

Digital Transformation of Incumbent Firms: A Business Model Innovation Perspective

Christoph Klos, Patrick Spieth , Thomas Clauss , and Christian Klusmann

Abstract—The literature argues that a real digital transformation of firms requires holistic changes of the business model. Despite knowledge about this ambitious goal, understanding of how digital business model transformation can be achieved is still very limited. In this article, we explore how firms achieve digital business model transformation. We apply a case study design to investigate how incumbents have changed their respective business model dimensions during digital transformation. Our findings center on interview data and complementary archival records from 15 cases. We present a framework for digital business model transformation along the dimensions of value proposition, value creation, and value capture. Our results emphasize the importance of a preparatory phase in which the strategic course is set. Furthermore, our findings demonstrate that transforming a company's business model is most effective when a single person, namely the Chief Digital Officer, is responsible. Our findings contribute to the business model literature, by providing a more holistic view on how business model innovation can be utilized during digital transformation.

Index Terms—Business model innovation (BMI), digital transformation, digitalization, value capture, value creation, value proposition.

I. INTRODUCTION

Rapid developments in digital information and communication technologies have recently created new business opportunities, but have as well disrupted established industries and have led to new market entrants and intensified competition [1]–[3]. Technologies, such as the Internet of Things (IoTs) [4], [5], three-dimensional (3-D) printing [6] or artificial intelligence [7] offer fundamentally new ways of doing business and may even have the potential to disrupt traditional business concepts [8]. Furthermore, research demonstrates that successful digital transformation has positive effects on firms' performance and creates competitive advantages [9]. Thus companies in many industries are forced to engage in digital transformation efforts. The results of large scale practitioner oriented studies regularly

Manuscript received 5 July 2019; revised 18 November 2019, 3 June 2020, 16 September 2020, and 2 February 2021; accepted 21 April 2021. Date of publication 26 May 2021; date of current version 24 March 2023. Review of this manuscript was arranged by Department Editor A. Brem. (Corresponding author: Patrick Spieth.)

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Digital Object Identifier 10.1109/TEM.2021.3075502

report that companies are heavily investing in digitalization and digital transformation efforts [10].

Digital transformation however is arguable not an easy endeavor. As compared to new start-ups that are often build around new digital technologies, incumbent firms need to find ways to digitally transform while preserving core competencies and traditions [11]. Since new digital technologies often affect the fundamental mechanisms of how companies run their operations, they must obtain new management practices and strategies to cope with the challenges of digital transformation [12], [13]. Recent research, therefore, clarified that instead of just encoding analog information into digital format or electrifying existing processes (i.e., digitization), digital transformation describes a company-wide change that requires the development of new business models by implementing a new business logic to create and capture value [11], [14].

Business models are conceptualized as configurations of the three interrelated elements: value proposition, value creation, and value capture [15]–[18]. Business model innovation (BMI) is then defined as “designed, nontrivial changes to the key elements of a firm's business model and/or the architecture linking these elements” [17, p. 207]. In the case of digital BMI, these changes are embodied in or driven by digital technologies [18]–[20].

Despite the general agreement that incumbent firms need to pursue BMI for successful digital transformation, limited research has addresses the nature of digital BMI. Previous research has focused mostly on the external antecedences of incumbents BMI such as IoT [5], big data analytics [21], opportunity recognition [22] or family influence [23]. Li [24] examines how digital technologies have been used to facilitate BMI in creative industries, highlighting which areas of the business model were affected by automation, extension or transformation. Other studies explore very specific types of technology driven business models such as 3-D printing business models [6] or digital platform business models [25].

Despite these recent advancements in this research area, we still lack understanding on how the business models of incumbent firms are innovated during digital transformation. This gap is of a high theoretical and practical relevance, considering that many firms still struggle with a holistic transformation of their business models [26] and as Gebauer *et al.* [27] recently highlights the digital paradox “which means that they invest in digital offerings, but struggle to achieve the expected revenue growth, despite the proven growth potential of digital technologies.” To fill this gap we analyze the literature regarding BMI and digital

transformation. We, then, empirically analyze the process of BMI during digital transformation based on cases of incumbent companies that have transformed their business models. Based upon our findings, provide a process framework that provides companies with a structured template for achieving digital BMI.

We contribute to the academic literature and provide managerial recommendations: We provide insights for Fjeldstad and Snow [28] call for an analysis of how new digital architectures affect BMI. Our findings identify transformation activities in all three business model dimensions. Following Massa, Tucci, and Afuah's [29] we provide a deeper analysis of important activities, outcomes and individual involvement in BMI processes. We conclude on a process framework of digital BMI that aggregates relevant business model reconfigurations during firms' digital transformation. This is of a high relevance for managers as it can be used as a basis for cognitive reflection or benchmark of own activities and it provides a basis for a structured planning of BMI during digital transformation.

II. THEORETICAL BACKGROUND

A. Digital Technology and Changes in Business Models

Digital transformation has gained recent attention in practice and academia, as new digital technologies have emerged continuously over the past decades [14], [30]–[32]. Technology driven organizational change has for example been studied concerning technological enablers [33], necessary resources [34], and its potential advantages [35]. However, the discussion about digital technology's transformational impact was particularly driven by a perspective on technology adoption for improving business operations and processes in an organization [1], [32]. Thus, research has dealt in particular with facilitating business application systems, infrastructure, and organizational and financial frameworks [36] to achieve outcomes such as enhanced efficiency and cost reductions from automatized and optimized processes [35].

More recently, the literature showed that digital transformation has to go beyond the electrification of existing processes and structures by implementing new technologies (i.e., digitization), but requires the holistic change and innovation of a firms' business model [11], [14], [27]. Verhoef *et al.* [14] highlight that digital transformation is a companywide phenomenon that changes the logic of value creation and value capture through the use of digital technologies. In line with this the more recent literature on digital business models and digital BMI [1], [22], [37], [38] shows that digital BMI requires fundamental organizational changes. The redesign of an organization's structures is more important than simply integrating a certain amount of digital technology [39]. This is particularly important if the idea of digital BMI is a greater service-orientation and customer interaction to achieve value creation across the boundaries of the firm [27], [28], [40], [41].

Recent studies already demonstrate the link between digital transformation and business model design in particular setups. Warner and Wager [42] analyzed the dynamic capabilities needed for digital transformation. Although they do not provide a more detailed analysis of the nature of BMI, they concluded that that all the digital transformation of all incumbents' in

their case analysis involved the strategic renewal of business models. Gebauer *et al.* [27] identify three phases of converting digital offerings into revenue enhancements in the B2B industry. Whereas in the first phase, products are augmented with software, in the second phase, more complex customer problems are solved through software solutions and in the third digital platforms are used to store and combine data about customers' manufacturing systems. Li [24] analyze how digital technologies change business models in creative industries. By analyzing very specific changes to the business model dimensions, they found that reconfigured business models were often not new in an unprecedented sense but that through using digital technology the deployment of multiple business models became possible.

BMI was found to be an important mechanism for small and midsized enterprises (SMEs) in Europe [16]. Just recently, studies in the European context have analyzed the determinants of technology driven and digital BMI. Cozzolino *et al.* [43] based on a longitudinal case study of an Italian news media publisher found that disruptive changes of incumbent firms' business models can either be triggered by opportunities that arise from new (digital) technologies or by threats from new industry entrants. These external triggers then lead to mechanisms in which external knowledge is accumulated (i.e., through alliances and acquisitions) and internal knowledge is created (i.e., through experimentation). Similarly, Garzella *et al.* [44] show that digitalization increases the connection point and interfaces with the firms external stakeholders (e.g., customers) and thereby stimulates BMI. Heider *et al.* [45] found that dynamic capabilities enable digital innovation in the dimensions of the business model (i.e., value creation, value proposition, and value capture). However, the benefits for sensing and seizing as well as transformation can be utilized to a significantly lower degree in small firms. Based on a large scale dataset among German SMEs, Soluk *et al.* [23] have identified environmental dynamism and dynamic capabilities as drivers of digital BMI. We add to this important stream of empirical research by taking a more detailed look at the nature of digital BMI instead of its determinants.

B. Business Model Innovation

The business model consists of several components which are aggregated into business model dimensions. In fact, there are more than 70 semantically different business model components in the literature which form between two and up to 12 business model dimension [15]. More recently, researchers agreed that the business model can be appropriately captured based on three interrelated dimensions: value proposition, value creation, and value capture [15], [17], [18]. We used Teece's [18, p. 179] business model definition for our research project: "A business model articulates 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." These business model dimensions are not separate from each other, but form unique configurations of an organization [46]. If one dimension is changed, modular changes in the other dimensions are usually necessary [17].

BMI deals with the design of new business models or the reconfiguration of existing ones [17], [47]. BMI is a new type

of innovation complementing product and process innovation through a holistic perspective on innovation potentials in the key dimensions of the organization. [48]. Besides designing new and changing existing business models, BMI includes the discovery of new business practices, which seek to generate a new value proposition, new value creation processes, and new cost and revenue streams [49]. This process is particularly facilitated by new digital technologies [44], [50]. In the following, we provide an overview of digital technology's potential for BMI.

"The *value proposition dimension* contains a portfolio of solutions for customers and how they are offered [15, p. 387]." Innovation in the value proposition process is enabled by digital technologies as these significantly affect customer behavior. Many digital technologies (e.g., smart phones or smart home devices) are now present in customers' homes. This provides companies with opportunities to remain in constant contact with (potential) customers [51]. Digital customer interfaces have positive effects, e.g., on customer relationships, customer satisfaction, and/or on brand reputation [52], [53]. For many digital products and in particular if a company provides a platforms in which the value proposition is to facilitate transactions between otherwise independent actors [54], firms rely on network effects [55]. Direct network effects are created if the value of the value proposition is enhanced if more users join an ecosystem in general [56]. This could be for example if a group of buyers could jointly negotiate better prices from a supplier if their number increases. Indirect network effects arise if an increased number of users leads to greater number of participants from a different segment (e.g., more users of an online market place lead to more providers in this space). Digital advertising and promotion may become even more important owing the fact that especially younger people spend much time online [57]. Through digital interaction processes with customers and customer products large amounts of data can be obtained that can be used for product development or individualized marketing activities [58]. Digital technologies influence on distribution channels is evident looking at internet-only players such as eBay or Amazon. Matarazzo *et al.* [51] recently demonstrated that digital transformation in the value proposition dimension can facilitate omnichannel marketing and delivery in particular for new digital offerings.

"The *value creation domain* defines how and by what means firms create value along the value chain using the resources and capabilities of intra and interorganizational processes [15, p. 387]." In general, digital technologies help companies to innovate their value creation as processes can be automated to a very high level [59]. Furthermore, digitalization creates new interfaces that help companies to integrate customers into the companies' value creation [51]. Incumbent firms can use digital technologies to strengthen customer relationships along various physical and digital channels and touch points of the consumer journey [60]. Digital tools are used for customer co-creation to better understand consumer desires and future trends for higher product success [51]. Business functions such as product development and marketing can be supported or even taken over by communities of self-selected individuals [19]. Incumbent firms can facilitate value co-creation with customers through

knowledge transfers and the establishment of structures and rule for collaboration in the ecosystem [61], [62]. Opportunities for digital value creation processes arise from a growing customer demand for customized products and services [59], [63]. Digital technologies, such as 3-D printing provide customers with the opportunity to get highly individual solutions for prices that are significantly lower than traditional tailor made solutions [6], [64]. Companies can in turn analyze the preference data from customers to enable better a and more sustainable co-creation relationship with their customers [65]. Another example for innovative value creation and service processes is the IoT. IoT describes the connection and communication processes between products and services that are supposed to form a network for constant data exchange [66]. Therefore, companies must enhance their IT and software to handling data's changing role [67]. Besides the opportunity to integrate customers in a digitally enhanced value creation process, an improvement of the industry and university collaboration can be a source for BMI [68].

"*Value capture* defines how value propositions are converted into revenues. It defines how firms gain revenues that cover cost and achieve profits that ensure sustainable performance [15, p. 387]." The value capture dimension can change when digital technology disrupts the ways product firms compete and offer services [69]. For many companies, digitalization efforts in the other dimensions of the business model also require the design of the right value capture approach [70]. This is in particular because value capture innovation was shown require systemic adaptations of the other dimensions of the business model to prevent potential issues from local optimization [16]. In recent years, many companies' revenue concepts changed from one-time sales to achieving recurrent revenue streams. Examples are pay per view/use, subscriptions, or freemium models [18]. The opportunity to use various revenue models is closely connected with the immaterial nature of software. Software can be produced with marginal variable costs. Thus pricing and revenue model decisions are more holistic. Additionally, revenue models, such as subscription facilitate more long term relationships in which also value creation can continue, e.g., through software updates [27]. Further, digital technologies provide opportunities to build digital services that are bundled with products in companies portfolios and create additional revenues [71]. One case in point example is the strategy of many B2B machine construction firms who now sell machines with small margins or even install these for free but offer long term maintenance and service contracts. Such service offers are facilitated by the advancements in sensor technologies that enable the manufacturers to collect valuable data and to provide predictive maintenance solutions that could not be offered by independent service providers. For most companies, a combination of different revenue streams may be useful [69].

III. RESEARCH DESIGN AND METHODOLOGY

As we seek to explore the BMI process for digital transformation of incumbent firms, we used a qualitative case study research design [72]. The chosen research design allowed us to conduct a cross-case analysis, which is beneficial to discover emerging

patterns between interrelated constructs, and therefore provides more generalizable insights than single-case studies [73]. Moreover, as the discovery of patterns and their relationships can provide key conceptual insights, it supports theory-building as well [74].

A. Sample and Data

Our purpose is to analyze how incumbent companies (in business for >10 years) change their business model in the course of digital transformation efforts. We needed to select companies that pursued corresponding digital transformation initiatives. Following a purposeful sampling strategy [75], we only considered incumbent companies for our study that described concrete digital innovation steps for at least one of their respective business model dimensions. We attempted to select “illuminative cases” that exemplify contexts where an innovation was perceived notably as a success or a failure [75]. We, therefore, searched for critical incidents as a major source for case selection [76]. We gathered information from academic research results, corporate websites and annual financial reports for selecting incumbent companies which conducted digital BMI. The business model categorization of Clauss [15] was used as a pattern for identifying BMI activities in the information provided at corporate websites and in financial reports. In line with Hess *et al.* [13], we searched for cases that utilized rather complex digital BMI as compared to a simple integration of technologies. Furthermore, some cases were identified from recommendations of business consultants in the area of digital transformation. These consultants were further interviewed to validate our findings from the case studies from the perspective of external experts who have a broad understanding of various projects aiming for digital BMI. The advantage of integrating the view of external informants (e.g., consultants) is that they may unveil internal retrospective and key informant bias [77]. We aimed for maximal sample variation [75] in order to understand the phenomenon from a broader perspective, to generate more generalizable results and to enhance our findings’ external validity [74]. Therefore, we purposefully selected cases across industries and of very different sizes (i.e., from small-sized to large-sized firms). This may on the one hand reduce the direct comparability of results but ensures the we generate a more complete picture of digital BMI. In line with this, we included one startup company (company O) that developed a digital business model. Although this company had a less established business model, they went through a similar process of pivoting and developing the digital business model. Our final case selection based on 15 companies. Although these companies all went through rather complex changes in their business models, each one was associated with innovation in one primary BMI dimension. Five of these cases were primarily associated with a value proposition, six cases with a value creation innovation, and four with value capture innovation.

After the case companies were identified, we approached these via telephone. Semistructured interviews were our primary data source, since they are the most appropriate method for collecting retrospective data from experts [78] who were

involved in BMI processes. After an initial kick-off discussion with a member of the management board, we either decided to conduct the interview directly with the respective board member or asked for the contact information of a manager in charge for digital innovation. We asked the interviewee for a retrospective description of their digital BMI efforts. We followed a detailed interview protocol for each of the interviews (see Appendix A). This protocol was used for the interviews with each case company. The business consultancies referred to the questions from the perspective of firms who used their consulting services. We gathered data over a five-month period from September 1, 2016 to January 20, 2017. The interview duration was between 30 and 65 minutes (average of 45 min). Interviewees were CEOs ($n = 3$), business development managers ($n = 8$), project managers, or other persons responsible for their company’s digital BMI initiative ($n = 7$).

Furthermore, we received additional archival data (e.g., innovation descriptions in annual reports, strategy presentations and handouts, or the description of digitally induced change in the corporate history) which we used for triangulation to ensure the validity of our study results [79]. First, we analyzed the corporate website and social media presence of each company. Second, we were provided with internal documents of reports, presentations, plans for BMI, work instructions, etc. Third, we analyzed the incumbents’ annual reports (if available) to see the financial impacts of the BMI processes (value capture perspective). Finally, we took notes during all additional conversations with companies’ representatives (kick-off discussions, interviews, queries). Table I gives the key characteristics of our selected case companies and Table II gives the information about the validation interviews with the consulting firms.

B. Analysis

Through our documentation and analysis of the interview data, website and social media activity, annual reports, and additional internal documents, we strived toward establishing a chain of evidence [80] while improving validity and reliability. We followed an iterative coding procedure as suggested by Corley and Gioia [81] and Gioia *et al.* [78]. First, we started with open coding to aggregate similar statements across the interviews into first-order concepts. We, then, condensed related concepts into second-order themes. This data structure allowed us to build aggregated dimensions in a third step. Further, we sorted the 9-D from the coding procedure to the three business model dimensions which we deduced *a priori* from the analyzed theory. This data-theory matching process enabled us to further assess the validity of the article [82]. The data were coded by two independent researchers and the codes were compared and discussed before they were aggregated according. Excerpts of the findings were presented to and discussed with the members of the business consultancies to receive an external validation of our findings. Fig. 1 shows the results of our data analysis.

After the coding procedure, we conducted a cross-case comparative analysis, which included a comparison of themes and dimensions [80]. We, therefore, used the results from the coding procedure and searched for similar concepts in the data that was

TABLE I
SELECTED CASES

Business company	Description	Em-ployees	Tenure in years	Interviewee's position	Data	Primary di-mension of BMI
Company A: Communication provider	International telecommunication company, established in 1950	225,243	7	Head of Digital Innovation	Interview, kick off discussion, website/social media, reports, internal documents	Value proposition innovation
Company B: Self-service department store	International retail business, founded in 1828	43,000	5	Head of Multi-channel Management	Interview, website/social media, reports, internal documents	Value proposition innovation
Company C: Public utility 1	Service company in primary care, established in 1919	156	19	Head of Operational Services	Interview, kick off discussion, website, internal documents	Value proposition innovation
Company D: Public utility 2	Service company for electricity, gas and district heating, founded in 1901	356	23	Project Leader Digitalization	Interview, kick off discussion, website/social media, reports, internal documents	Value proposition innovation
Company E: Energy provider	Responsible for the energy supply of 1 of the 16 German states (1921)	20,288	9	Head of Digital Office	Interview, kick off discussion, website/social media, reports	Value proposition innovation
Company F: Automotive supplier	International automotive supplier, founded in 1915	138,269	14	Head of Corporate Communication	Interview, website/social media, reports	Value creation innovation
Company G: Heating-Syst. manufacturer	Family business since 1917 that produces heating technology products	11,600	8	Head of Corp. Development	Interview, kick off discussion, website/social media, reports, internal documents	Value creation innovation
Company H: Engineering company	Supply engineering company for heating and sanitary, founded in 1963	24	30	Chief Executive Officer	Interview, website, internal documents	Value creation innovation
Company I: Airport operator	Operating company of an airport, founded in 1947	20,720	11	Head of Digital Transformation	Interview, kick off discussion, website/social media, reports	Value creation innovation
Company J: Airline	German airline group, established in 1953	129,424	6	Head of Digital Business Development	Interview, website/social media, reports	Value creation innovation
Company K: Medical supplier	Medical- and pharmaceutical company, founded in 1839	55,719	9	Product Manager	Interview, kick off discussion, website	Value creation innovation
Company L: Major bank	Cooperative bank, established in 1808	51,305	14	Head of Digital Business Development	Interview, website/social media, reports, internal documents	Value capture innovation
Company M: Association of cooperative banking groups	Umbrella organization of cooperative banks, founded in 1972	188,000	21	Head of Communication and Multichannel	Interview, website/social media, reports	Value capture innovation
Company N: Cooperative banking group	Major German bank, established in 1870	49,417	12	Chief Executive Officer	Interview, kick off discussion, website, reports	Value capture innovation
Company O: Car-sharing provider	German car-sharing group, founded in 2009	100	6	Deputy Managing Director	Interview, website/social media, internal documents	Value capture innovation

TABLE II
ADDITIONAL INTERVIEWS FOR VALIDATION PURPOSES

Business company	Description	Employees	Tenure of the respondent	Interviewee's position
Company P: Business consultancy 1	Professional service company 1986	173,965	9	Business Transformation Advisory
Company Q: Business consultancy 2	Service company for auditing and tax consultancy, founded in 1924	9,805	7	Manager for Digital Transformation
Company R: Research Association	Organization for research and development activities, established in 1949	24,000	5	Head of Research Group “Business Models”

available for the other cases. We aggregated the information in Table III. We found that all case companies were active in various BMI dimensions although their focus varied. Appendices B to D provide a summary of representative quotes in each dimension of the business model.

IV. FINDINGS

All the incumbent companies in our case study had conducted BMI activities during their digital transformation efforts. Interestingly, most companies focused on the value proposition and value creation dimension, whereas less activities were conducted changes in the value capture dimension. Although, we basically conducted our analysis along the three constitutive business model dimensions—value proposition, value creation, and value capture—we could clearly derive a new and additional pattern from our data. Many interviewees emphasized the need of a separate phase, in which the digital BMI process is prepared and the strategy is defined before changes in the business model are conducted. We will now outline how incumbent companies conducted changes in their business model dimensions. Based upon our findings we summarize the main activities for BMI during digital transformation in Fig. 2.

A. Preparing the Strategic Setting Before Initiating Digital BMI

Innovating business models for ecosystem connectivity requires both new methods of strategic planning and the clear assignment of responsibilities. Owing to the complexity and internal resistances to change, it is crucial to ensure top management support and transparency during the BMI process. Therefore, in most case companies, clear roles and responsibilities for the digital transformation were defined [e.g., by introducing the position of a chief digital officer (CDO)]. A project manager summarized the situation as follows.

“In a first step, companies have to define what they want to do. Then they have to know how to achieve it. And in a last step... and this is important... they have to determine who is going to do it. (...) I would recommend to introduce the position CDO. This person is in charge of the process (...) and, with the introduction of key figures and milestones, every single employee can see what has been

already achieved or not. (...) The CDO should be experienced and trustworthy enough to lead the transformation process.” [Company O]

Such a role is then responsible for the digital leadership and the definition of a digital transformation strategy, which defines to what extent specific business model dimension must be innovated. However, besides being a driving force in the BMI process, they also represent a central supervisory authority, since they define concrete key performance indicators to measure the BMI progress and success. They should also be able to map the changing cost structure and new revenue stream options.

B. Innovating the Business Model’s Value Proposition Dimensions

Although recent IT developments allow to build digital customer-centric products and services, the value proposition innovation starts with enhancing a company’s digital communication and expanding its distribution channels to a digital environment. The main idea behind these rather operative approaches lies in establishing better interfaces to facilitate value co-creation with other members in the ecosystem. These changes require specific capabilities and are therefore interrelated to the value creation innovation phase. Concerning digital communication processes, almost paradoxically, some of our cases companies started by revising their web presence. Owing to the multidevice usage trend, responsive webpages are necessary to ensure that company presentations, user experiences, and interactions are of the same quality, no matter which devices customers and other actors use. This does not mean that these companies had no webpages before. However, companies realized that as digital communication nowadays is more bidirectional, a traditional web presence that is primarily marketing driven cannot establish interactive relationships. Thus they aimed to facilitate a more convenient, more automated and bidirectional customer interaction. Digital communication is usually complemented with a more strategic use of social media and/or a company-specific app to strengthen relationships with both existing and new customers, while offline customers must not be neglected:

TABLE III
CROSS CASE ANALYSIS

Dimension	2nd order theme	Case													Frequency	
		A	B	D	B	E	F	G	H	I	J	K	L	M	N	
Planning Digital Transformation																
Strategy setting		x		x	x	x	x			x	x	x	x		9	
	Digital Leadership	x		x	x	x	x			x		x	x		8	
	Key Performance Indicators		x			x					x					3
Value proposition																
Digital services		x	x	x	x	x	x	x	x	x	x	x	x	x	x	15
	Value co-creation		x		x			x		x		x	x	x	x	8
	Customized services	x	x	x	x	x	x	x			x	x	x	x	x	12
Digital communication	Speed and agility	x		x	x	x	x	x	x	x	x	x	x	x	x	11
	Homepage	x	x	x					x				x		x	6
	Social media		x	x	x	x			x	x		x	x	x	x	9
Digital channels	App	x			x	x		x	x	x	x	x	x	x	x	10
	Customer relationship	x	x	x	x	x			x	x		x	x	x	x	10
	Online-shop/ Customer Service Portal	x	x	x	x	x		x	x	x		x	x	x	x	12
	Mobile digital device							x	x			x	x	x	x	5
	Multichannel distribution	x	x		x	x		x		x		x		x		7
	Value creation															
Technology integration		x	x	x	x	x	x	x	x	x	x	x	x	x	x	13
	Implementation				x	x		x							x	4
	Process orientation	x	x	x	x	x		x		x		x	x	x	x	10
Data utilization	Capabilities	x		x		x	x	x			x	x	x	x	x	9
	Data generation	x	x		x	x		x	x	x	x	x	x	x	x	12
	Analytical methods				x	x		x	x	x	x	x	x	x	x	7
Partnerships	Data protection	x	x			x		x		x		x	x	x	x	9
	Strategic networks	x		x	x	x		x	x	x	x	x	x	x	x	15
	Customers	x					x	x		x					x	9
Corporate Culture	Start-ups	x		x			x	x			x	x				6
	Universities	x	x			x									x	3
		x	x	x	x	x	x	x	x	x	x	x	x	x	x	12
	Contemporary adjustment	x			x	x		x		x	x	x	x	x	x	8
	Work processes	x	x	x	x	x	x				x	x	x	x	x	9
	Human resource policy	x		x			x				x			x		4
Value capture																
Expand revenue model		x	x	x	x	x	x	x		x	x	x	x	x		11
	Monetize from service	x			x	x	x		x	x	x	x			x	8
	Networks and platforms				x		x		x	x		x			x	5
Costs and Budget			x	x	x	x	x	x	x	x	x	x	x	x	x	10
	Change of cost structure	x	x					x	x		x	x			x	6
	Budget for the digital transformation		x		x	x	x	x	x	x	x	x	x	x	x	8
Frequency		24	20	20	28	27	20	26	20	21	24	19	32	27	17	13

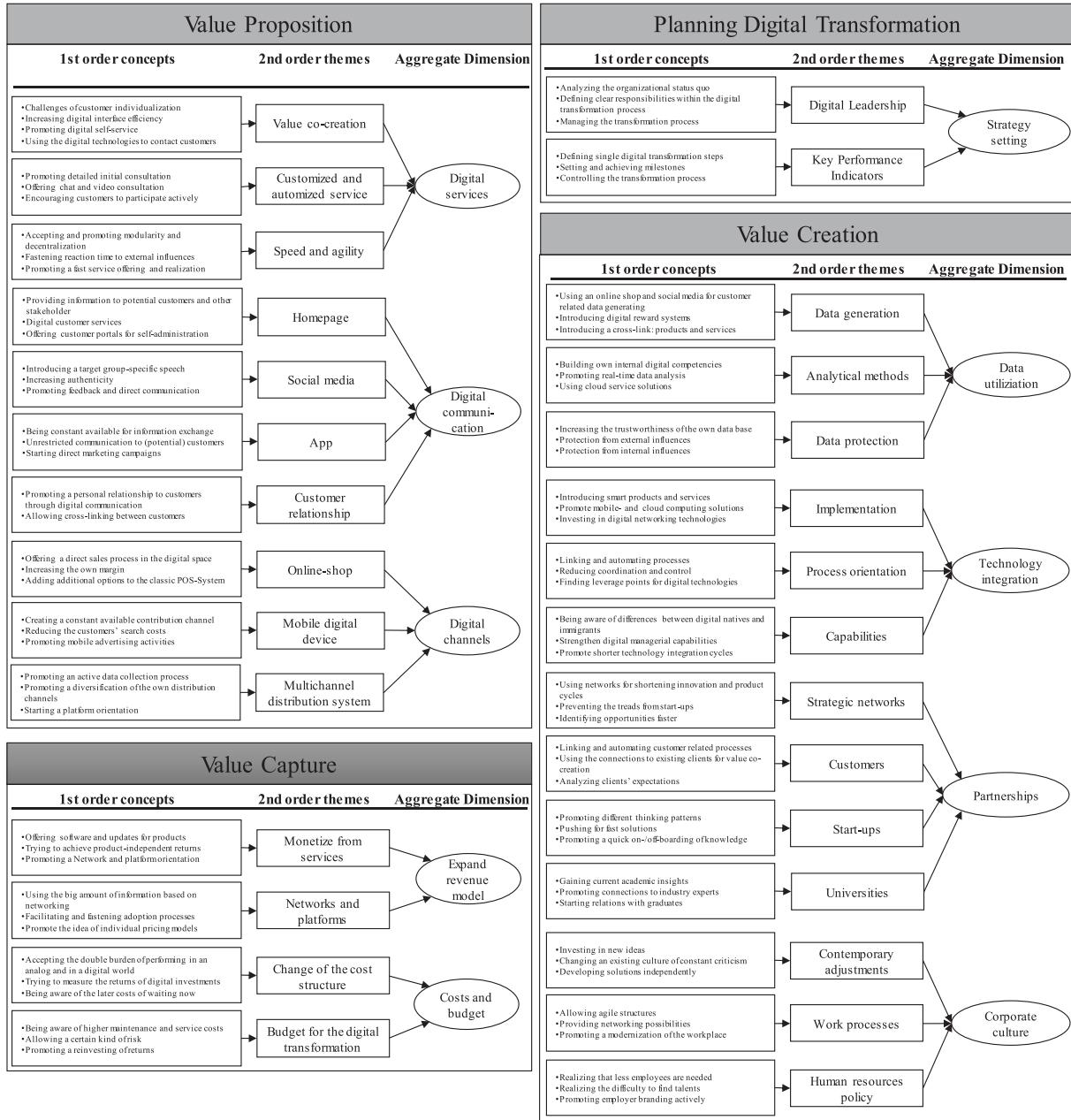


Fig. 1. Data analysis.

"We offer our digital presence, communication, apps, and online banking to everyone. Many people use it, but many people also refuse these offerings. So, in the end ... we have to do both." [Company L]

The above findings are in so far important as they show that digital relationships with customers might rely on rather trivial and basic technological changes in the first place. Instead of carrying out complex holistic digital strategies, even large firms were starting with rather basic structural interfaces to enable a bilateral communication with their customers.

Besides the structural interfaces, internal processes and roles need to be established that take the responsibility for continuous maintenance of these channels. Quite surprisingly even the larger firms were struggling to ensure that these channels were used regularly and in both ways:

"We have a homepage and we are on Facebook. Building a website or joining Facebook is not difficult. But we have difficulties in updating information. (...) Nowadays, customers don't simply want information (...) they want updates and digital communication. (...) We have to pay attention to our service and support." [Company D]

The establishment of this initial ability to connect the firms' offerings with their customers then has to be integrated with the remaining organization and strategy. Although firms have established these channels to facilitate interactions, they are then in the need to use the collected information (and data: see value creation innovation) for product development and organizational learning. Consequently, it is necessary that all online and offline communication processes with customers are gathered in databases (i.e., customer relationship management systems) and are used for customized communication and offerings. Besides

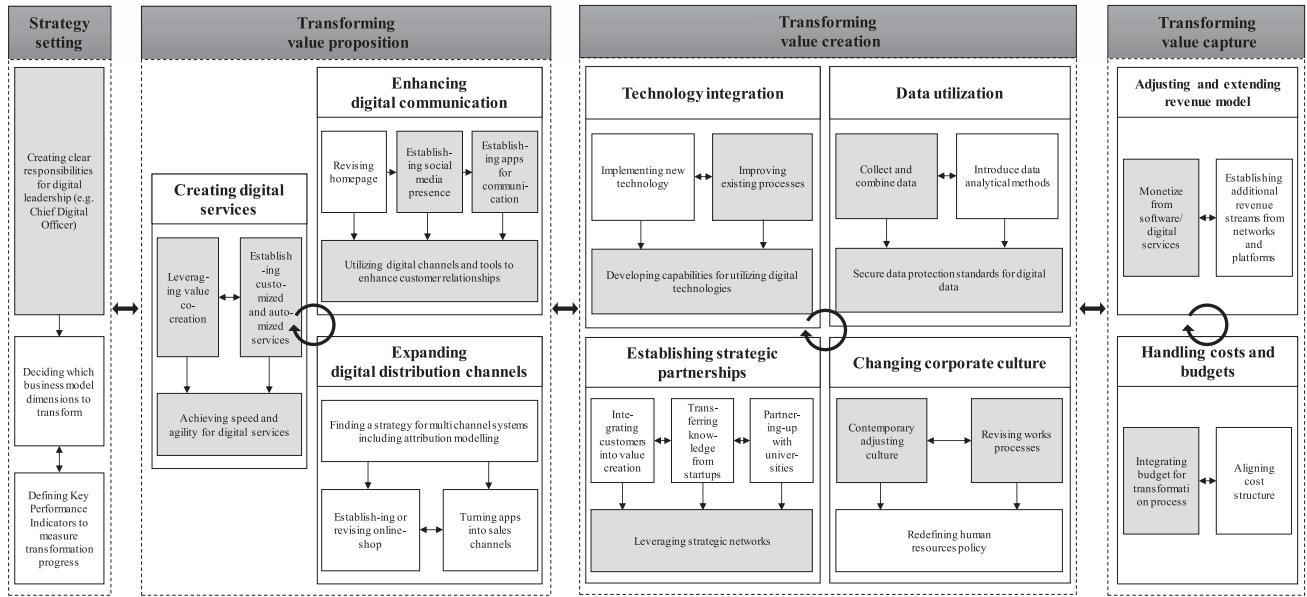


Fig. 2. Framework of Digitally Induced BMI Opportunities.

the possibility to identify customer needs anonymously via data analysis, active communication with and involvement of customers allows firms to co-create new digital services which enable the establishment of long term relationships with customers. Along this line case firms utilize digital technologies to empower the customer to customize their solutions and to continuously interact with the firm. Many case firms mention that they have established virtual platforms for crowd sourcing and open innovation activities. Related to this, interviewees emphasized that detecting new opportunities derived from customer needs is fairly simple, while providing necessary resources and establishing required capabilities in a short period of time is challenging.

“Digital technologies allow us to build a really close connection to our customers. If we understand what customers desire and create the capabilities to react to customer wishes fast enough (...) we can improve service or product features (...) and can create services and products with people. (...) The required digital technology for a constant exchange of data between companies and individuals is already available.” [Company G]

Because of the connection with other partners in the ecosystem, firms can then extend their value proposition as product-service systems that offer an “all-round carefree packages” (Company A) in which accompanying services around the main product or service of the company are offered from other players in the ecosystem. Our case firms highlight that the customization of the value proposition may be the most remarkable objective and challenge which is enabled through digital technologies.

“Customers want more and more customized, tailor made products and services. This is by far the greatest challenge that we have. On the one hand we have a standard product portfolio but on the other hand we must achieve permanent flexibility.” [Company H]

This kind of mass customization is enabled because customers can provide their preferences more easily and as the customization of digital or digital-enhanced products is doable with reasonable efforts. In turn, dominant product configurations can be adopted for R&D and new regular products.

In line with the above, communication channels are integrated with digital distribution channels. This also requires resource to maintain online and offline channels resulting in a financial double burden. However, besides the downsides of the financial double burden to run digital as well as analog distribution channels, we find that incumbent companies also question the commercial viability of digital sales channels due to fierce pricing competition.

“All these opportunities work great as long as you offer a unique product which is exclusively distributed by your company. Take electronics retailers as an example. Customers go to the shop and get a free product consultation. In the end ... they [i.e., customers] purchase the product on Amazon because it's five euros cheaper.” [Company A]

C. Innovating the Business Model’s Value Creation Dimension

In this dimension incumbents focus on design steps, such as successfully integrating digital technologies, handling data, and establishing relevant capabilities either internally or externally through partners. Necessary changes are supported by a change in corporate culture. Innovating the value creation begins with integrating new IT which. However, we see that most case firms, digitalization was used to optimize current processes and workflows in order to realize efficiency gains.

One of the main resources for value creation in digital business models is data. Our analysis suggests that the data collection process does not represent a bottleneck in the value creation innovation. Most of the case companies indicate that data are readily available and are also collected. Interestingly, however,

companies see a major challenge in the process of making sense of the data and transforming data into a basis for decision making. Combining data, detecting data patterns, extracting valuable information are less developed yet important requirements for digital BMI in incumbent companies.

"Collecting customer data is not the problem in today's world. The challenge is to use the data and derive a benefit from them." [Company J]

"In the end, we need the technology to generate a benefit from the available data. The kind of data is not important. Customer data, machine data, or other kinds of data. (...) The success of a company in the modern world depends on data processing. Services, IoTs, Industry 4.0 (...) You must have the capabilities to handle the large amount of data." [Company F]

We also come across substantial restrictions of our case companies regarding the requirements of data security. Many case companies put a high emphasis on their responsible behavior in using customer data. Furthermore, it was mentioned a few times that data protection in Germany as compared to e.g., the U.S. puts substantial boundaries to what can be done and to what extend available data can be used. This is not just a formal requirement but is also closely related to the firms' reputation, as firms want to be perceived as trustworthy and reliable when it comes to data.

"On the one hand, businesses have to protect the data from external dangers, for example hacker attacks. On the other hand, internal factors like careless employees can be dangerous, too." [Company K]

Thus, incumbents that are able to rapidly establish or acquire the necessary competencies to analyze data responsibly are likely to benefit from competitive advantages. Therefore, one of the main objectives of the changes in the value creation dimension is that the relevant resources and capabilities for the new digital processes are established. Companies often lack the relevant digital capabilities. Thus, firms need to find ways to establish the relevant capabilities. Most of the case companies actively invested in internal capability building across all levels of the organization.

"We have established e.g., digital know-how sessions, these are two hour meetings in which employees can get an easy introduction into start-ups, cloud, IOT etc." [Company L]

As companies often report that it is difficult to establish the relevant digital capabilities through training and hiring, it is essential to also rely on partnerships with stakeholders that already possess the relevant capabilities. Company G, which is a traditional family firm that was established more than a century ago for instance concluded that of course new competences and capabilities need to be established but that these also need to fit into the organization. Besides that, especially in more rural areas, the availability of digital experts might be limited. Therefore, all cases emphasize the importance of collaborations with partners who can compensate for the internal lack of digitalization capabilities.

"Partnerships are a central aspect of a change process in a company. Especially when we talk about chances regarding digitization, most

businesses do not have the capabilities to develop everything internally. (...) You need partners and experts who can help you. And it does not matter who they are. (...) You need high quality and fast solutions to your problems." [Company G]

It can be concluded that companies who successfully want to transform their business models should establish a network with different partners. The case companies collaborated with various stakeholders such as technology providers or B2B customers, but also with universities and/or start-ups who can serve as a "window on technology." As there is not a universal solution to BMI, collaborative value creation benefits from diversity and boundary spanning.

"If there are players who are successfully utilizing digital channels and ecosystems and are also successful that I believe it is mandatory to talk to them. These can be Universities, Associations and [others]." [Company M]

Integrating these partners is not only beneficial but often necessary, as incumbent firms often lack the agility to close capability gaps internally and could thus fall behind more experienced partners or especially start-ups that were built around new digital technologies.

In order to facilitate these new approaches to value creation changes in the corporate culture are needed. Our interviewee from case company D mentions "from my opinion digitalization starts in the heads of the people." As work processes are continuously improved owing to the integration of new IT, the corporate culture requires contemporary adjustments. Although this task is obviously challenging, some basic values and traditional success factors internalized in the culture of incumbents may need to be revised. This is especially the attitude towards knowledge disclosure and the value of external knowledge.

"There is a cultural change from "knowledge is power" towards "sharing powerful knowledge". At the end, we benefit from knowledge exchanges with others [i.e., customers and competitors]; and we do this intensely. [Company A]

Interestingly, the case companies utilize some more structural changes for facilitating the emergence of a more digital and failure tolerant culture. These approaches comprise using modern working tools such as design thinking, redesigning office spaces or changing obvious symbols such as introducing "no-tie-policies." Finally, companies follow new HR policies as a basis for the rejuvenation of their workforce.

D. Innovating the Business Model's Value Capture Dimension

Among the three business model dimensions, the innovation of value capturing is a challenging and a very sensitive issue. This change dimension includes two design steps, in which new revenue models and new cost structures are defined. All case companies agreed that they are working on new revenue models, although, many of them are still not finished and see more potential than the already realize. Companies are trying to generate new revenues and are experimenting with substituting revenues. The dominant change in revenue models stems from additional revenues that can be generated from additional sales of digital services. This is mainly because digitally enhanced services can lead to additional incomes. We see that the options

for generating additional revenues however are very diverse and very specific to the offerings of the individual company. Our cases further show that, it is often not clear how to bargain from these additional services due to the "for free mentality" of the Internet.

"We face significant difficulties to generate a new source of income as the expectation that digital things are provided for free causes that many customers, companies as well as private customers are not willing to pay extra money for these." [Company J]

In addition to revenues that can be directly generated for customers, all case firms realize the value of newly generated data. However, none of the firm so far established a revenue model that generates direct revues from selling these data. The primary value lies in the use of data for a better understanding of the customer. This, then, leads to more individualized offerings and in turn enables individual price differentiation. Additionally, individualized offerings and additional services lead to enhanced customer retention, resulting in higher customer lifetime values and therefore higher profits.

Finally, the case companies have realized that digital transformation may enable the generation of indirect revenues (e.g., through commission fees). However, we see that although most companies have realized that platform business models may have a great potential for revenue generation in ecosystems, companies are struggling to radically change their revenue models. Together, we can conclude that the value capture dimension is the least established among the case companies. Our interviewees all see great potential for new revenue models in ecosystems, but there is obviously a gap between the expected and the realized potential. Furthermore, we were even confronted confidentiality concerns in one case as this company did not want to disclose their strategic projects in the area of new revenue models.

Besides the potential for revenue generation firms are also considering the cost aspect. Concerning the cost structure, it is clear that the fundamental changes a company undergoes are also reflected in costs and expenses. In particular, as revenues of digitalization efforts are often uncertain or hard to quantify, the full potential of digital initiatives is not always captured.

"We have to keep an eye on the costs. The investments in digital transformation may lack in a different project." [Company N]

Digital technologies extend our field of action and may shift our key areas. One must assess how reasonable high investments in IT are. Besides high acquisition costs there are monthly maintenance costs and then you need an employee who supports that. We need to differentiate whether this makes sense or not." [Company H]

However, refusing necessary changes is short-sighted since opportunity costs of waiting and or retarding innovation are generally associated with higher expenses.

"We have to consider the opportunity costs of waiting. (...) At a certain point, you have to digitize." [Company M]

Consequentially, incumbent firms need to find ways to dedicate the relevant budget to projects for digital BMI. One aspect is the definition of key performance indicators for the innovation process' success or failure. As many projects might not directly lead to financial returns that can be related to the investment in the firms accounting, traditional key performance indictors

require redefinition. Another relevant aspect is that digitalization might lead to cost savings in some areas and therefore frees up money for investments into new revenue models.

"To get the money for new business models, we need to optimize the current business. For instance, by atomization of key processes money and time can be saved and I will get faster and this in turn helps me to free up money and resources for more experimental projects." [Company E]

V. DISCUSSION AND CONCLUSION

This article sought to provide a more holistic view on how business models of incumbent firms were innovated during digital transformation and to demonstrate concrete design options/steps during this process. Based on the analysis of our collected qualitative data, we were able to provide an aggregated framework of digital BMI by presenting different design options along a preparatory phase and the constitutive business model dimensions (see Fig. 2). Our empirical analysis revealed nine main activity blocks incorporated in the digital transformation process: creating digital services; enhancing digital communication; expanding digital distribution channels; technology integration; data utilization; establishing strategic partnerships; changing corporate culture; adjusting and extending revenue model; and handling costs and budgets. In comparison of the activities in the various case companies, we saw that each company put an emphasis on some particular areas in their business model. Although, the epicenters for the start of the BMI process were not the same, we realized from the cross-case comparison, that each company conduced some activities in each business model dimension and that even companies that focused primarily on one dimension have adapted the other dimensions of the business model as well. We highlighted those activities in light grey that were mentioned by more than half of the case companies, as these may represent the common set of BMI activities during digital transformation.

A. Theoretical Implications

Following Fjeldstad and Snow's [28] request for an analysis of how new digital architectures effect BMI and Massa *et al.*'s [29] call for a deeper analysis of important activities, outcomes, and individual involvement in the BMI process, the article contributes to the evolving discourse on BMI for and during digital transformation.

First, the aggregated findings of our case analysis in Fig. 2 provide a comprehensive overview of potential design options for the BMI process. Therefore, we contribute to the ongoing research on BMI management [e.g., 83]. Previous European studies on digitalization and BMI in incumbent firms have paid attention to the determinants of digital BMI [23], [43], [45]. Furthermore, studies investigated the integration of particular technologies in the business model [5], [6] or the utilization of digitalization strategies [84], [85]. We provide a more holistic operational perspective on digital BMI. In support of Chanias *et al.* [85] we saw in all companies that the process of developing a more digital BMI was not linear, but rather iterative. This is because most companies did not follow a clear digitalization

strategy. We found that the preparatory phase of BMI during digital transformation did also not show a homogenous picture. Whereas about half of the case firms operated without having a formal planning phase and/or role (i.e., CDO) for the transformation, we however saw, that this planning phase and digital strategy making [84] was key to accelerate the transformation process and to prevent internal redundancies.

Second, although the analysis revealed that companies followed a BMI logic during their attempts for digital transformation, the results were surprising insofar as some of the activities that were identified at a first glance seem to be rather basic. In particular, the emphasis of many companies of the digitalization of their communication was surprising as intuitively one would have assumed that most companies have concluded these processes already. However, also Matarazzo *et al.* [51] found similar pragmatic changes in incumbents' business models when analyzing the digital transformation of the value proposition in Italian SMEs. Whereas the literature often prescribes more disruptive approaches to digital BMI [e.g., 20, 60, 86], the empirical reality of incumbent firms may actually lack behind. We see that even firms that were identified as exemplars of digital transformation mostly dealt with rather basic activities, such as establishing interfaces, collecting data and enhancing their existing product and service portfolio with software. This supports also recent findings of Li [24] who concludes "the reconfigured business models are often not 'new' in the unprecedented sense. BMIs are primarily reflected in using digital technologies to enable the deployment of a wider range of business models than previously available to a firm." More disruptive changes in particular in relation to revenue models or fundamentally new logics of doing business were at least not yet established in any of our case companies. This may allow two interpretations: First, incumbent firms in particular in the German context may be oriented towards more conservative and incremental changes [11]. This may be related to the empirical basis (i.e., start-ups [87] or extreme cases such as Amazon or Google [88]) of those other studies finding more radical approaches. Laudien and Daxböck [89] supports that BMI activities of average market players may not mirror those of a few iconic role models. Similar arguments are mentioned by Hock-Doepgen *et al.* [90] who analyze BMI in SMEs. Second, in line with Furr and Shipilov [91] this finding may also be a sign that digital transformation does not necessarily require radical BMI but that firms may be advised to carefully and holistically work through the dimensions of their business model instead of reinventing it.

B. Managerial Implications

Our research results also have high practical relevance. Managers can use our findings to better understand the process of BMI during a digital transformation process. By aggregating and categorizing the BMI various activities, we provide different design options, which allow managers to plan and execute the aspired BMI process. We show common factors that are important for a digital transformation of the business model, regardless of a company's size and industry. Our framework is of a high relevance for managers as it can be used twofold: First, it can be considered as a basis for cognitive reflection or benchmark

of own activities when digital transformation activities were already started. Second, it provides a basis for a structured planning and controlling of BMI during digital transformation. This may be particularly relevant during digital strategy making.

C. Limitations and Future Research

While the article has provided valuable insights that contribute to understanding BMI during digital transformation, there are limitations. First, although digitization is a global phenomenon, the article sample consisted of only German companies, which may make our findings specific and restrict them to the economic and societal environment of Germany. This may also be a reason for the comparably incremental nature of most case companies' BMI activities. Therefore, we encourage future research that replicates the article in cultural contexts that are less risk averse or in which the industry structure is generally more dynamic as compared to Germany (e.g., China).

Second, we have to emphasize that the data were collected from 2016 to 2017. Although we believe that the results are still relevant for incumbent firms in their digital transformation, digitalization, and digital technologies are areas that are developing very fast and characterized by continuous change and innovation. Therefore, it could be possible, that the emphasis of the firms in our sample on digital communication may have shifted to operations management or internal processes or that the role of the CDO would have been complemented with informal roles and more agile organizational structures if the article would be repeated today. In particular, the digitalization boost by the COVID-19 [92], [93] pandemic may have shifted the focus of incumbent firms, calling for continuing research that investigates BMI during digital transformation.

Third, although the article has benefitted from expert insights of decision-makers and persons in charge of digital BMI in each particular company, our empirical basis is limited to, only one key informant interview per company. Although, all case companies were conducting company-spanning digital transformation projects, informants may have emphasized specific issues more, owing to their subjective perceptions and weighting. Thus, our findings may not be free of potential informant as well as retrospective bias.

Fourth, the article explored the BMI activities of incumbent firms during digital transformation. However, as we do not know the actual performance outcomes of each digital transformation projects, we could not conclude on whether or not these design elements are also success factors. Without longitudinal data on the preparation, execution, and later effects of a BMI during digital transformation, the article is naturally unable to analyze the evolution and long-term consequences. Thus, researchers should concentrate on longitudinal studies and a combination of qualitative and quantitative data to identify those changes in the business model dimensions that may have the most beneficial effects for incumbent firms.

Finally, owing to the nature of our qualitative research approach, and the limited number of interviews, the generalization of our results may be questioned. However, our chosen cross-industry sample somewhat mitigated these concerns.

APPENDICES

APPENDIX A
INTERVIEW GUIDE (SHORTENED)

	<i>Business Model Innovation</i>
<i>Value Proposition</i>	<p>In your opinion, to what extent do the new possibilities in digital space affect the value proposition you make to your customers? What influence do new/digital possibilities have on the relationship between companies and customers?</p> <ul style="list-style-type: none"> - To what extent does the way in which offers are submitted change? - What effects does digitalization have on sales channel selection and sales promotion? - What are new ways of communication between your business company and your customers? - Which new jobs were created in your business company to proof value proposition? - What are potential risks of involving digital technologies into the value proposition to the customer?
<i>Value Creation</i>	<p>To what extent do the new digital possibilities affect the performance of your company? How do new digital possibilities affect your services?</p> <ul style="list-style-type: none"> - What opportunities do exist to involve customers in the service delivery process? - Regarding digital technologies and new opportunities, what role do partnerships play in your business model? - How would you characterize your corporate culture in terms of digital technologies? - Which opportunities does "Industry 4.0" offer for your business model? - Which opportunities does the Internet of Things offer for your business model? - What methods do you use to generate customer data? - What is the purpose of this data acquisition? - Which special technologies does your company use for data analysis?
<i>Value Capture</i>	<p>To what extent do the new digital opportunities affect your revenue model?</p> <ul style="list-style-type: none"> - To what extent does digital technology offer the opportunity to generate new revenue streams? - Which costs arise and which costs incur? - How do you benchmark your value capture system with competitors? - How can the new revenue streams be used in common? - How do you estimate the problem that the costs of investing in digital technologies are immediate, but the impact is only discernible in the medium or long term? - How did digital technologies change the cash flows of your company? - What are potential risks of integrating digital technologies into the value capture process?

APPENDIX B
PREPARING THE DIGITAL BMI

<u>Topic</u>	<u>Preparing the digital BMI</u>
Design options	Creating the position Chief Digital Officer, to take charge of the digital BMI and bridging the gap between the strategy planning and ecosystem connectivity. The CDO defines the business model dimensions to be innovated and the related KPIs.
Evidence by expert statement	<i>"A CDO, I mean a Chief Digital Officer, is in our opinion the best solution. A CEO can also carry out digitalization, but in most cases, he does not have the experience, the educational background, or the trustworthiness to conduct digital transformation projects and cannot steer the right programs. [...] In contrast, the CDO represents exactly the right intersection to answer questions about customer needs, questions from the marketing and sales department, and how to transform the business model. [...] If these questions and tasks are coordinated at the C-level by a CDO, then this is exactly the right approach." [Company P]</i>
Cross-case Analysis (contrasting statements)	No additional statements.

APPENDIX C
VALUE PROPOSITION INNOVATION

Topic	Communication	Distribution channels	Digital services
Design options	Companies should have an own homepage, including a digital customer center. By using social media and apps, they can have a more digital communication process for a potential ecosystem connectivity. Using different digital interfaces, they can reach various customer groups at a more individual and emotional level even across digital architectures.	Companies should use a multichannel sales system in their sales process, which includes both digital and analog distribution channels. Products and services can be offered in an own online shop and/or partner shops. Also, mobile devices should not be neglected to facilitate a future ecosystem connection.	Digital services are a key aspect for BMI with the goal of creating ecosystem connection. Through this, companies can increase customer experiences, can modularize different services, and can then offer them on product-independent ecosystems.
Evidence by expert statement	<p><i>"Nowadays, our value proposition starts on our website."</i> – [Company A]</p> <p><i>"If we manage to satisfy the needs for constant availability of current information and easy, hurdle-free means of communication, then we have a more complete picture."</i> [Company A]</p> <p><i>"Yes, this is our full range: social media, blogs, Twitter, Instagram, etc. We also started to offer 'digital branches' for younger people."</i> [Company C]</p>	<p><i>"We need a certain extent of diversity to get this bandwidth in our portfolio, because we want to address many people."</i> [Company E]</p> <p><i>"... because the customer relationships are changing so much and especially so quickly, there is no time to amend the sales channels accordingly at the same speed."</i> [Company A]</p>	<p><i>"Topics like the Internet of Things and also Big Data value creation processes will be extremely optimized and will also be made more efficient. From a communication perspective, the interfaces to the customer are noticeably simplified, so that the customer is closer to the actual performance with a higher transparency. Service will surely become more modular and decentralized. Thus, production aspects are split and then, at some point in time, decentral distributed across ecosystems."</i> [Company G]</p> <p><i>"The physical product inside a business model takes a back seat and is enriched with digital services. Customer experiences and benefits are to be increased in this way. Products still need to be good, but in the future, the differentiation is about which digital services can be offered around a product."</i> [Company L]</p>
Cross-case Analysis (contrasting statements)	<p><i>"We have to ask ourselves what we should use to be successful. In the area of communication technologies, there are mobile phones, e-mails, websites and Facebook. Obviously, the Internet appearance is important. But you also have to be cautious about the support. If you offer a service, you have to work on it with full commitment. We ask ourselves if we can manage this, or if the cost would exceed the earnings by far. The possibilities are huge, but there is also a risk."</i> [Company H]</p> <p>The business-to-business area is fairly restrained: <i>"Even in the automotive sector, where we have the highest number of customers, we are only talking about forty to fifty companies. The value proposition we offer to them is not via adverts and social media activities. Here, the digital transformation has no points of attack, because the communication is personal. Obviously, also via digital channels. But there are no points of attack in general."</i> [Company F]</p> <p><i>"They... often lose relationships to customers."</i> [Company F]</p>	<p><i>"At least it is questionable if a comparison of sales channel systems between B2B and B2C companies make sense. The company's size is also a very relevant factor. There was no further analysis, owing to the fact that this work is researching design possibilities inside processes and systems."</i> [Company I]</p>	The establishment of a transformation to digital services is actively pursued in all case studies.

APPENDIX D
VALUE CREATION INNOVATION

Topic	Partnerships	Corporate culture	Data collection process	Technology integration
Design options	Partnerships are key to the BMI ecosystem connectivity, since companies are no longer able to master all of the challenges they face. A strategic network of partners (including startups and universities) offers possibilities of rapid exchange of knowledge and a certain flexibility.	Corporate culture plays a key role in the implementation of the digital innovation process of the business model ecosystem connectivity. Executives must be involved, employees must be motivated and cared for, and the culture should become modernized.	While data generation has been a major problem in the past, digital data is now easy to create. Thus, data management (analysis procedures and uses) should, in the case of a BMI for ecosystem connectivity, play a key role in the service provision.	Companies should integrate digital technologies into the organization to absorb them into processes, products, and services. This creates the basis for networking and the current challenges such as Industry 4.0 or the Internet of Things.
Evidence by expert statement	<p><i>"Significantly faster innovation cycles and we have significantly higher scaling possibilities over digital possibilities. Small businesses can destroy our business with simple possibilities."</i> [Company H]</p> <p><i>"As a company, I need to be able to survive in the long term. A partner or alliance structure that allows me not to have to reinvent the wheel every time, but to rely on experienced and specialized partners. It is about speed and the avoidance of economic risks. Otherwise, I would have to invest myself in all these things, which takes a very long time and costs a lot of money."</i> [Company J]</p> <p><i>"We have to choose strong partners with whom we cooperate and then ensure a certain speed, which we cannot always guarantee, as a large group compared to small innovative companies or startups."</i> [Company G]</p>	<p><i>"Challenges of digital architectures are not just a matter for the individual departments, but only through the cooperation of very diverse experts from all areas. This is why we must create the basic conditions."</i> [Company K]</p> <p><i>"You have to give people the possibility to interconnect, and digitalization also helps. For example, if they have a social tool through which people can communicate, this helps to talk across hierarchies, and then they are more likely to meet communities."</i> [Company F]</p>	<p><i>"The more data can be collected about a customer, the better the offers can be tailored to them. King's discipline also must create an individual approach in which the customer is also perceived as an individual with their buying behavior, in their interest as well as in their social environment."</i> [Company B]</p> <p><i>"Nowadays, I have somewhere in the background, computing capacities in servers or applications that allow me to connect information to a yet unknown extent to for instance recognize new patterns or to gain new insights. This does not always have to be Big Data, but these research logics, which can link data from different data sources, can generate much information for me as a company."</i> [Company K]</p>	<p><i>"A classic physical analog object is provided with micro-electronics which allows me, for example, to identify the object digitally. I can localize it, I can communicate with it, and these aspects that result from this are very valuable for the business segments, especially in the B2B area, since the generation of data creates a transparency about the use of the product. They can be interesting for users, but they can also lead to the interlinking of objects. The development of algorithms also brings advantages, because our products will also be present in a digital future. We have to make these products intelligent and have to connect them to systems. These systems require high software intelligence. We would like to teach the products to see and think. The focus is on decisions by self-learning algorithms."</i> [Company F]</p>
Cross-case Analysis	Partnerships were seen as positive by all companies.	There were the greatest differences in the expert statements regarding employee age. There is a gap between digital natives and digital immigrants in companies, and one wonders how to close this.	A cross-case analysis shows that no company has to start at an absolute zero point. However, the ideas in the various sections and the company sizes are very different.	The fact that digital technologies need to be integrated was mentioned by all the experts. However, some emphasized the actual technology, while others see the integration (employees, mindsets, change) as a real success factor.

APPENDIX E
VALUE CAPTURE INNOVATION

<u>Topic</u>	<u>Revenue model</u>	<u>Cost structure</u>
Design options	Through further development or a complete reorganization of different processes, these can be individually offered and monetarized independently of the product in the ecosystem.	The additional costs associated with BMI for ecosystem connectivity force companies to restructure their cost structure. Clear budgeting for the process, technologies, and implementation simplifies the process.
Evidence by expert statement	<p><i>"The latest digital enhanced services make them more valuable. And there are of course many revenue models that you can put behind it and make money with it. And of course you have the purely digital services that you have due to the data or other services. The services will certainly be more modular and decentralized. So, production factors are split up and then decentralized at any time distributed across ecosystems."</i> [Company L]</p>	<p><i>"You have to look what opportunity costs you have. What will it cost me in the future if I don't take these steps now? This means: Ok, the market will overtake us and then the company/ and the business will be even more difficult."</i> [Company O]</p> <p><i>"The economic loss is not geared to digital change to meet customer needs would be significantly higher than today's costs in IT infrastructure, IT security, and the expansion of digital channels and, most importantly, the employees' abilities to deal with it."</i> [Company M]</p> <p><i>"And new investments are no longer available to finance the classic business. You can spend every euro only once."</i> [Company R]</p>
Cross-case analysis	All surveyed companies are looking for new revenue models, although it can be seen that companies in some sectors actively search for new revenue models (banks), whereas follow trends in the industry (retail).	A comparison of the expert statements shows how closely the individual parts of the business model are connected. Some experts refer to the willingness to invest in top management, others talk about long-term employee and cultural change, and others compare investments and returns in different time horizons.

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