Digitization capability and the digitalization of business models in business-to-business firms: Past, present, and future

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ABSTRACT

While the use of data in business-to-business marketing is not a new phenomenon, the digitization and digitalization of business-to-business firms' business models have recently attracted a great deal of attention. With the aim of creating an overview and consolidating this stream of research, the present paper offers a brief historical overview of research on digitization and digitalization in business-to-business markets – concluding that this discussion has a long tradition and, thus, is not a new phenomenon. We develop a definition of digitization capability as a basis for discussing how a firm's digitization capability interacts with its business model to allow for data-enabled growth, i.e. its digitalization, and we highlight promising avenues for future research.

1. Introduction

Digital technologies have changed the way business-to-business firms act in business markets in terms of what they sell (their value propositions, e.g., Gandhi, Thota, Kuchembuck, & Swartz, 2018) and how they sell it (their value demonstrations, e.g., Syam & Sharma, 2018)—and they also pose new requirements to a firm's capabilities. Although the topic of digitalization is currently prominent in the minds of many practitioners and academics, digitization and the digitalization of business are not new topics of interest.[1] One of the earliest applications of computing power in business was the computerized registration of 26 million US citizen's employment records by IBM equipment to support the Social Security Act in 1935.[2] Similarly, the first conference on artificial intelligence was held at Dartmouth in 1956. Hence, topics like big data (i.e., large amounts of data) and artificial intelligence have been discussed for decades and, therefore, have long been fields of interest for practitioners and academics alike. As such, the current focus on the notion of data-driven disruption is not an issue of "newness." Instead, it is most likely related to the growth in available data made possible through access to cost-efficient equipment for data collection and access to computing power needed to handle analytics: more data exist today than have done so before in history (Smolan & Erwitt, 2012) – and approximately 5 billion gigabytes were generated from the beginning of recorded history until 2003, whereas 5 billion gigabytes of data were claimed to be generated every 10 seconds in 2015 (Zwitter, 2014). Therefore, growing academic interest into the topic arguably reflects this empirical trend—although it has long been accepted that technology is altering the nature of competition resulting in a 'new competitive landscape' (Bettis & Hitt, 1995), albeit the evolutionary nature of competitive change is arguably reflected in different phases (Table 1).

As digitization and digitalization (which we define in the next chapter) are major trends that affect many aspects of business-to-business marketing, a number of researchers have examined these issues in numerous studies based on a variety of research questions, methods, and theories. For example, Industrial Marketing Management has published over 100 articles over the past five years relating to digitization, digitalization and digital. Yet, directions for future research on the topic are unclear due to conceptual ambiguity and lack of overview. For instance, Ross (2017) argues that digital and digitized are two very different organizational phenomena, where the former concerns digital value propositions in the marketplace and the latter relates to the transition from analogue data to digital data which streamlines existing processes—while others use the terms interchangeably. In addition, current research efforts appear dispersed and unconnected as topics vary and connections are not made. By adopting a business model

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[1] For descriptions and interesting displays of the development of computing power for business use, please visit the Computer History Museum in Mountain View, California (www.computerhistory.org). The museum's exhibitions highlight the development of the many business-relevant applications that serve as the basis for the current wave of digitization.
[2] As described at www.ibm.com.

Table 1
Phases in digitization research.

	Phase 1	Phase 2	Phase 3	Phase 4
Time	Pre-1990	1990–2000	2000–2010	After 2010
Phenomena	Digital data	Digital platforms and communication	Digital efficiency increases	Digital as the new normal
Main focus	Experimentation	Disintermediation	Exploitation	Integration
Dominant activities	Digital technologies are explored as a new way of working and developing businesses	Digital technologies are used to connect with customers, either directly in a costefficient digital way or via platforms (Dot Com wave)	Digital technologies are used to optimize business flows—mainly to increase efficiency of known business processes	Digital technologies are wide-spread and become an accepted fact of business rather than being special or extraordinary

perspective on the different conceptualizations, it becomes clear that some studies deal with streamlining and digitizing capabilities (digitization) and others deal with value propositions (digital/digitalization) which takes place in different places in a business model (Ritter, 2014). Hence, the application of a business model framework to discuss the various conceptualizations of key constructs can help clarify meanings and differences.

We address these challenges by providing a set of definitions to increase conceptual clarity, by suggesting (i) a distinction between digitization and digitalization, (ii) a conceptualization of a digitization capability, as well as by (iii) developing an overview of the evolving landscape of digitalization research using a business-model framework that can simultaneously structure existing insights and inspire future work.

We make three key contributions to the literature on digitization and digitalization in the industrial marketing literature. First, we provide definitions and a conceptualization of a firm's digitization capability as consisting of three dimensions: data, permission, and analytics. Second, based on the alignment squared business model (Ritter, 2014), we argue that a firm's digitization capability is an antecedent to a firm's digitalization, as this capability can impact all elements in business models. Third, we outline avenues for future research.

2. Digitization vs. digitalization

In recent years, the discussion regarding the use of data in businesses has typically been gathered under headings such as "digitization", "digitalization", and "digital" (e.g., Brennen & Reiss, 2016; Ross, 2017; Weill & Woerner, 2018). While some of the authors use the terms interchangeably, others offer distinct—but varying—definitions for the two terms (Table 2). For instance, Ross (2017) posits that there is a difference between being digitized and digital: Being digitized entails moving from analogue to digital data for streamlining existing processes such as building an operational backbone or introducing ERP-systems through a standardized process where the end-state is known. In contrast, being digital relates to digital value propositions which necessitate ongoing, and iteratively, testing and revising offerings in the marketplace, as the end state is not known (Ross, Beath, & Mocker, 2019). Coreynen, Matthyssens, and Van Bockhaven (2017) similarly focus on data application but use the term digitization in a slightly different manner that does not explicitly distinguish between digitization and digitalization. We argue to maintain the above distinction as it carries important implications for organizational transformations, as they can pursue different paths depending on their underlying desired end states. Below we will therefore clarify our conceptualizations which are partially based on Brennen and Kreiss (2016), as they build their distinction between digitization and digitalization on an extensive, and interdisciplinary, review of the literature that is relevant for the field of industrial marketing.

In its basic form, a digit is a number. Information technology uses binary digits, such that a digit can have a value of either 0 or 1. When digits are used to represent data, the data become digitized. In contrast, analog data are not available as strings of zeros and ones. In line with Brennen and Kreiss (2016), we use the term "digitization" to describe the transformation from analog to digital data: "the technical process of converting streams of analog information into digital bits of 1s and 0s with discrete and discontinuous values" (p.1).

Digitization, i.e. the increased availability of digital data enabled by advances in creating, transferring, storing, and analyzing digital data, has the potential to "structure, shape, and influence the contemporary world" (Brennen & Kreiss, 2016, p. 6). For discussing the impact of digitization, we define the term "digitalization" as the application of digital technologies—in our work related to the application in businesses; in line with Brennen and Kreiss' (2016) interpretation of digitalization in relation to digital communication as "to broadly refer to the structuring of many and diverse domains of social life around digital

Table 2
Selected definitions of digitization and digitalization.

Authors	Construct	Definitions
Coreynen et al. (2017) based on Hsu (2007)	Digitization	"the increasing use of digital technologies for connecting people, systems, companies, products and services"
Brennen and Kreiss (2016) based on Oxford English Dictionary	Digitization	"the action or process of digitizing; the conversion of analogue data (esp. in later use images, video, and text) into digital form."
Brennen and Kreiss (2016)	Digitization	"the material process of converting analog streams of information into digital bits."
Ross (2017)	Digitization	"Digitization involves standardizing business processes and is associated with cost cutting and operational excellence."
Brennen and Kreiss (2016) based on Oxford English Dictionary	Digitalization	"the adoption or increase in use of digital or computer technology by an organization, industry, country, etc."
Brennen and Kreiss (2016)	Digitalization	"the way many domains of social life are restructured around digital communication and media infrastructures."
Ross (2017)	Digital	"To become digital, leaders must articulate a visionary digital value proposition. This value proposition must reassess how digital technologies and information can enhance an organization's existing assets and capabilities to create new customer value."

communication and media infrastructures" (p. 6), i.e. digitalization is the impact of digitization on society. As such—given our focus on business-to-business issues—digitalization refers to the application of digital technologies that brings about changes in business-to-business firms and business markets caused by digitization.

In the following, we will use the distinction between digitization and digitalization by first offering a discussion of a firm's digitization capability, i.e. the capability of firms to operate digital data. Thereafter, we structure arguments and illustrative cases of digitalization, i.e. the utilization of digitization in business, using a business model framework. We also outline the historical development of data utilization, i.e. digitalization, in business-to-business firms.

3. Digitization capability

A capability is a qualification or skill necessary to perform a certain activity (Day, 1994; Drucker, 1985; Li & Calantone, 1998) or, in other words, "a set of skills and proficiencies needed to achieve a goal" (Sabnis, Chatterjee, Grewal, & Lilien, 2013, p. 56). Consistent with this view, Grant (1996, p. 377) defines an organizational capability as "a firm's ability to perform repeatedly a productive task which relate[s] either directly or indirectly to a firm's capacity for creating value through affecting the transformation of inputs into outputs." The repetitiveness aspect is often highlighted by researchers who view capabilities as entailing routines (e.g., Winter, 2003).

As a supplement to studies of firms' digitization efforts (e.g., Lenka, Parida, & Wincent, 2017; Nolan, 1979), our own research[3] identified three types of fundamental skills related to digitized business models: data, permission, and analytics. While other studies have similarly sought to conceptualize firms' digitization capabilities (e.g., Gupta & George, 2016; Lenka et al., 2017), our conceptualization is different, as we not only include technical and analytical activities, but similarly incorporate a dimension related to both regulatory, contractual and societal permissions. We suggest that the combination of skills in data, permission, and analytics represents a firm's digitization capability (Fig. 1). By doing so, we nuance existing studies on digitization capabilities, as we suggest that this capability cannot be solely comprised by technical and analytical elements—regulatory, contractual and ethical considerations must similarly be included when collecting and analyzing data. We shortly discuss the three dimensions:

First, firms work with the generation, transmission, and storage of data, as well as access to that data. Commercial value cannot be extracted from data if the firm does not generate or have access to data, and if that data is not transmitted and stored appropriately. Therefore, data-related activities are logically an essential dimension of a firm's
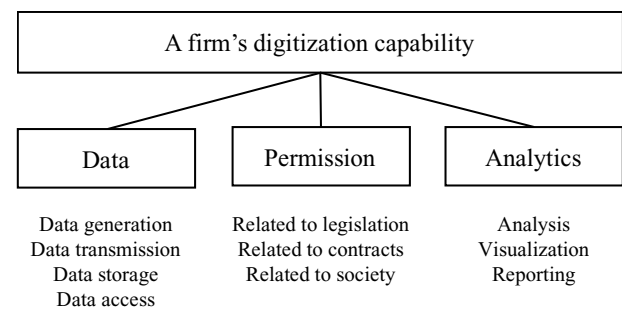
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[3] In a three-year research project, 100 firms were surveyed and nine capabilities were identified necessary for data-driven growth. Of these, we consider three as basic or fundamental capabilities enabling digitization in businesses.

Fig. 1. Dimensions of a firm's digitization capability.

digitization capability (for a discussion and measure of "data availability", e.g., Cao, Duan, & El Banna, 2019; Gupta & George, 2016). The data generation and storage activities are complicated by the changing nature of data, as (big) data is characterized by e.g. *volume*, *velocity* and *variety* (McAfee & Brynjolfsson, 2012). Moreover, the issue of the management of cybersecurity risks is entailed within this domain (Jalali, 2018).

Second, firms need permission to use data. This dimension has three sub-domains. First, data must be used in accordance with local and international legislation. Such legislation is under constant development, as politicians are updating their knowledge of and their opinions on digitization. The recent introduction of the General Data Protection Regulation in Europe has highlighted the massive demands as well as shortcomings in this regard (e.g., Tankard, 2016). Second, the use of data needs to be negotiated with the partners in a firm's eco-system. Even if the exchange and use of data are lawful, those activities might be restricted by other actors. For example, firms may negotiate data-usage rights with producers of certain equipment (e.g., an oil-filter system with sensors), system operators (e.g., a firm using certain equipment in its daily operations), and service providers (e.g., local repair and maintenance providers). This aspect of digitization strongly relates to research on negotiation in business markets (e.g., Geiger, 2017; Herbst, Voeth, & Meister, 2011). Third, data-utilization needs to pass the moral test of society. While the use or distribution of data may not be illegal, members of society may feel offended by certain applications of data and may raise ethical issues (e.g., Zwitter, 2014). In other words, societal norms may not be synchronized with current law, as the area of data utilization is constantly evolving. As such, regulations may lag behind reality.

Consider "smart" home equipment as an example. In today's world, electricity meters, water meters, heat pumps, and thermostats are often connected devices that transmit data. The first key question in this regard is the following: Who can legally use the data and for what purpose? Firms realize that they have access to data that is (at times unintentionally) subject to specific regulation (e.g., the GDPR in Europe).

Table 3
Conceptualization of a firm's digitization capability.

Dimension components	Data	Permission	Analytics
Individuals	What kinds of employees are working with data generation, transmission, storage, and access for the firm, and how many? Which new roles will be needed?	What kinds of employees are working with permissions for the firm, and how many? Which new roles will be needed?	What kinds of employees are working with analytics for the firm, and how many? Which new roles will be needed?
Processes	What kinds of processes related to data generation, transmission, storage, and access are established in the firm?	What kinds of processes related to permissions are established in the firm?	What kinds of processes related to analytics are established in the firm?
Structure	What kind of structure governs data generation, transmission, storage, and access in the firm?	What kind of structure related to permissions exists in the firm?	What kind of structure governs analytics in the firm?

The second question relates to power issues along the value chain: Can the data be used and commercially exploited by the product's user (e.g., to optimize usage), the service provider (e.g., in relation to payment and consulting), the installer (e.g., to optimize maintenance), or the producer (e.g., to initiate product innovation)? While such uses may be supplementary and, thereby, able to co-exist, this question may lead to new business models in which data is offered to other parties in the value chain for a fee. The third question concerns social norms: Will consumers accept fine-grained surveillance by private firms in general even if it is allowed by law?

Third, given access to data and permission to use, firms analyze, visualize, and report data. These activities comprise their data analytics. There is a difference between data and information, as information, or insight, can only emerge when data are processed (e.g., Ackoff, 1989; Gandhi et al., 2018). Hence, analytics are needed to process data in order to produce insights and valuable information. Currently, this dimension is subject to a substantial amount of attention, as illustrated in the widespread discussions surrounding data scientists (e.g., Davenport & Patil, 2012), predictive and prescriptive analytics (e.g., Bertsimas, O'Hair, & Pulleyblank, 2016; Siegel, 2013), and artificial intelligence (e.g., Brynjolfsson & McAfee, 2014).

Without the combination of data, permission, and analytics, little value can be extracted and commercially exploited from data. Therefore, the combination of these three dimensions serves as a gauge of a firm's overall digitization capability. To further explore this three-fold digitization capability as an organizational phenomenon, we adopt the micro-foundational view of strategy (Felin, Foss, & Ployhart, 2015; Foss & Pedersen, 2014) and employ three micro-level categories—individuals, processes, and structures—as suggested by Minbaeva (2017). Table 3 highlights some key preliminary questions needed to assess an organization's digitization capability; and Table 4 highlights some business-to-business examples of the different elements encompassed in a digitization capability.

4. Digitalization

While firms' degree of digitization capability may vary within and across industries, digitization is only of interest to a firm if digitization investments are utilized in firm's business model—i.e. when digitalization takes place. If digitization is not employed in the business model, a firm's digitization capability is just an expense as there is no return on the investment. Therefore, it is important to map where and how digitization impacts a given business model. In general, business models are explanations of how a firm does business (Chesbrough & Rosenbloom, 2002; Magretta, 2002) and how a given actor "chooses to connect with factor and product markets" (Zott & Amit, 2008, p. 3). While there are many suggestions for how to best depict a business model (e.g., Gassmann, Frankenberger, & Csik, 2014; Osterwalder & Pigneur, 2010; for an overview of different approaches to business models, see Ritter & Lettl, 2018), we use Ritter's (2014) alignment squared business model to illustrate the impact of digitization on business models, as it allows for a discussion of connections between

the different business-model dimensions. According to Ritter (2014), a business model has four components (Fig. 2): capabilities, customers, value proposition, and value demonstration.

4.1. Capabilities

The analysis of capabilities in business models follows the resource-based view (Barney, 1991; Wernerfelt, 1984), which argues that an important element of firms is their unique resources and activities. Porter (1985) describes the value chain of firm-internal activities to illustrate different forms of capabilities. In a nutshell, a digitization capability can be relevant for all other capabilities of a firm. For example, Lai, Wong, and Cheng (2008) illustrate the positive impact of digitization on logistics performance. Syam and Sharma (2018) discuss the impact of machine learning and artificial intelligence on sales practices. In fact, in many firms and industries, it now appears impossible to have strong capabilities without digitization (Gandhi et al., 2018). The application of data for capability optimization is internally driven and, for the most part, invisible to customers. For example, the literature on marketing analytics (e.g. Cao et al., 2019; Germann, Lilien, & Rangaswamy, 2013) documents a positive impact of a marketing analytics capability on managerial decision-making, i.e. internal resource allocation. The impact of digitization on a firm's capabilities thus follows an exploitation logic: using data for optimizing the existing business model.

4.2. Customers

It is also important to specify the relevant customers for a business. In other words, who does the business want to attract? Customers, or segments of customers, are characterized by specific bundles of needs (e.g. Kotler & Armstrong, 2010). Firms must understand these needs in order to build successful business models. In the endeavor to better understand customers and their needs (i.e., "market sensing;" e.g., Day, 1994), firms can use data about customer behavior and, thereby, increase their customer knowledge. While the availability of data enhances customer understanding, the ongoing digitalization of customers in itself also constitutes a relevant segmentation variable: customers differ in terms of their needs for data, their value-creation potential associated with data utilization, and their willingness to share data with the firm. Customers can enhance the digitalization of a supplier's business model by demanding data and digital solutions, or they can hinder digital transformation by rejecting new, data-enabled ways of doing business. Examples from practice have documented that buyers in a business-to-business setting differ in terms of their digital preferences and needs.[4]

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[4] See https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/when-b2b-buyers-want-to-go-digital-and-when-they-dont.

Table 4
B2B examples of digitization capability elements.

| Authors	Dimension	Company	Applications
Gandhi et al., 2018	Data	Verizon, Deutsche Telekom, Telefónica	These telcos collect data as a part of their operations which in turn can be used to optimize the existing business, as well as open up for new streams of revenue such as geotargeting and fencing, smart targeting and location planning for stores.
Gandhi et al., 2018	Data	John Deere	John Deere has partnered with Cornell University to collaborate with its AG-Analytics data platform, which can be used to access farm data. The platform integrates public data sources.
Ransbotham (2015)	Permission	Equifax	Equifax has engaged in careful considerations whether their technical capabilities and data resources are in line with their ethical and legal responsibilities.
Wilson, Daugherty, & Morini-Bianzino, 2017	Permission	Accenture	In a global study of more than 1000 companies, Accenture identified three new categories of jobs created by AI. One of these were so-called "sustainers". That is, monitors of the fairness and audibility of AI systems in the form of e.g. an ethics compliance manager or watchdog.
Kardon (2019)	Analytics	Conversica	Provides automated email solutions to clients such as Microsoft and Oracle. The software reaches out to inbound leads and engages in two-way conversation.
Kardon (2019)	Analytics	Chorus	Provides AI software for audio analysis of recorded sales calls. It transcribes and analyzes content - and provides insights on how to better serve customers.
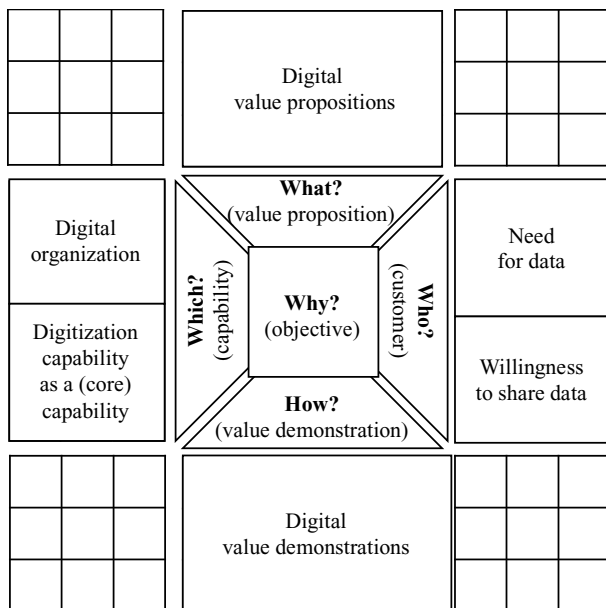
Fig. 2. Digital business models.

4.3. Value proposition

The original definition of value proposition, which is attributed to a McKinsey study (Bower & Garda, 1985; Lanning & Michaels, 1988), is formulated as "a statement of benefits offered to a customer group and the price a customer will pay" (Ballantyne, Frow, Varey, & Payne, 2011, p. 203; see also Kowalkowski, Persson Ridell, Röndell, & Sörhammar, 2012). In other words, a value proposition is a description of the exchange between a supplier and a buyer of what a firm sells and a customer buys. Notably, there is a difference between the two, as what a firm sells can be seen as the inside-out perspective of a value proposition (driven by the underlying capabilities that enable the firm to offer a given value proposition) and what a customer buys can be viewed as the outside-in perspective (driven by the customer's perception of the exchanged resources' potential value-in-use).

Digital value propositions can take different forms (e.g., Gandhi et al., 2018): they can focus on the data itself (e.g., the provision of credit information about (potential) customers to firms or data about usage of equipment). For example, Volvo Construction Equipment monitors the use of its machines and allows customers access to that data (see Pagani & Pardo, 2017); telecommunication companies provide city planners in municipalities access to geolocation data for optimizing traffic management systems (Gandhi et al., 2018).

Alternatively, value propositions can focus on data-enabled insights, i.e. the value proposition is based on the presentation of analyzed data: "AkzoNobel has created a decision-support model for ship operators to enable fuel and CO_2 savings" (Gandhi et al., 2018, p. 5).

In addition, value propositions can focus on digital services (i.e., services that are enabled by data). For example, Vendrell-Herrero, Bustinza, Parry, and Georgantzis (2017) discuss the impact of e-books, as opposed to printed books, on business relationships and retail markets. Many industrial firms have recently embarked on servitization journeys which add services to their products (for a review, see Raddats, Kowalkowski, Benedettinic, Burtond, & Gebauer, 2019). Most of these services rely on data which is discussed in the literature as digital servitization (e.g., Raddats et al., 2019; Vendrell-Herrero et al., 2017).

Digital products are another interesting issue regarding digital value propositions. Many products are today enabled by connectivity, so that these devices send data back to the supplier. While these data streams do not alter the functional value of the products (e.g., of pumps and production equipment)—and data may not be used to enable other value propositions (see above)—the pure flow of data from products to suppliers can constitute a managerial challenge in terms of data management (transmission and storage) and permission management (when data is classified or sensitive).

4.4. Value demonstration

Similar to value communication, we define value demonstration as all those interactions with customers that aim at convincing customers to buy a firm's value propositions (Ballantyne, Frow, Varey, & Payne, 2011; Corsaro, 2014). Put differently, value demonstration relates to sales and marketing activities. In business markets, data on potential customer value creation has long been a topic of interest (e.g., Anderson, Narus, & Van Rossum, 2006): How can firms generate data on value creation before the customer realizes value-in-use and how can firms best communicate that value-creation potential to customers? The literature has long argued for value-based selling and value modelling as a promising way to use data in selling (e.g. Terho, Eggert, Ulaga, Haas, & Böhm, 2017). In the value-demonstration process, customers provide data about their use of different sales channels. Such activities might involve the tracking of movement or attention paid to certain areas of websites or applications (e.g. Järvinen & Karjaluoto, 2015), or the visiting of physical spaces at trade shows.

Another perspective on digital value demonstration is found in the current debate on social media usage in business-to-business markets (e.g. IMM special issue by Wang & Pauleen in 2016; digital communication forms – e.g., Schultz, Schwepker, & Good, 2012; content marketing – e.g. Järvinen & Taiminen, 2016). These contributions argue that business-to-business firms need to utilize digital

Table 5
Examples of studies on the impact of digitization.

Business-model elements	Examples	References
Customer	Changes in industrial buying behavior based in digital communication	Müller, Pommeranz, Weisser, & Voigt, 2018
Value demonstration	Use of computers in sales	Moncrief, Lamb, & Mackay (1991)
	Computer messaging system to communicate with overseas customers	Holden (1991)
	Web-enhanced brand community and relationship building	Andersen (1991)
	Electronic commerce and marketing communication	Perry & Bodkin (2002)
	Impact of digital technology on relationships	Pagani & Pardo, 2017
	Comparison of in-person vs. digital contacts	Wang, Malthouse, Calder, & Uzunoglu, 2019
Value proposition	Servitization through digitization	Coreynen et al. (2017)
	Digital offerings	Ross et al. (2019)
Capability	Application of internal data for better segmentation	Meredith (1985)
	Use of computers in sales	Moncrief et al. (1991)
	Marketing automation	Järvinen and Taiminen (2016)
All elements	Multi-actor, internet-of-things-based business models	Leminen, Rajahonka, Wendelin, and Westerlund (2019)
	Business model innovation based in disruptive digital technologies	Simmons, Palmer, and Truong (2013)
	Optimizing digital business models	Weill and Woerner (2018)

communication channels to address today's customers communication needs.

4.5. Digitalization of business models

As described above, business models can be digitalized along the four dimensions (Table 5). As Vendrell-Herrero et al. (2017, p. 71) state: "the digital transformation of business models is re-shaping consumer preferences and consumption as industries are introducing digital technologies to enhance their competitiveness in order to change customer relationships (Dellarocas, 2003), internal processes (BarNir, Gallaugher, & Auger, 2003) and value propositions (Lusch, Vargo, & Tanniru, 2010)." Currently, a great deal of attention is being paid to the internet of things and Industry 4.0. The latter relates to production capabilities and enables new value propositions, such as "when smart wind turbines are networked, software can adjust the blades on each one to minimize impact on the efficiency of turbines nearby" (Porter & Heppelmann, 2014, p. 81).

However, it is also relevant to consider customers who demand interconnectivity or react negatively to a lack of interconnectivity in either a value proposition (e.g., one piece of equipment not being able to connect to the firm's enterprise resource planning system) or a value demonstration (e.g., misalignment of sales channels). As such, today's business customers demand compatibility (e.g., that different products and services can be connected to different digital platforms) and integration (e.g., discussed as omnichannel integration, Lee, Chan, Yee-Loong Chong, & Thadani, 2019). Therefore, it can be argued that (i) digital customers may drive the digitalization of the suppliers' business models, and (ii) digital business models will require further alignment between the components of the business model (Ritter, 2014).

4.6. Connections between business model elements

The above discussion illustrates the digitalization of business model elements. Several studies have already illustrated how the digitalization in one element of the business model has an impact on other elements. Coreynen et al. (2017) show that changes in digitization (capability) enables new servitization offerings (value propositions): a switchboard manufacturer developed a web-based switchboard configurator which was originally part of a new customized value proposition but later became a value proposition in its own right as licensing the web configurator software to foreign switchboard manufacturers. Similarly," the implementation of 3-D printing is an example of back-end digitization that has enabled Gamma to manufacture customized, high precision components for a wider range of industrial applications" (p. 47). Analyzing trading firms, Lai et al. (2008) document the impact of digitalization on logistics value proposition and, in turn, the impact on

corporate performance. In sum, future studies can benefit from focusing less on the impact of digitization on isolated business model components, and rather, study how digitization affects the relationships among business model components.

The four dimensions offer four opportunities for digitizing business models and, therewith, four possibilities to apply digitization capabilities in business models. We can divide these opportunities into two categories: exploitation of an existing business model through data and exploration of (partially) new digitized business models (March, 1991; Tushman & Anderson, 1986). As exploitation relates to improving existing ways of doing business and, thus, does not change the value proposition, the value demonstration, or customers, data-enabled exploitation deals with improving the understanding of customers and optimizing capabilities. Data-enabled exploration includes new digital value propositions and new digital value demonstrations, such as the development of new customer segments. For instance, Ritter, Pedersen, and Sørensen (2016) distinguish between optimization capabilities (i.e., the utilization of data to streamline existing processes and make them more efficient) and cross-selling capabilities (i.e., the utilization of data to create an additional value proposition that complements a physical product). A similar distinction is made by Weill and Woerner (2018), who note that information technology and data can be utilized to increase operational efficiency and enhance the customer's experience (see also Gandhi et al., 2018).

As such, the distinction captures the classical division between internal efficiency (exploitation) and external experimentation (exploration) found in the literature on organizational learning (March, 1991). In practice, however, firms often initiate their journeys by experimenting with the digitalization of existing processes (exploitation), which may result in discovery processes that point to novel commercial opportunities (exploration). Having clarified the denotation of digitalization, we will now explicate how digitalization in business-to-business firms has developed over the years, in order to provide an overview of the developments in the field.

5. Development of digitalization in business-to-business firms

Early inroads into the topic in the marketing field accentuated the business potential of data. Academics have examined the impact of computing and information technology on industrial firms and markets in general and on business-to-business relationships in particular for several decades (e.g., Bakos & Brynjolfsson, 1993; Goodman, 1972; Haas, 1977; Malone, Yates, & Benjamin, 1987; Meredith, 1989; Nolan, 1979; Porter & Millar, 1985; Venkatraman, 1994). For instance, Goodman (1972) discusses the use of different kinds of data for estimating the size and buying potential in business markets. While this early focus on the use of data is remarkable (please note that 1972 is the

first volume of Industrial Marketing Management) and his discussion of the then current state of data highlights primarily existing limitations, Goodman (1972, p. 285) concludes that "several steps can be taken, however, to improve both the utility and use of data employed for industrial market measurement." In a similar vein, Haas (1977) argues for more effective market research through the application of data from different data sources which can be combined when based on a common system, in his case the Standard Industry Classification (SIC) system. Based on the example of Bio-Chem, Haas (1977, p. 435) illustrates that "knowledge of the SIC system by itself is not sufficient – the industrial marketer must also know what additional sources of SIC related data are available, where they can be found, and how they may be used." The intent of his article to illustrate "how the industrial marketer might make full use … of data to obtain more complete market data to facilitate better decision making" (Haas, 1977, p. 435) is still a timely managerial challenge today. Interestingly, customer acquisition continues to be the most data-infused area in marketing practice according to the 2015 CMO Survey (Ariker, Diaz, Moorman, & Westover, 2015), accentuating the validity of the points already being raised by Haas in the 1970s.

Nolan, 1979 explicates the early evolution of firms with advanced data processing systems, identifying six stages, and forecasts an extremely rapid growth in data processing. Meredith (1985, 1989) illustrates the use of internal data for customer profiling. Her example illustrates how a "decision support system is designed to function both as an early warning mechanism for management as well as a diagnostic tool useful in the evaluation of company marketing activities" (Meredith, 1989, p. 255).

In the field of strategic management, Porter and Millar (1985) note that information technology (IT) is changing the way organizations operate and that the information made available by IT may provide a competitive advantage. In information systems research, Malone et al. (1987) predicted that IT would result in the increased use of markets, rather than hierarchies, to coordinate economic activity as a result of inherent reductions in coordination costs. These authors not only discussed the market-creation and market-shaping effects of information technology, but they also made predictions that have subsequently become reality in contemporary marketing practice. For instance, they noted that "it is easy to imagine even more sophisticated systems that use artificial intelligence (AI) techniques to screen advertising messages and product descriptions according to precisely the criteria that are important to a given buyer" (Malone et al., 1987, p. 493). Hence, they imagined future use cases that describe the current reality of many industrial marketeers. Bakos and Brynjolfsson (1993) study the role of information technology and its effect on supplier-buyer relationships. In addressing the theoretical prediction that firms should increase the number of suppliers due to the reduction in search and coordination costs, Bakos and Brynjolfsson (1993) suggest that information technology increases the importance of suppliers' noncontractible investments. Venkatraman (1994) introduces five levels of IT-enabled business transformation and proposes that organizations match benefits with costs and efforts of the needed changes, and move to higher levels when competitive demands and customer needs require it. Put differently, IT-enabled business transformation must entail an intricate and continuous balance between internal planning and external adaptation. From a more exogenous perspective, Bettis and Hitt (1995, p. 12) argue that technological developments are altering competition, resulting in a 'new competitive landscape', where it "…is not only the scope of the changes, but also the decline in the costs and increased accessability of these resources that are creating a new competitive landscape."

The subsequent years experienced an increasing scholarly attention toward the concept of business models, particularly as it coincided with the adoption and technological acceleration of the world wide web. This is evident in e.g. Timmers (1998), who posits that "Electronic commerce over the Internet may be either complementary to traditional business or represent a whole new line of business" (p.3), resulting in

several critical questions organizations need to ask themselves, such as "what is the emerging business model?" The era's preoccupation with the notion of business models, and its role in a "new economy" driven by the advances of the internet, peaked in the IT-bubble which burst in the early 2000s. The crisis gave rise to debate about digital business models, as evident when Porter (2001) argues that business models were a part of the Internet's destructive lexicon, and therefore, should be excluded from the business literature altogether. In a more nuanced vein, Margretta (2002) argues that "Today, 'business model' and 'strategy' are among the most sloppily used terms in business; they are often stretched to mean everything – and end up meaning nothing" (p. 92). Far from minimizing the academic interest in business models, the subsequent debate rather provided the basis for subsequently solidifying research on business models (e.g. Ritter & Lettl, 2018) as well as digital business models (e.g. Ross, 2017).

While the interest in applying data and analytics in marketing continues (e.g. Cao et al., 2019; Germann et al., 2013; Hanssens & Pauwels, 2016; Wedel & Kannan, 2016), recent marketing research has also addressed issues related to computerization (Good & Stone, 2000), the role of computers and the internet in supply chain management (e.g., Bakos & Brynjolfsson, 1993: Lancioni, Smith, & Oliva, 2000; Obal & Lancioni, 2013; Plank, Reid, Kijewski, & Lim, 1992), digital markets, electronic marketplaces and platform business models (e.g., Dou & Chou, 2002; Hartmann, Ritter, & Gemünden, 2002; Muzellec, Ronteau, & Lambkin, 2015), and electronic data exchange (Hart & Saunders, 1997). In recent years, new inroads have similarly been made to integrate various related literature streams in industrial marketing, such as studies explaining how companies can leverage digital technologies to enhance service offerings, resulting in digitalization enabling servitization (Coreynen et al., 2017). Moreover, efforts have been made to integrate the literature streams on technology and mindset in B2B-innovation (Ringberg, Reihlen, & Rydén, 2019). Despite the many recent inroads that have been made regarding the digitalization of business-to-business firms, the efforts can arguably appear scattered across a multitude of topics (see Table 6 for examples of recent studies in IMM). While the diversity of themes comprises an extensive variety of research on digitization and digitalization in business-to-business firms and markets, more cross-fertilization is needed among constructs and topics to develop a holistic understanding.

Although far from exhaustive, this historical overview demonstrates three important issues: First, the process of digitalizing industrial firms and markets is a longstanding phenomenon that is still evolving. The early contributions demonstrate that the interest in digitalization, especially its impact on business in general and marketing in particular, is by no means a novel phenomenon. Moreover, marketing practitioners were among the first to utilize data to improve marketing and sales practices, as evidenced by their early use of database marketing, digital rolodexes, and IT-enabled customer relationship management systems, such as Siebel Systems, which was launched in the early 1990s. Hence, industrial marketeers responded and adapted to these market developments at an early stage, long before the IT bubble in 2000 and the current wave of digitization. In conclusion, most of the currently relevant issues have been raised some 20 years ago but the practical applications have been slowly implemented, or as Plank et al. (1992, p. 247) state: "EDI appears to be off to a very slow start."

Second, research efforts to date appear to be scattered across a multitude of topics that could, in principle, cross-fertilize each other. However, such cross-fertilization would require the field to agree on a common point of departure (including definitions) and a framework that can link the studies. The third conclusion from this overview is that the application of data, computer skills, and information technologies must be a core capability of any organization in today's world (Ghandi et al., 2018)—most contributions argue that digitization and subsequent digitalization can have beneficial effects for industrial firms (e.g. Ariker et al., 2015; Cao et al., 2019). In this regard, we argue that digitization capability can serve as a relevant point of departure for

Table 6
Overview of recent studies related to digitization.

Authors	Themes	Methods	Findings
Gregory, Ngo, and Karavdic (2019)	*E*-commerce	Mixed	Specialized e-commerce capabilities within marketing increase a firm's degree of distribution and communication efficiency.
Lee et al., 2019	Omnichannel	Quantitative	Channel integration quality dimensions positively influenced customer engagement, which resulted in positive word-of-mouth and repurchase intention.
Pei and Yan (2019)	E-tailer SCM	Quantitative	Suppliers and e-tailers have a strong incentive to share information when a full return policy is offered to consumers.
Cao et al. (2019)	Analytics	Quantitative	The study investigates how marketing analytics can be utilized to obtain a sustained competitive advantage.
Lim, Ahmed, and Ali (2019)	Data	Methodological	The concept of data partitioning is introduced as a form of data management useful for knowledge engineering in B2B marketing experiments.
Nunan, Sibai, Schivinski, and Christodoulides (2018)	Social Media	Conceptual	Existing work is commented and a research agenda is proposed in which different directions for investigating social media within the sales process are identified.
Ogilvie, Agnihotri, Rapp, and Trainor (2018)	Social Media	Quantitative	The impact of social media technology on customer relationship performance and sales performance is demonstrated.
Chaudhry, Srivastava, and Joshi (2018)	IT Service	Quantitative	Client involvement has varied effect on response strategies within client – vendor relationships, as shown in the IT services industry.
Miao, Wang, and Jiraporn (2018)	IT operations	Quantitative	Key supplier involvement in the focal firm's IT operations, and the subsequent effect on performance, is contingent upon relational and environmental variables.
Chirumalla, Oghazi, and Parida (2018)	Social Media	Qualitative	The study exemplifies the role of social media and proposes a social engagement strategy for an improved marketing and R&D interface.

studies on digitalization in industrial firms and that the business-model construct can serve as a relevant linking framework for the various studies on digitalization. These two aspects are clearly linked: a digitization capability is a starting point that can anchor digitalization studies in business-to-business firms and markets, and the use of a business model as a linking mechanism would not only serve to illustrate the relations among different studies in a business context but also as an illustration of how data and digitization capabilities enter and affect an industrial firm's business model. In other words, digitization capability is the organizational building block on which a digital business model is based.

6. Future research

As our eclectic overview suggests, many aspects of digitization and digitalization in business-to-business firms and markets have been analyzed over a longer period. Although this rich body of literature has provided many insights, the complexity of digitization itself, the manifold applications and impacts of digitalization, as well we the speed of development of digital technologies and business practice make digitization and digitalization highly relevant topics for further investigations in the business-to-business marketing field. Digitization and digitalization have been addressed from various angles, but the journey toward understanding the phenomenon, its impact on firm performance, and its antecedents has only just begun. For instance, Obal and Lancioni (2013, p. 851) note that: "while a great deal of published research on customer–firm relationships in the Digital Age has focused on end users and consumer markets, much less research has dealt with the impact of digital communications on the relationships between buyers and suppliers in industrial marketing." Pagani and Pardo (2017, p. 185) echo this message, noting that "while B2C exchanges are the subject of numerous studies on the transformations brought by digital technologies, B2B exchanges are far less analyzed" and that "the nature of change, the impact of business relationships and the problem identification related to these changes require appropriate theoretical lenses fine-tuned for a B2B-context." As such, much more research is needed to understand digitization and digitalization. In the following, we will introduce several potential research avenues.

6.1. Research theme 1: Measuring digitization capability

An important step in the process of understanding this phenomenon will be the development of a scale that empirically captures digitization

capability. Our conceptualization can guide future studies toward an operationalization of this concept. Moreover, as the concept is multidimensional and supposedly context-specific (e.g. depending on industry), there is ample room to use both qualitative and quantitative methods to reveal suitable measurements. A better measurement of digitization will also allow for better analysis of the performance implications of digitization.

6.2. Research theme 2: Drivers of digitization and digitalization

Equally important is the need for a better understanding of the drivers of digitization and digitalization in firms in all areas such as technological developments, firm-specific issues, or actions by competitors or a firm's ecosystem. The speed of technology development is an important force that enables new and improved ways of using digital technologies in business. A firm's strategy and its use of data also drive or restrict the development of its digitization capability. Moreover, differences in firms' strategic focus may affect the adoption of certain approaches to digitization. The reason why it is important to understand the drivers of digitization and digitalization is twofold: First, it can help explain differences in progression in different industries. Second, it can help predict the trajectories that different industries will take. Consequently, it will have value for the theorizing, and practical utility, of digitization and digitalization of industrial firms.

6.3. Research theme 3: Impact of digital on established constructs

Another important and emerging aspect of ongoing research is the integration of digitization into current research trends. In terms of the value proposition, digital services and digitally enabled servitization (Vendrell-Herrero et al., 2017) appear to be promising areas if we are to understand and develop the interconnections between servitization and digitalization. Likewise, digital communication (e.g., social media) encompasses new avenues for research. Business-to-business marketing research has a rich tradition in analyzing customer-supplier relationships, and consequently studies have analyzed the impact of digital communication formats on business relationships.

6.4. Research theme 4: Born digital business-to-business firms

Firms may be "born digitized" (e.g., Amazon, Google, SAP), but the current debate in business-to-business marketing mainly focuses on the transformation of already established business models into digital

business models. While this focus offers important insights, it is relevant to also understand born digital business-to-business firms and to compare born digital and transformed firms.

6.5. Research theme 5: The impact of digitalization on business relationships

Recently, a few promising inroads on the impact of digitization on business relationships have been made (e.g. Pagani & Pardo, 2017). However, we still need additional research from a variety of contexts and theoretical perspectives to follow up on this promising stream of research which is central to the readership of IMM. Hence, there is ample room for studying the ways in which digitalization impacts business relationships.

6.6. Research theme 6: Advancing permission for data-driven growth

Furthermore, little attention has been dedicated to all three elements in the permission activities in digitization (regulatory, contractual and ethical). As permission is an essential dimension of digitization and, thus, an antecedent for successful digitalization, more research is needed to fully comprehend the complexities and potential conflicts that may arise within this overlooked field of research.

6.7. Research theme 7: Validating the business model perspective in digitalization[5]

While we have utilized a certain perspective of business models in our conceptual discussion of digitalization, future research could test the verisimilitude of the perspective in different contexts. Moreover, there is also room for additional perspectives on business models (e.g. Ritter & Lettl, 2018) in assessing the validity of the models in terms of their explanatory power of digitalization. This is important as different perspetives, and models, convey different assumptions, logics and lenses on reality.

7. Managerial implications and concluding remarks

Managers pay a significant amount of attention to digitization, which is viewed as the "new oil" for business[6]. While digitization is likely to continue to affect the business world, its content and direction demand managerial attention.

First and foremost, it will be important that managers build and leverage their digitization capability. In order to do so, they will need to be cognizant of its dimensions, i.e. data, permission and analytics. In practice, these dimensions are often "owned" by different functional managers within organizations, e.g. a CIO is responsible for data, a legal department (or a chief ethicist) is in charge of permission, and a chief analyst is responsible for data analytics. Moreover, it is not enough that these dimensions thrive in isolated siloes – these functions will need to interact, coordinate and collaborate in order to obtain a streamlined digitization capability.

Second, in order to obtain success with digitalization, the digitization capability will need to be aligned with the rest of the business model (Ritter, 2014). That is, the digitization capability provides the basis for subsequent commercialization of data, which expresses itself in digital value propositions and value demonstrations. Consequently, the previously mentioned functions will necessarily also need to interact and collaborate with e.g. sales and marketing functions.

Third, managers will need to ask themselves a variety of strategic

questions on a continuous basis: For instance, to what extent will digitization change business and in which direction? What kind of market strategy does a firm need to compete with digitized business models? The wealth of opportunities related to the use of technologies and applications in value propositions and value demonstrations makes digitization a key managerial challenge, as managers need to understand the areas on which they should focus and how they can best apply digital technologies. Managers also need to decide whether they want to lead or follow in the field of digitization. While pioneering has both advantages and disadvantages, the same is true for fast-second and follower strategies. As such, the timing of digitization is a crucial management issue.

Despite the early inroads discussed in this paper, the extant literature on industrial marketing has not yet realized the full potential of digitization and digitalization in industrial relationships. In order to facilitate the development of this field, we propose a conceptualization of digitization capability, suggest viewing digitization in relation to business models as a "bridging mechanism" for cross-fertilization between studies, and outline current research on the impact of digitization on a firm's business model.

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[5] We are thankful to an anonymous reviewer for pointing out the need for this research stream.

[6] https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data

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