales can be reduced substantially by selling the 3D data of those parts instead of the spare part itself (Industrial Products: B7). In this context, the use of new technologies within the production processes also serves as an essential prerequisite for the integration of digital technologies into new or existing products. However, this goes along with the requirement of changes in procurement processes, the supply chain management, and the existing workforce. For example, because of the increasing electrification of cars, firms within the automotive industry must completely rebuild existing factories. In general, because the production lines of incumbent firms are typically large and durable, the process of integrating new technologies and synchronizing them with existing machines and technologies becomes a complex issue. Some industries also must consider legal aspects when trying to integrate new digital technologies into the production line. For example, the whole production line of a pharmaceutical manufacturer must be validated by government authorities. Therefore, every change within the production line must be reported and the validation process starts over. Changes in such industries, consequently, proceed very slowly (Pharmaceutics: B3).

Within the infrastructure management of incumbent firms, a ***shift from data centres to cloud computing*** can be observed. One major reason is the desire of a closer collaboration with partners across the world (Pharmaceutics: B4). Other reasons include the acceleration of processes and the saving of resources. The shift to cloud computing comes along with a reduction of workforce and a decentralization and externalisation of data (Retail: C6). Some of the examined firms use solutions from external cloud providers (e.g., Amazon Cloud or Microsoft Azure), whereas others use their own established solutions (e.g., Automotive: B2; Pharmaceutic: B3). When establishing their own cloud solutions, firms additionally employ in-house security experts to ensure data security (Automotive: B2). A major challenge that comes with the use of external cloud solutions is that these solutions do not cover all required destinations. For specific regions, like China or Russia, additional solutions are needed (Retail: B9). Other challenges include concerns regarding data security and privacy policies. To address these challenges, some firms develop cloud solutions in cooperation with knowledgeable partners (Industrial Products: B7).

Key Resources

New digital technologies, like data analytics, cloud computing, or artificial intelligence are becoming new key resources offering novel opportunities for gaining competitive advantages. These new technologies are mainly used to enhance products or services or to improve internal processes (e.g., Automotive: C1; Pharmaceutics: B5; Industrial Products: B7; Retail: B8). However, in order to get the most out of new technologies, it is challenging for most firms to build up appropriate know-how, which would consist of a mixture of the technological know-how and domain-specific know-how (e.g., Automotive: B2). Many incumbent firms lack the appropriate know-how to use these technologies sensibly (e.g., Automotive: C1; Retail: B9). The most common reaction to this issue is the creation of special teams (e.g., digital teams) that work outside the core business and offer the appropriate know-how as a service to all departments of a firm (e.g., Pharmaceutics: B4).

Data increasingly becomes a key resource for firms across all industries (e.g., Automotive: B1; Industrial Products: B6; Pharmaceutics: C3; Retail: C6). This includes customer specific data, as well as product specific data. Data can help firms to improve the unique selling point (USP) of products and

services or the personalization of products, services and marketing campaigns (Pharmaceutics: C3; Retail: C6). Furthermore, data can serve as a product itself, which can be sold to third parties (Automotive: C1; Pharmaceutics: C3). Data also help firms to improve business processes like the production process or the supply chain management (e.g., Industrial Products: B7; Retail: C6). To establish an adequate database, firms set up a variety of activities to gather and analyze data. For example, automotive manufactures revamp their whole distribution structures to establish direct contact with end customers to gather first-hand customer data (Automotive: C1). Furthermore, firms equip their products with technologies (e.g., sensors) to gather data (e.g., Automotive B1; Automotive B2; Industrial Products: B7). The main challenges regarding the handling of data are privacy issues, the availability of appropriate know-how, and the requirement of a high-quality and well-integrated database (Automotive: B2; Pharmaceutics: B3; Industrial Products: B7; Retail: B9). To address these data-specific issues, firms build up data governance resources, as well as data warehouses and data lakes within the firm (e.g., Pharmaceutics: B4; Industrial Products: B7). In order to build up the required competencies, firms establish data analytics teams offering their know-how as a service to all departments of a firm (e.g., Pharmaceutics: B4; Retail: B9).

Whereas new digital technologies and data become new key resources, the work force has always been one of the most important key resources of a firm and humans play a major role during transformation (Industrial Products: C5). However, the process of digital transformation requires a ***transformation of the established work force and culture***. This transformation includes a shift in know-how (e.g., new technological know-how), in methods (e.g., new methods like agile, design thinking, or scrum), in mindset (e.g., to be more open minded), and in culture. This transformation is an ongoing process and most firms face a lot of challenges while transforming work force and culture. These challenges concern the support of the established workforce, as well as the hiring process of new talents. Especially the tendency for inertia of the existing staff in incumbent firms demands for a change in mindset and culture (e.g., Pharmaceutics: B5). Also, the need for re-education within the established workforce causes problems (e.g., Pharmaceutics: C3). Although there exists no general blueprint to solve these issues, some firms use incentivization mechanisms. Another challenge concerns the hiring process of new talents. Because incumbent firms across all industries are not competitive in many fields with their established workforce, hiring of new staff is essential (e.g., Automotive: B1). To build up new competencies in areas with the greatest gaps in know-how, like analytics, data science, software engineering and digital marketing, most firms build up required expertise through hiring domain experts (e.g., Pharmaceutics: B4; Retail: C6). However, this strategy is also associated with challenges. First, the labour supply of talents with the required knowledge is rather limited (e.g., Automotive: B1; Industrial Products B6; Retail: C6). The situation is further complicated by the fact that such talents usually require an appropriate working environment. Incumbent firms usually cannot provide that and are therefore not attractive for those talents (e.g., Automotive: B1). In addition, the work ethic and labour protection laws are incompatible with requirements of innovative talents (Industrial Products: C5). Finally, many executives also have expressed their concerns regarding the university education of talents (especially in Germany), which is not practical enough (Industrial Products: C5; Retail: B9). Firms address these challenges with the creation of Tech-Hubs in attractive areas (e.g., Tel Aviv, Shanghai or Los Angeles), where the pool of talents providing the required knowledge is much higher than in the cities of the head offices of European firms (e.g., Industrial Products: C5; Retail: B9; Retail: B10).

Key Partners

More and more firms see their ***customers as partners in their ecosystem*** (e.g., Automotive: C1; Retail: B10). On the one hand, customers take the role of buyers of products and services and generate revenues. On the other hand, customers increasingly turn into suppliers of data, serving as an input for improving products and services (Pharmaceutics: C3; Retail: B8; Retail: B9). However, when using customer data for specific purposes, firms need to consider industry-specific privacy policies. Additionally, it is important to consider that an increasing number of customers have the fear of becoming a transparent customer (Industrial Products: C5). Firms need to make their customers feel, that their data confidentiality is protected, and the data is only used by the specific firm for pre-defined purposes. Firms should give their customers the feeling that they can decide for what purposes their data may be used. Firms with a good data governance will have an advantage of trust in this case. Furthermore, to ensure that the customers have a good feeling about offering their data to the company, incentives should be offered to the customers (e.g., free additional services) (Automotive: C1).

Furthermore, an ***increasing number of partnerships with technology firms*** can be observed (e.g., Automotive: C1; Pharmaceutics: C3). This includes partnerships with global players, medium-sized technology firms, as well as startups. Partnering with technology firms is an appropriate approach for extending the value proposition of existing products or services or even for offering new products or services (Automotive: B1; Industrial Products: C5; Retail: C6). Technology firms can serve as a supplier of additional technologies or technological knowledge (e.g., Industrial Products: C5). Furthermore, especially global players with platform business models can provide a necessary customer interface what incumbent firms usually do not offer (Automotive: C1). A typical challenge in partnering is finding a profit-sharing model which is acceptable for both parties (Industrial Products: C5).

Partnerships with direct or indirect competitors are also increasing steadily (e.g., Retail: B8). A main goal of these partnerships is to reduce material costs. Several firms together have a greater market power than a single firm. In many industries, firms together build up platforms where they join forces (Retail: B10). However, in this case, partnering bears the risk of giving up a potential competitive advantage created by good negotiation skills. Because prices are usually negotiated individually, partnering with a firm with higher prices always means giving up a competitive advantage (Retail: B8). Therefore, companies need to be aware of their individual competitive situation.

Financial Aspects

The following Table 6 shows our findings regarding the financial aspects of a firm's business model.

BM Element	Changes	Challenges	Responses
Cost Structure	Increasing investments in innovative business areas	Potentially arising financial risks	Partnerships with peers
Revenue Streams	Emergence of additional revenue streams	Small share of total sales	Double-barreled strategy
	Emergence of additional payment models	Uncertain profitability	Payment options should depend on the product
		Modification of products	

Table 6. Changes, Challenges, and Responses regarding the Financial Aspects

Cost Structure

The total costs of firms are increasingly driven by a constantly ***increasing amount of investments in innovative business areas***. Because these expensive investments in new innovative areas are highly uncertain in terms of their outcome, but unavoidable to stay competitive, related firms face financial risks (e.g., Automotive: C1; Pharmaceutics: C3). Through joint investments with other inter-industrial firms, they try to diversify this financial risk (Pharmaceutics: C3). The resulting lower investment sums enable the possibility to invest in different projects which allows a diversification of potential risks. Additionally, most investments require an internal compensation, which means that cost-saving interventions in other areas are required (Automotive: B1).

Revenue Streams

Executives off all examined industries agree that there are and will be ***additional revenue streams*** caused by digital transformation (e.g., Automotive: B1; Pharmaceutics: C3; Industrial Products: C5; Retail: B9). This mainly stems from the sale of additional digital products and services. However, across all examined industries, such revenue streams represent only a small share of total sales (e.g., Automotive: B2; Pharmaceutics: B5; Industrial Products: B6; Retail: B9). Thus, the additionally offered products and services only have a supporting role as of now. However, most executives agree that this share will increase in the future, even if most executives also consider that this process might take up to 10 years (e.g., Automotive: B1; Pharmaceutics: B5; Retail: C6). In order to be prepared for this moment, it is essential to continue pursuing the development of new digital products and services (e.g., Automotive: B2). Stopping investments in innovative business areas would spell doom for those companies once digital products and services determine their industries. Furthermore, it needs to be considered that the purpose of many additional digital services is not to directly generate new revenue streams, but to gather data, to improve customer relationships, or to fulfil other purposes instead of generating revenues (Retail: B9).

Not only the origin of revenue streams changes, also the structure of the underlying revenue streams changes. Across industries, ***additional payment models*** play an increasingly important role (e.g., Automotive: B1; Pharmaceutics: C3; Retail: C6). These additional payment models include pay-per-use-models, subscription models, and leasing models. Whereas subscription models are predominantly used in the consumer & retail industry (Retail: C6) and the pharmaceutical industry (Pharmaceutics: C3), pay-per-use models and leasing models are primarily represented in industries, where the products are typically relatively costly (Automotive: B1; Industrial Products: C5). Especially the pay-per-use model is also often used for additional digital services (e.g., navigation system in cars). To ensure the profitability of new payment models, firms need to evaluate which payment models should be offered for which types of products and services (e.g., Automotive: C1). Additionally, firms need to consider that especially for using the pay-per-use-model the underlying products might require a modification (e.g., a washing machine where each cycle is charged separately) (Industrial Products: B7; Industrial Products: C5).

Discussion

Implications for Research and Practice

The results of our case study provide several important implications for both researchers and practitioners alike. First, our study contributes to the literature of digital transformation by providing new insights to advance the scientific understanding of the impact of digital transformation on the business model of incumbent firms in traditional industries. Consistent with existing literature, our findings indicate that digital transformation has an impact on all elements of an incumbent firm's business model and thereby has the potential to (re)define a firms' value propositions(s) and to change its whole identity (e.g., Wessel et al. 2020). The findings of our study regarding the creation of new value propositions, the augmentation of physical products with new digital services, the digitization of marketing and sales channels, and the transformation of workforce and culture confirm previous findings of Porter and Heppelmann (2014), Strohmeier (2014), Barret et al. (2015), Hansen and Sia (2015), Piccinini et al. (2015), and other researchers. However, our paper takes existing research one step further by providing a more holistic view of the impact of digital transformation on each business model element of incumbent firms across various traditional industries. Furthermore, we contribute to the existing literature by providing detailed information on how the overall impact of digital transformation on incumbent firm's business models can be accessed and conceptualized. As illustrated in Figure 1, we conceptualize the impact of digital transformation on incumbent firm's business models as (1) changes triggered by the use of digital technologies, (2) challenges resulting from changes that collide with existing organizational and/or environmental conditions, and (3) organizational responses a firm needs to adopt to address the arising challenges.

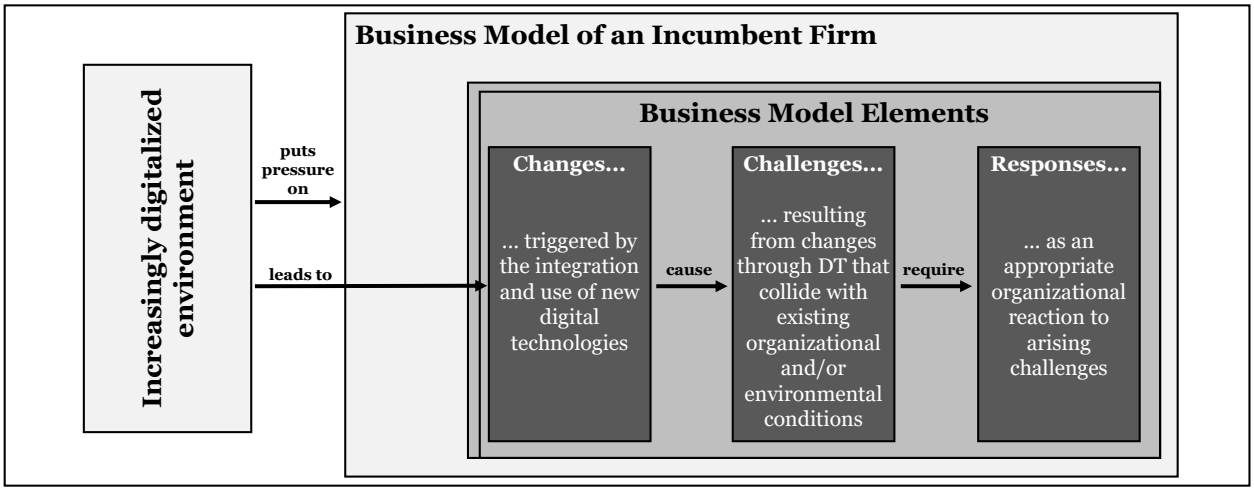

Figure 1. The Impact of Digital Transformation on Incumbent Firm's Business Models

As illustrated in Figure 1, an increasingly digitalized environment puts pressure on existing business models of incumbent firms. To stay competitive, incumbent firms need to undergo a digital transformation and therefore need to integrate digital technologies into their existing business model. The integration and use

of new digital technologies cause changes across all business model elements of incumbent firms. Consequently, no element of the business model of incumbent firms remains unaffected by the changes caused by digital transformation. Therefore, executives across industries need to consider all elements of their specific business model by driving digital transformation. Furthermore, our findings indicate that the scope of specific changes differs across the specific business model elements. Some of the identified changes are merely radical, i.e., they have a strong impact on the specific business model element, what causes bigger challenges and subsequently requires more strategic effort. However, other changes are merely incremental and do not require much attention of the top management. Furthermore, the scope of specific changes also varies across industries. Whereas all industries go through the same change process, for some industries the challenges of change are more difficult than for others.

Our findings further show that it is difficult for incumbent firms to handle the changes triggered by digital transformation. These difficulties are presented as challenges in our study and arise from changes through digital transformation that collide with existing organizational conditions (e.g., long grown corporate governance structures or outdated IT infrastructures), or environmental conditions. In general, every change within the business model elements of incumbent firms evokes at least one new challenge the affected firm must deal with. Hence, when changes within a specific business model element are envisaged, potential new challenges must also be considered. Accordingly, appropriate organizational responses are needed for achieving digital transformation and to ensure that the introduced changes have a positive effect on the future performance of a firm.

Overall, our findings also underline the great importance of the development of ambidextrous capabilities to address contrasting demands and resolve paradoxical tensions (Gregory et al. 2014), as well as agile capabilities to react rapidly to new changes and challenges caused by digital transformation. These capabilities can be a key for a successful digital transformation.

Limitations and Future Research

Despite the careful design of our study, this paper is subject to several limitations due to the nature of the applied research methodology. A major limitation concerns the external validity. Because case studies are susceptible to context, the boundary conditions and generalizability of the specific study need to be considered (Marshall 1996; Lee and Baskerville 2003). In this study, we analyzed four different traditional industries, which play a major role in the European economy. However, because these industries do not reflect all traditional industries, it is uncertain whether our results can be generalized to other traditional industries. Furthermore, we only analyzed firms with headquarters in Europe, which limits the geographical scope of our study to Europe. Overall, this study primarily argues for the generalization of the findings to incumbent firms of the four analyzed industries in the European territory. However, a question worth verifying in future studies would be whether the findings also can be generalized to other industries and other territories. Finally, this study investigated the overall impact of digital transformation and thereby did not differentiate between the use of different digital technologies. However, future research can build on this by analyzing the impact of individual digital technologies, like artificial intelligence, on the overall business model of incumbent firms. Furthermore, future research could analyze whether the use of some digital technologies has a greater impact than the use of others.

Conclusion

In recent years, research has already started discussing digital transformation in relation to business models. However, its focus has mainly been on specific business model elements or on specific industries. Furthermore, a clear conceptualization of the impact of digital transformation on incumbent firm's business models was missing. This study aimed to approach these research gaps by exploring the impact of digital transformation on the overall business model of incumbent firms across different industries and thereby examining the nature of this impact to provide detailed information about how this impact can be conceptualized and what it means for an incumbent firm.

The results of our study show that digital transformation causes changes in all elements of an incumbent firm's business model across all examined industries. No business model element remains unaffected by digital transformation issues. These changes, which are primarily triggered by the use of new digital technologies as a reaction to an increasingly digitalized environment, can be incremental or radical. The

scope of a specific change varies across specific types of change, as well as across industries. Changes caused by digital transformation are difficult to handle for incumbent firms across all industries. This is reflected by the fact that changes through digital transformation that collide with existing organizational and/or environmental conditions cause challenges the respective firms must deal with. Consequently, appropriate organizational responses need to be prepared as a reaction to challenges that may occur.

Overall, our paper contributes to the ongoing research in the field of digital transformation by providing novel insights to advance the scientific understanding of digital transformation in incumbent firms. Additionally, due to our practical implications, the provided insights are useful for practitioners to recognize and prepare for potential challenges, which may arise from a firm's digital transformation efforts.

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