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Digital transformation of industrial businesses: A dynamic capability approach

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ABSTRACT

Industrial firms are under severe pressure to undertake digital transformation and leverage the Industrial Internet of Things (IIoT) and emerging technologies for the integration of industrial machines to share information on a real-time or near real-time basis. Though in recent years researchers have focused their attention on digital transformation, there is limited scholarly guidance for developing capabilities for such transformation. Drawing on dynamic capability theory and exploratory qualitative interviews with senior 'elite' executives from five of the world's largest multinational firms, the study outlines a new conceptual framework for digital transformative capability development. The integrative framework demonstrates how the three core capabilities of digital sensing, digital seizing, and digital reconfiguring manifest through associated capabilities of Strategic Sensing, Rapid Prototyping, Organization Structure, Business Model Transformation, and Cultural/Mindset Transformation. Internal and external contingencies are proposed as moderators of the relationship between IIoT and emerging technologies, and digital transformative capability development. Collectively, the article makes the case for Digital Transformation Capability and sheds new light on the digital transformation process. Implications for theory and practice are highlighted, and limitations are discussed.

1. Introduction

Emerging technologies such as Big Data, Cloud technology, Artificial Intelligence and Machine Learning (AI/ML), enhanced robotics, Data Analytics, 3D Printing, Cryptocurrency, and Blockchain are disrupting industrial businesses on a vast scale (Lee et al., 2019; Ibarra et al., 2017; Morkunas et al., 2019; Ustundag and Cevican, 2018). These technological disruptions place senior managers under significant pressure to transform their industrial businesses. An especially acute source of pressure is the Industrial Internet and Industry 4.0, or the Industrial Internet of Things (IIoT), compelling digital change initiatives among industrial businesses (Gilchrist, 2016; Sestino et al., 2020). In consumer markets, billions of everyday devices are equipped with smart sensors and internet and computing functionality (Sestino et al., 2020). However, for industrial businesses, the problem lies not in making such devices, but in digitizing the business to be at the forefront of controlling digital platforms and digital industrial equipment, and in transforming from a product-based business model to one that incorporates live services within their machines. For example, in healthcare, traditional software focused on medical records and document management is being replaced by cloud computing with instantaneous access to patients' data; in supply chain management (Ben-Daya et al., 2019; Calatayud et al., 2018), "self-thinking supply chains" based on IoT and AI-ML enable firms to receive supply chain events from different partners and suppliers, analyzing those events, and take proactive business decisions; in shipping, IBM and Maersk have a blockchain-based system to trace container shipping (Lal and Johnson, 2018); in airlines, the automated cockpit grows increasingly complex and substitutes for traditional piloting (Casner et al., 2014). Yet, the danger, let alone opportunity, posed by IIoT for industrial businesses is especially sharp. As appropriately surmised by Bill Ruh, former CEO of GE Digital, "if you cannot master the idea of digital inside your business, you are opening the door for commoditization" (Lopez, 2018).

However, to date, industrial businesses are struggling with digital transformation. Tabrizi et al. (2019) note that digital transformation risk was the #1 concern of the C-Suite in 2019 into 2020, and despite the

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level of attention devoted by C-Suites to digital transformation, 70% of all digital transformation initiatives failed to achieve their goals. The problem is one of complexity in the range of concurrent activities industrial businesses must master. For instance, businesses must anticipate and address digitization in business and corporate strategies (Mithas et al., 2013; Kohli and Grover, 2008), revise organizational design (Sund et al., 2016), and implement new digital technologies (Setia et al., 2013) and generate new capabilities (Tripsas and Gavetti, 2000) to innovate new value propositions (Krotov, 2017), or else be left behind. Consequently, industrial managers are not confident of how to initiate or achieve strategic digital transformation initiatives within their organizations. Tellingly, studies pin the success rate of digital transformations among industrial businesses as little as 4 to 11 percent (McKinsey and Company, 2018), despite the growing body of extant scholarly research on digital transformation.

To address this pressing business problem, the study draws on Teece (2007) framework of dynamic capability, to examine in depth the development of 'Digital Transformative Capabilities' (DTCs) as an unfolding process of sensing, seizing, and reconfiguring firm resources. The theoretical lens of 'dynamic capability' is particularly relevant in contexts of rapid change (Teece et al., 1997). Dynamic capabilities are enablers of change allowing "management to develop conjectures about the evolution of consumer preferences, business problems, and technology; validate and fine-tune them, and then act on them" (Teece, 2014: 332), but the dominant focus in research into capabilities and dynamic capabilities has been on those that drive firm performance. We depart from this and focus specifically on the development of digital transformation capabilities. While a transformation process has been examined previously (Karna et al., 2016; Pavlou and El Sawy, 2011; Teece, 2014), we extend this investigation to digital transformation and IIoT contexts since industrial businesses are inherently different from traditional businesses and digitalization itself affects virtually every part of the business. IIoT requires connecting industrial assets (such as machines, people, control systems, etc.) with information systems and business processes, such that a large amount of data can be collected from these combinations and analyzed on a real-time basis for proactive business decision-making (Sisinni et al., 2018). By leveraging Industrial IoT, we project that senior industrial manager can accelerate digital transformation. For example, industrial IoT and its associated technologies can accelerate digital transformation when interdependencies among industrial businesses are embraced within a digital ecosystem (Subramaniam et al., 2019). Notwithstanding the extant literature related to IoT and digital transformation (e.g., see reviews by Li, 2020; Sestino et al., 2020), industrial managers still require answers to two key questions: (i) *What are the core capabilities for digital transformation in an industrial business?* And (ii) *how are emerging technologies affecting these core capabilities?*

To address these two research questions, the study draws on twenty-five interviews with senior, elite leaders from five of the world's largest industrial businesses that are actively engaged in digital transformation initiatives. In the high-velocity environments in which these organizations operate, the development of DTCs to readjust their business processes both internally within the organization and externally with ecosystem partners is essential for favorable digital transformation. We define "*DTC as the ability of a firm, to systematically identify and develop core capabilities for digital transformation*". The DTC is a special form of dynamic capability and does not fit cleanly into the existing theoretical apparatus. Specifically, DTC is not simply about the renewal of existing capabilities or about making existing capabilities malleable; developing new digital capabilities takes priority, and digital transformation involves the replacement of long-standing business norms and views of products and digital trading.

In response to criticisms that extant research has addressed the materialization of digital transformation in a limited fashion (Warner and Wäger, 2019), we provide two contributions to the digital transformation field. First, we present a new conceptualization of DTC informed by a qualitative exploration of a set of world-leading technology companies currently affected by the IIoT/Industry 4.0 and its emerging technologies. Second, consistent with the view that dynamic capabilities and competitive advantage are jointly affected by organizational and environmental factors (Fainshmidt et al., 2019), we derive a set of research propositions relating to DTC development. In the form of an integrative conceptual framework, the exploratory findings provide new insights into the managerial actions necessary for competing in the new normal digital landscape through digital transformation.

2. Theoretical overview

Digital transformation leveraging Industrial Internet and emerging technologies is a relatively new initiative for industrial organizations. However, in recent years, much research has emerged around this phenomenon and Appendix 1 summarizes relevant studies from 2016 to 2020. For instance, Sousa-Zomer et al. (2020) suggest three micro-foundation capabilities related to organizational cultures, such as digital-savvy skills, digital intensity, and conditions for actions and interactions, as constituting a digital transformative capability. Similarly, Carcary et al. (2016) suggest core foundation capabilities related to the culture of an organization for digital transformation. Li et al. (2018) studied small and medium enterprises (SMEs) with inadequate capabilities and resources and suggest that managerial capabilities are the main driving force for digital transformation. Some researchers such as Nwankpa and Roumani (2016) and Vial (2019) emphasize the role of information technology (IT) capabilities and argue that IT capabilities drive firm performance with digital transformation initiatives acting as a mediator. While Nwankpa and Roumani (2016) were not clear on what constitutes digital transformation initiatives, Warner and Wäger (2019) identified a set of digital sensing, digital seizing, and digital transforming capabilities for digital transformation in the traditional industry. A review of these studies reveals that there is a gap among existing literature as to the definition and conceptualization of DTC, with existing studies placing a premium on the cultural aspects of DTC as opposed to DTC itself.

Emerging technologies are influencing digital transformation. Mendonça and Andrade (2018) identified the relationship between emerging technologies and dynamic capabilities and suggest that AI-ML, Big, Data, and IoT influence the seizing capability of an organization as a component of a traditional dynamic capability. Based on an empirical study, Rossmann (2018) concluded that IoT influences digital transformation, but the underlying mechanisms are once again missing. In contrast, Li (2020) argues that business model innovation influences digital transformation, and emerging technologies have a direct impact on business model innovation. Industrial IoT and emerging technologies can stimulate new value propositions based on new products and services and new value delivery models, but oftentimes have less influence on customers and revenue models (Kiel et al., 2017). The disruptive effects of industrial IoT also extend beyond the boundaries of the firm and into its supply chain (Ben-Daya et al., 2019), which requires further integration (Calatayud et al., 2018).

The problems of implementing digital transformation initiatives are compounded by historical tendencies among large, established industrial organizations. For instance, while Industry 4.0 has a profound impact on digital transformation, the need to shift business models to achieve digital transformation is concurrently tied to the need to radically overhaul the historical investments of the firm. The first three industrial revolutions took place due to mechanization, electricity, and computerization, for example, whereas in the fourth industrial revolution, industrial businesses must develop cyber-physical systems (CPS) consisting of smart machines, automated production facilities, and storage systems which can improve product design, manufacturing, distribution and supply chain processes (Kagermann et al., 2013). We are also moving from the fourth industrial revolution to the fifth industrial revolution (Industry 5.0), a pace of change that only exacerbates

the need to establish the properties of a DTC. In the fifth industrial revolution, man and machine will become integrated seamlessly to deliver business outcomes by utilizing AI and other emerging technologies (Nahavandi, 2019). Though researchers have highlighted the impact of emerging technologies on business processes and digital transformation initiatives, the influence of emerging technologies on DTCs needs further exploration by understanding specifically what constitutes DTC and its materialization.

Drawing on Teece (2007) framework of dynamic capability, we examine the development of DTC as an unfolding process of sensing, seizing, and reconfiguring firm resources. As Teece (2009) suggests, such a process requires top management teams to possess entrepreneurial capabilities to adapt to and influence a rapidly changing environment (Arndt and Bach, 2015). Though dynamic capabilities are frequently associated with competitive advantages (Efrat et al., 2018), in isolation, dynamic capabilities do not assure the success nor continuity of firms (Ambrosini et al., 2009; Woldesenbet et al., 2012). Instead, the firm must enable the conditions for transformation. While transformation processes have been examined previously (Karna et al., 2016; Pavlou and El Sawy, 2011; Teece, 2014), we extend this investigation to *digital* transformation and IIoT contexts since industrial businesses are inherently different.

Different schools of thought exist about the applicability and use of a dynamic capability framework. For example, Teece et al. (1997) and Teece (2007) assert, dynamic capabilities are necessary for sustaining competitive advantages under the specific boundary condition of 'high-velocity environment'. However, Eisenhardt and Martin (2000) suggest that dynamic capabilities are best practices, and such a specific boundary condition is not necessary as these capabilities should work in either moderate velocity or high-velocity environments. Winter (2003), by comparison, ranks capabilities on a hierarchy, where zero-order capabilities are required for day-to-day activities of the firm and higher-order capabilities are needed for dynamic capabilities.

Despite these differing interpretations of the dynamic capability framework, our view of a DTC (as defined in the Introduction section) aligns with the Teecian perspective since Industrial IoT and emerging technologies create a high-velocity environment that heavily destabilizes firms' existing activities and capabilities. It is this instability that disrupts the status quo of industrial businesses in ways that traditional change solutions are no longer solutions to the changes they face. Consequently, a DTC is a higher-order capability, and its development is expected to be possible only when organizational conditions support digital transformation in the face of high-velocity change. For example, Siemens and Atos are developing a digital replica of the pharmaceutical production process (digital twins) to improve production and innovative solutions (Atos, 2020). Digital Twin is a higher-order capability for digital transformation (DTC). Zahra et al. (2006) theorize dynamic capabilities are context-dependent, proposing that a capability that is operational or ordinary in one firm may be a dynamic capability for another firm in a different context. For example, a product development capability might be an operational capability for a software firm like Oracle that uses product development as a standard routine; for GE Digital, a new product development capability is essential for faster time-to-market software solutions more akin to renewing the business and renewing, renovating or replacing outdated and outmoded products, services, business models, or capabilities. A further consideration is that an organizational intent to transform may not necessarily cause actual improvement and holds the potential for degradation as well (i.e., transformation does not assure a positive outcome because means-ends relationships are ambiguous and uncertain in high-velocity environments). This is especially indicative of industrial businesses, which, in the space of a few short years have experienced several forms of the industrial revolution. For example, GE started an ambitious digital transformation initiative throughout the GE businesses, invested multi-billion dollars, started a new business GE Digital, and finally decided to scale it down (Cimilluca et al., 2018). In adopting the dynamic capability view, then, the firm ought to develop *sensing, seizing, and reconfiguring* capabilities for digital transformation (e.g., Warner and Wäger, 2019).

The crux of the problem lies in not just developing DTCs but understanding the conditions and factors for transformation surrounding it. To date, there is inadequate theoretical and conceptual development in the dynamic capability literature related to capabilities for digital transformation (a DTC) and a framework for DTC development is absent. New knowledge inductively generated from industry and, specifically, the practices of strategic managers leading digital transformation is needed and forms the focus of our research. This focus will shed light on the digital transformation process and identify factors responsible for transformation.

3. Research methodology

3.1. Research design and context

Since the phenomenon of digital transformation by leveraging IIoT is still emerging among industrial businesses, a qualitative investigation enables the intricacies of digital transformation to be uncovered (Denzin and Lincoln, 2000). Specifically, by adopting a case-study methodology, the phenomenon of digital transformation can be explored in great depth enabling an exploratory approach to addressing the study's two research questions. A case study methodology is particularly apt given the focus of the research is on a contemporary phenomenon within real-life contexts (Yin, 2003).

The case study method is employed with multiple semi-structured interviews with the leaders of the leading industrial companies that form the case organizations, and how they are developing dynamic capabilities for digital transformation (DTC) and leveraging IIoT and emerging technologies to this end (Eisenhardt and Graebner, 2007). The study focused on five cases of the world's largest technology companies (revenue exceeding US$1B) operating in computing networks, semiconductors, aviation, and healthcare markets, among others, and are executing significant digital transformation in their companies on a scale never previously experienced. All five case organizations are founding members of different digital transformation consortiums such as the Industrial Internet Consortium, Digital Twin Consortium, Open Fog, Object Management Group, etc. Further detail about the five case organizations is provided in Appendix 2. The scope of data collection is given in Table 1.

3.2. Data collection

From February 2016 to August 2020, we collected a wide range of data, including semi-structured interviews, industry documents, annual reports, and company announcements related to digital transformation. Before conducting any interviews, we analyzed the annual reports for the previous five years (2012 through 2016) of all focal companies which were available at their respective company websites. We specifically analyzed digital transformation initiatives from the annual reports. We also analyzed event notifications of these companies to understand some of the key digital initiatives. As a novel approach, we noted down our observations and later used them during the face-to-face interview.

We adopted face-to-face semi-structured interviews to collect data for our case study and to enable personal contact with the interviewers (Alvesson, 2003). We followed a semi-structured interview approach and interviewed one respondent at a time with a mixture of open and close-ended questions and followed by 'why' or 'how' questions (Newcomer et al., 2015) to probe responses further. We conducted interviews in three phases: in phase one we mapped out the IIoT and digital transformation landscape; in phase two we examined the action/execution of digital transformation in the case companies; and in phase three, we evaluated the success of the digital transformations and

Table 1
Purposeful sample and scope of data collection.

	Software Inc.	Health Inc.	Semicon Inc.	Industrial Inc.	Network Inc.
Case Overview					
Industry	Software	Healthcare	Semiconductor	Industrial	Networking
Size (Employee)	100,000+	50,000–100,000	100,000+	100,000+	50,000–100,000
Revenues (2019)	$25B - $50B	$1B - $25B	$75B - $100B	$75B - $100B	$50B - $75B
Founded	Late 1970s	Late 1990s	Late 1960s	Late 1880s	Late 1980s
Firm type	Parent	Subsidiary	Parent	Subsidiary	Parent
Market focus	Global	Global	Global	Global	Global
Scope of case study data					
Interviews	6	3	6	7	3
Position	Sr. Vice President, Sr. Directors, Directors	Sr. Vice President, Sr. Director, Directors	CTO, Sr. Directors, Directors	Sr. Vice President, Sr. Directors, Directors	Sr. Vice President, Sr. Director, Directors
Education	MS, BS	MS, BS	MS, BS	Ph.D., MS, BS	MS, BS
Experience	20+ years	20+ years	20+ years	20+ years	20+ years
Annual Reports	2015–2019	2015–2019	2015–2019	2015–2019	2015–2019
Totals/ Summary	**25 in-depth interviews**	**400 years of leadership experience**	**BS - Ph.D. education levels**	**Experience across 8 industrial contexts**	**25 Annual Reports and 60 published reports examined**

lessons learned.

In phase one, we interviewed five key executives (one from each case organization) from April 2016 to June 2016. These executives were all Senior Vice Presidents/Chief Technical Officers of the company and were responsible for digital transformation initiatives in their respective companies. Given the degree of confusion about digital transformation in industrial businesses, phase one interviews sought to capture the current digital transformation landscape from the perceptions of those experiencing this in practice. Specifically, phase one interview questions (Appendix 3) were related to Industrial IoT (IIoT) business within the organization and their core lines of businesses; how the digital transformation process was being executed; and the implications for the existing business model and necessary operational and strategic changes needed to support digital transformation. The phase one interviews enabled us to understand the strategic importance of digital transformation in industrial businesses. Since one of the authors was an executive in one of these companies and was responsible for organization-wide digital transformation initiatives and had two decades of senior-level experience in companies across Silicon Valley, we had a head start in our interview process in terms of access to senior executives and the C-Suite of the focal companies. The insights garnered from phase one were then used to inform phase two of the data collection process which comprised fifteen semi-structured interviews with senior executives from the same technology companies to delve deeper into the critical themes for digital transformation in practice (Appendix 3). Phase two interviews were conducted from September 2016 to September 2017. In phase two interviews we asked the participants to discuss their digital transformation initiatives leveraging IIoT, internal communications, and operations within the company, interactions with external partners, capability development, and measurement of success for digital transformation initiatives. The purpose of these interviews was to get some clarity related to the influence of IIoT and advanced technologies for digital transformation and what are the core capabilities needed for digital transformation. As these interviews progressed, we started to develop an idea for a process model of DTC and asked our participants to clarify with examples their digital transformation journeys, core capabilities, and factors that could influence these capabilities. As phase two was approaching its conclusion, we collected data from annual reports and other company documents along with a further two face-to-face interviews. Based on these interviews, we analyzed our findings and developed a conceptual model for DTC.

To triangulate our findings, we conducted an additional five interviews (Appendix 3) with the elite informants of the same companies between June 2020 and August 2020 as phase three of our data collection efforts. These participants have similar or extended responsibilities from the participants in our first interview. Due to pandemic restrictions, these interviews were conducted using Zoom videoconferencing and were recorded. These additional interviews allowed us to triangulate our observations and lesson learned from our previous observations. These interviews also highlight the changing nature of the IIoT landscape and how some of our findings have changed between 2017 and 2020. We also supplemented this with gathering annual reports up to the end of the 2019 financial year and probed these for further insights. All our interviews across phases one, two, and three ranged from 45 min to 60 min and, consistent with the accepted good practice were recorded (with explicit permission), transcribed with triangulation among the research team, and subsequently subjected to analysis.

3.3. Data analysis

The study followed the qualitative data analysis prescriptions of Miles et al. (1994), Tracy (2013), and Yin (1994), which involved coding the interviews and classifying the codes into themes and patterns. While the process of creating codes can be pre-set or open, we adopt a hybrid model as described by Gibbs (2018). A list of pre-set codes was developed from the literature and a preliminary exploratory study. For example, ‘alliances’, ‘partnerships’, and ‘external collaboration’ were initially coded as individual codes, but as data emerged, they were later collapsed into a category labeled ‘ecosystem partnerships’. The approach is consistent with recent adoptions of soft positivism in qualitative investigations. As (Hodgkinson et al., 2017: 999) observe, this “allows the analysis to be conducted with certain expectations based on prior theory, while also allowing for unexpected themes and explanations to emerge, as is more typical of interpretivist approaches”. Considerations in this process included: What are participant sayings? Is it consistent among all participants? Or it is an outlier? What is this an example of? What kind of events are associated with it? What is happening? Can I make some meaning out of it?

To further refine the codes, different iterations were created (e.g., Lofland and Lofland, 2006) and supported by using nVivo 12, a qualitative data analysis application, to identify in-case conceptual patterns from primary and secondary data by coding, and classifying data in fragments (Miles et al., 1994). In-case similarities were aggregated into border categories through data reduction (Miles et al., 1994). In the next step, we conducted a cross-case analysis to find out the similarities and differences across the cases (Eisenhardt and Graebner, 2007). We derived first-order concepts from the observations of our interview participants and combined similar concepts from different cases into second-order themes (Gioia et al., 2013) (Table 2). Finally, from the

Table 2
Second-order theme development.

Concepts	Software Inc.	Health Inc.	Semicon Inc.	Industrial Inc.	Network Inc.
Ecosystem Partnership (31)					
Delivering total IIoT solution with partners for DT (12)	3	1	3	4	1
Partners fulfill IIoT solutions gap for DT initiatives (9)	2	2	3	1	1
Engaged with limited partners for DT opportunities (10)	3	2	2	2	1
Technology Disruption (28)					
Constant technology changes are affecting our operations (12)	3	1	3	3	2
We are adopting emerging technologies for changing our business models (8)	2	1	2	2	1
We need to retrain our employees for technology disruptions (8)	2	2		3	1
Business Model Changes (33)					
Developing capabilities to move from product-centric business model to service-centric business model (15)	3	2	3	5	2
Capability to develop a pay-per-use business model (10)	2	2	2	3	1
Developing an outcome-based business model using IIoT (8)	1	1	2	3	1
Strategic Sensing (30)					
We are sensing external and internal environments continuously for new digital initiatives (12)	2	1	3	4	2
We are scouting external environments with our partners for new digital business opportunities (10)	1	2	4	3	
Internal collaboration capability has increased as we are entering unchartered territories of IIoT and DT (8)	2		3	2	1
Rapid Prototyping (31)					
		2	3	3	2
We develop product prototypes rapidly (10)					
We have implemented a lean product development methodology (12)	1	2	3	4	2
Modular operations capability in the factory are new norms influenced by IIOT and DT (9)		1	4	4	
Organization Structure (31)					
Created specific business groups for IIoT and DT (12)	1	2	4	4	1
Established solution-centric groups for IIoT projects (11)		2	4	5	
Chief Digital Officer (CDO) is coordinating IIoT projects (8)		1	4	2	1
Culture/Mindset Changes (32)					
Managers need to have data-driven decision-making capability for DT (14)	3	2	3	4	1
Managers must have a digital mindset for DT (10)	2	1	2	3	2
We should have a solution-centric mindset for IIoT initiatives (8)			3	3	2
Strategic Focus and Intent (30)					
Top-down strategic focus is critical for DT (12)	2	2	4	3	1
Strategic focus and intent is necessary for IIoT projects (11)	1	2	4	4	
Seniors managers are driving DT initiatives (7)		1	3	3	
Path Dependency (28)					
We are still skeptical about developing new business models (13)	2	2	3	4	2
Service centric business model is difficult and uncertain (8)	1		3	4	
		1	3	2	1

(continued on next page)

Table 2 (*continued*)

Concepts	Software Inc.	Health Inc.	Semicon Inc.	Industrial Inc.	Network Inc.
There is sluggishness in our businesses to change our operations (7)					

Note.
- The number in parenthesis indicates the number of occurrences during the interviews.
- The number in the table indicates the number of occurrences from each company.

second-order themes and our first-order concepts we developed a conceptual data structure as presented in Fig. 1, which illustrates graphically how we developed our model from first-order concepts to second-order themes (Gioia et al., 2013). It also depicts the interrelationships between first-order concepts, second-order themes, and aggregate dimensions of the model.

4. Findings and discussion

We were guided by our research questions during data analysis and interpretation. Specifically: (i) *what are the core capabilities for digital transformation in an industrial business?* and (ii) *how are emerging technologies affecting these core capabilities?* We present our findings next concerning the literature and develop a series of propositions, which

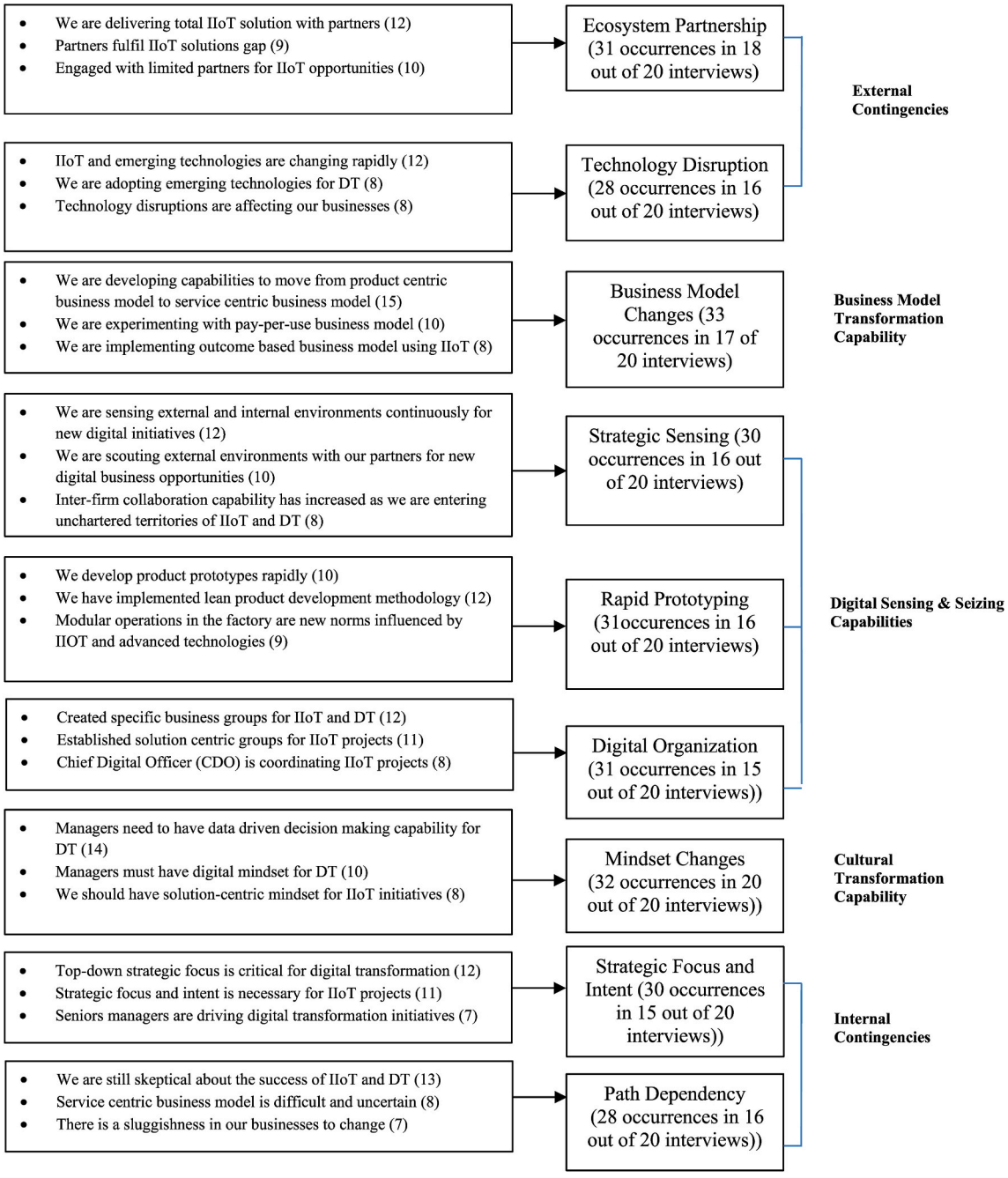

Fig. 1. Data Structure Note:
The number in parenthesis indicates the number of occurrences during the interviews.

form an integrative framework for DTC, as presented in Fig. 2.

4.1. Findings and discussion

4.1.1. Building digital transformative capabilities

To explore the identified knowledge gaps from the literature review regarding DTC definition and conceptualization, we asked the participants to discuss the core capabilities needed for an industrial firm to successfully implement digital transformation. Based on our discussion, several core capabilities emerged based around the Teecian conceptualization of sensing, seizing, and transforming. For Digital Sensing and Digital Seizing, we identify 'Strategic Sensing', 'Rapid Prototyping', and 'Organization Structure' as the core capabilities. For Digital Reconfiguring, we identify 'Business Model Transformation' and 'Cultural Transformation' as core capabilities. All participants in the study agreed with these findings in the follow-up interview phase post-analysis.

4.1.2. Digital Sensing and Digital Seizing

4.1.2.1. Strategic sensing. Most interviewees (16 out of 20) discussed strategic sensing as a core capability for digital transformation, as influenced by IIoT and emerging technologies (Fig. 1). Put simply, the march of technology and digitization is pushing industrial firms towards digital transformation, and sensing is a key and necessary aspect of this. As technology-led businesses are growing, and companies have started the enterprise-wide digital transformation, scanning internal and external environments and scouting digital opportunities are essential to a sensing capability for digital transformation, and our participants expressed similar views:

As industrial lines are getting blurred, we must scan the external environments continuously and we should develop a systematic way to understand our opportunities and competitions. Scanning and scouting environments are critical factors for successful digital transformation (Network Inc.).

Another theme that emerged from our interviews is the solution-centric approach and the importance of internal and external collaboration (Intra-firm and inter-firm collaboration) in strategic sensing capability to identify opportunities in the digital space. Customers expect a complete solution for their problem using IIoT and emerging technologies, and partners should work together to provide that. This quote from one of our interviews illustrates that point:

To develop multi-faced businesses, we need managers who could deal with different industries and different solution partners at the same time. It is not domain-specific knowledge, but 'solution-centric knowledge influenced by IIoT and emerging technologies. This is a new way of looking at business. So, the new product development, product distribution, serviceability, after-sales support, and others need to converge towards the solution. Inter-firm collaboration becomes critical, and companies need to develop this new capability or add a solution mindset to their existing collaboration capability (Industrial Inc.).

In our third interview phase, four out of five participants emphasized the need for strategic sensing capability within the organization as a core capability:

We are stepping into unchartered territories, and sometimes, we are not comfortable with the business opportunities. We are selling healthcare equipment to our customers for decades, and now the healthcare market is changing rapidly. We need to sense new opportunities in the market and adjust our offerings accordingly (Healthcare, Inc.).

Our study suggests that as companies adopt digital technologies and adopt service-led business growth, strategic sensing capability is a key capability for transforming operating models in an organization. Indeed, these businesses are seemingly developing comprehensive sensing capabilities within their organizations as part of their digital transformative capability (DTC). Concurrently, among those we interviewed, firms with the weakest sensing capabilities were drifting and struggling to form coherent digital transformation strategies or execute their digital strategies in significant ways. Our findings echo and extend Blumensaat et al. (2019) who argue that ubiquitous sensing is a key capability for digital transformation for the utility industry.

The World Economic Forum (2016) identified key operating model capabilities such as sense and interpret disruption, experiment and launch products faster, understand and organize data, build and maintain a digital team, partner and invest for all non-core activities, organize for speed and develop a delightful user experience. Industrial businesses are utilizing emerging technologies to enhance their external

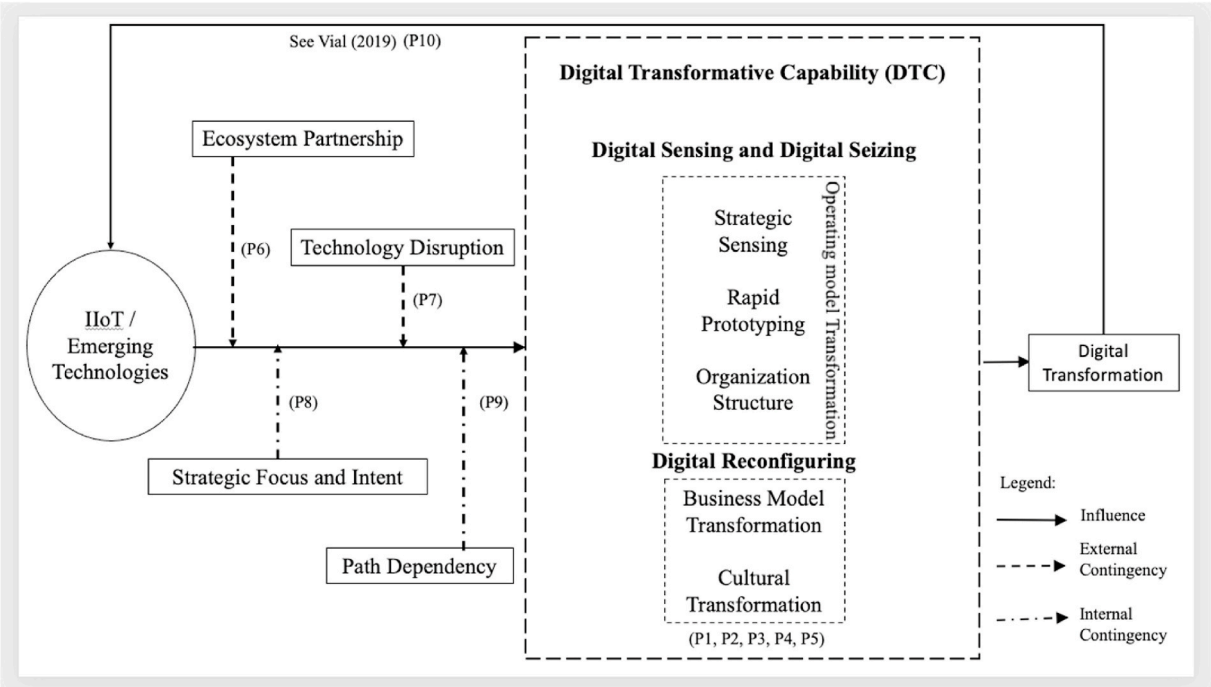

Fig. 2. An integrative framework for Digital Transformative Capability (DTC).

and internal environment scanning and sensing capabilities. A quote from one of our respondents illustrates this point.

> "Sensing the current and future business, from the core market segments and adjacent market segments, are very crucial. We also need to sense competition from the IoT market segment which is the combination of different industry segments. Digital managers need to have a comprehensive sensing process in place and need to develop core sensing capabilities for the IoT business. Emerging technologies are strongly influencing both the core sensing processes and capabilities". Semicon Inc.

Businesses are utilizing artificial intelligence to develop knowledge-based marketing by analyzing customers, users, and external marketing environments (Paschen, et al., 2019). Warner and Wäger (2019) emphasized the capabilities for digital scouting and digital scenario planning and long-term digital visions. As digital transformation is blurring organization boundaries (Ilvonen et al., 2018), competitors are emerging from different industries. For example, Apple has introduced new features in the Apple Watch, which can monitor health conditions at home (Bryant and Morrell, 2020) and competing with traditional healthcare companies such as GE Healthcare and Siemens Healthcare. A firm should understand the digital transformation needs of its current and prospective customers and the overall Industry 4.0 trends for the industry. This can be achieved by developing sensing capabilities, as per the Teecian tradition of dynamic capability, by an effective inter-firm and intra-firm collaboration strategy, and by scouting the external environments continuously. Digital transformation is a multi-year initiative, for example, GE started the digital transformation journey in 2010 and is continuing (GE Digital Industrial Playbook). So, a firm needs to develop a long-term digital vision for digital transformation and needs to scan and scout the environment continuously. Thus, strategic sensing is a key sensing capability for a new digital operating model.

We also observed that IIoT and Industry 4.0 initiatives were forcing industrial companies to redesign internal processes and internal operating models to seek favorable business outcomes. Extending Savastano and Guida (2018), for instance, several of our interviewees emphasized the centrality of sensing external environments and designing solution-centric business teams for better collaboration with partners. Warner and Wäger (2019) argue that the digital sensing capability using disruptive technologies such as artificial intelligence, analytics, and IoT capabilities helps an organization in its digital transformation journey. In our interviews, most of the respondents suggested that strategic sensing capability is important for digital transformation, but, and somewhat differently to Warner and Wäger (2019), IIoT and emerging technologies influence this sensing. To this end, sensing is the beginning of the journey and a point at which IIoT and emerging technologies are essential, not merely later in the journey or process of digital transformation Based on this discussion, we propose:

Proposition 1. *Strategic sensing capability is a key DTC, and it is influenced by IIoT and emerging technologies.*

Consistent with the Teecian view of dynamic capabilities, though, the interview data suggests that while strategic sensing is critical for Digital Sensing, it is not enough to trigger the seizing aspect of dynamic capability. Seizing capabilities are another key capability for digital operating models. According to Warner and Wäger (2019), *an entrepreneurial mindset, rapid prototyping, establishing innovation laboratories, and developing lean product development capabilities are important seizing capabilities for digital transformation. A firm needs to develop a Silicon Value startup culture known for rapid prototyping, agile decision-making, and flat organization structure* (Tabrizi et al., 2019). *Digital transformation initiatives are highly influenced by software technology and the agile software development processes including minimum viable products (MVPs) are key components for digital transformation* (Ebert and Duarte, 2018). *Rapid prototyping capability is a key capability for a new digital operating model. Digital transformation challenges existing organizational structures and generates new business champions, and it can facilitate new organization design* (Lanzolla et al., 2020). *For example, organizations may introduce Chief Digital Officers to coordinate digital initiatives* (Singh et al., 2020). *The results indicate Digital Seizing is enabled by capabilities in rapid prototyping and organization structure. We discuss these next.*

4.1.2.2. Rapid prototyping. Most interviewees (16 out of 20) acknowledged innovation and rapid prototyping capability as a core capability for digital transformation (Fig. 1) and seizing sensed opportunities. It would appear from our data that such rapid prototyping is a prerequisite capability for Digital Seizing. The IIoT industry is changing rapidly, and emerging technologies are impacting the business. Customers are demanding customized products tailor-made for their businesses; competition forces a firm to be efficient in its business operations and provide the highest quality products at a lower cost within a reasonable response time, and IIoT products are complex wherein the company must absorb these complexities in a changing environment. Companies need to innovate faster and develop rapid prototyping capabilities. Lean product development, including minimum viable product (MVP) based agile development methodology, are common in the software industry, but it is increasingly becoming a norm in industrial businesses as a solution to having to absorb these complexities. In enabling firms to seize on opportunities and push for digital transformation, rapid prototyping leveraging IIoT, and advanced technologies is a competitive advantage as expressed by our respondents:

> We have implemented rapid prototyping and MVP based product developments for our products. This allows us to develop our products rapidly and get feedback from our customers. This has reduced our new product development time significantly (Health, Inc.).

In our third interview phase, most respondents suggested the benefits of rapid prototyping and modular product development initiatives. They also expressed the trend towards joint product development initiatives with partners. The following quote elaborates on their points:

As more and more customers are asking for unique fulfillments, we need to develop rapid prototyping capabilities to meet those challenges. We have adopted 3D printing services for some of our components, and we are collaborating with our partners for joint product development using agile product development methodology such that we can meet our customer demands (Industrial, Inc.).

Based on these observations, rapid prototyping capability appears to be an essential capability for DT influenced by IIoT and emerging technologies. As customers are moving more and more towards the experience economy, industrial businesses should modify their operating models and develop rapid prototyping capability for DT. One of our respondents quoted a similar theme.

We have adopted rapid prototyping models to develop new products and processes for our business. Emerging technologies such as IoT, Big Data Analytics, and Cloud-based deployment are influencing rapid prototyping models. This is a core strategy for our digital transformation initiatives (Industrial Inc).

Based on our findings, we can suggest that Industry 4.0 and IIoT are driving automation and related digitization of operational technologies within the factory floor. However, most of the solutions are vendor-specific and lack interoperability. Rapid prototyping will help a firm to understand customer-specific requirements most economically. For the successful implementation of these initiatives, firms need to develop capabilities for multi-vendor modular production systems (Weyer et al., 2015). Our interviewers suggest that model-based prototypes enable a firm to develop a "Smart Manufacturing" ecosystem quickly that relates to ecosystem partners, suppliers, and customers, and through which they can test a solution with customers (Suri et al., 2017). Our respondents expressed that rapid prototyping capabilities, influenced by emerging technologies, are important for seizing the initiative for digital transformation, and this can be advantageous for a firm. Thus, we

propose:

Proposition 2. *Rapid prototyping capability is a key DTC, and it is influenced by IIoT and emerging technologies.*

4.1.2.3. An organization structure suitable for the digital age. Developing an organizational structure suitable for digital transformation was indicated by 15 out of 20 respondents as a core capability for digital transformation (Fig. 1). They insisted that an organizational structure can help or hinder such initiatives, as can an incapacity to adapt structure, and companies should develop proper internal operational structures with adequate roles and responsibilities for successfully implementing digital transformation initiatives. As such, Digital Seizing requires firms to be capable of adapting the structure to best suit digitization. For example, a firm developing a horizontal IIoT platform (a common platform for multiple businesses) for its customers might have one type of organizational structure, whereas another firm might have a different structure as it might be developing a specific IIoT solution for the healthcare industry (vertical platform). This difference was noted by an executive at Industrial Inc.

The traditional business/domain-based organization structure is changing. Earlier, our company has businesses in an industry vertical like Aviation, Oil & Gas, Healthcare, etc., but now the structure is changing more towards a solution-based organization structure, and multiple businesses are participating. So, the IIoT managers need to develop new collaborative capabilities or expand current capabilities to accommodate these changes (Industrial, Inc.).

Moving from a product-centric approach to a solution-centric approach was echoed by other participants. Instead of assigning people to particular business segments, the best companies are developing solution-based teams to develop and market IIoT solutions faster and secure early customer adoption.

Solution-centric organization structures are key for DT. If you look at our organization, we have groups such as IIoT – Solutions and Services, Core processors business groups, and all of them are struggling to develop a comprehensive DT strategy as the groups have different charters. I have seen the same problems as other companies. Unless they have a solution-centric organization structure, they cannot develop and execute the DT strategy (Semicon, Inc.).

In our third interview phase, all respondents agreed with the need for a proper organizational structure for successful digital transformation. There was also a discussion about the role of a Chief Digital Officer (CDO) in the organization. Some (3 out of 5) suggested that the role of CDOs is still vital as they manage the digital transformation initiatives in the organization. However, two participants cautioned that as the organization matures, the role of the CDO may not be necessary, and current organizational structure solutions such as chief technology officer (CTO) can manage the digital transformation initiatives:

We have changed our organization structure for DT projects, and we have a CDO who coordinates across all business segments and develop the overall strategy for the organization. Earlier, each group was running their initiatives and CDO has helped us to consolidate all these initiatives and we have developed an economy of scale (Health, Inc.).

Based on these observations, the capability to develop and adapt organization structure is a core capability for digital transformation and seizing upon opportunities to do so and is parallel with Warner and Wäger (2019) indication of the need to redesign internal structures and having capabilities to do this. The organization structure has a strong impact on firms developing DTC and launching digital transformation initiatives across the organization and this theme is echoed in our interviews. IIoT and emerging technologies have created a new and dynamic environment for organizations. Developing new capabilities or reconfiguring existing capabilities depend on the organization's structure, culture, people, and processes such that the organization can continue to develop and maintain existing products and develop new products and competencies in a changing environment (Verona and Ravasi, 2003). Our findings enrich Verhoef et al. (2019), who argued that digital transformation necessitates proper organization structure and performance metrics. But we see this as a capability, not a property, as do our elite interviewees. Most of our participants in our interviews argue that as companies are moving from a product-centric model to a service-centric model, the organization structure is a key factor for such changes. Researchers such as Bustinza et al. (2015) have similar views whereby selecting a proper organizational structure is important for servitization efforts. Based on our discussion, we propose:

Proposition 3. *A capability to develop and adapt organization structure is a key DTC influenced by IIoT and emerging technologies.*

4.1.3. Digital reconfiguring

Reconfiguration capabilities are another key capability for digital transformation under dynamic capability theory. There are two distinct ways digital transformation influences business models. In a new firm, managers can experiment with a new business model, whereas, in an established firm digital transformation influences business model reconfiguration (Lanzolla et al., 2020). Digitalization has influenced new value creation, value delivery, and value capture capabilities including servitization (Visnjic et al., 2016), platform business models (Constantinides et al., 2018), digital customer experience (Weill and Woerner, 2013), and smart contracts (Dutra et al., 2018). Culture is another key element of digital transforming capability. Digital transformation initiatives are frequently unsuccessful due to rigidities in an organizational culture that prevent change (Hartl and Hess, 2017). Tabrizi et al. (2019) suggest that one of the key lessons about digital transformation is that it is not about technology but adapting a digital culture that can foster innovation.

4.1.3.1. Building business model transformation capabilities. Teece (2018) suggests that a business model is an architecture for how a company creates and delivers values to its customers and the very mechanism for how it captures the value. Ritter and Lettl (2018) describe the business model as a concept for a company to explain "what it does", "what it offers" and "how the offer is made". IIoT and emerging technologies have disrupted industrial businesses and created new opportunities and customers. IIoT and emerging technologies have influenced three basic components of business models: value creation, value delivery, and value capture (Teece, 2010). During our interviews, some participants (e.g., from Industrial Inc., Health Inc., and Network Inc.) suggested that they were demonstrating a newer way to create and deliver business value by developing Industrial Internet platforms and expected their customers and partners to develop IIoT applications leveraging their platforms. This is a significant assumption but is also indicative of a race to establish a dominant platform. Among some of our other respondents, the race to establish a dominant platform was fueled by fears over late-mover disadvantage, whether their platform is exceptional or not.

Most of the interviewers (17 out of 20) mentioned business model changes as a core capability for digital transformation (Fig. 1). Most of these industrial businesses are involved in product-centric value delivery models, and they have ongoing relationships with their customers for additional products and services. However, the participants expressed that the market was evolving into an outcome-centric business model influenced by emerging technologies.

The industry is moving from an equipment-centric to an outcome/service-centric business model by leveraging IIoT and emerging technologies. So, the managers need to develop usage patterns, peak loads, performance indices, etc. to develop the new service models for the business. And service-based, pay-per-use models will be the norm of the future (Industrial Inc.).

Though all participants expressed the need to develop capabilities for business model changes for DT, some of them were skeptical about the pace of this change. They suggested an incremental approach for such a

drastic change. For example:

> My personal view is that business model changes are evolutionary, and the companies will develop these capabilities gradually. The businesses are not sure how to monetize the IIoT business. The businesses are thinking IIoT businesses either horizontally or vertically. However, the managers need to adopt a different business model than they are used to now (Software, Inc.).

Having available and effective routines and processes for business model changes appear to be a core capability for Digital Reconfiguration, and thus, DTC. In the third interview phase, all participants agreed on the importance of such capability for business model changes. However, all our respondents are still trying to implement new business models across the organization and in an effort to developing new value creation and delivery models for competitive advantage. This suggests such a capability is rare and a significant bottleneck. The following quotation highlights this point:

We are still trying to figure out the business models and how IIoT and emerging technologies could influence the business models. However, we are utilizing emerging technologies and defining the value creation and delivery mechanisms differently. We have developed a pay-per-use model for our aircraft engines and customers only pay for the hours utilized and we maintain those engines (Industrial, Inc.).

During our third interview phase, respondents expressed some concerns related to the adoption of IIoT platforms. Ten respondents supported the pay-per-use business model (Xu, 2012) theme, but the interviewees in phase 3 agreed that IIoT was only helping them to implement such a model gradually. The respondents also indicated that emerging technologies are influencing business model transformation.

IoT and advanced technologies are influencing businesses in developing new business models and it is an important capability for growth as this capability is helping the digital transformation of the entire business. (Healthcare Inc).

Implementation is a problem in most interviewed organizations. Such transformation is complex, and this view is also supported by Kiel et al., (2017). The outcome/service-centric business model (Baines and Lightfoot, 2014) became a recurring theme in our interviews, but digital servitization initiated by digitization influences the business model of the firm and the business models of ecosystem partners (Kohtamäki et al., 2020). Thus, while business model transformation is critical for digitally reconfiguring the firm, it is fraught with difficulty. In conclusion, Digital Reconfiguring requires business model transformation capabilities and a shift from traditional models towards outcome-centric digital servitization (Frank et al., 2019, Paiola and Gebauer, 2020), as expressed by executives from Industrial Inc. and Network Inc., for instance. Based on these observations, we propose:

Proposition 4. *Business model transformation is a key DTC capability influenced by IIoT and emerging technologies*.

4.1.3.2. Building cultural transformation capabilities. All respondents (20 out of 20) in our interviews unanimously expressed that a change in mindset is an important factor for DTC (Fig. 1). As businesses are changing and the companies are concentrating on a solution-centric approach for digital transformation, the industrial managers need to change their mindset for a favorable outcome to materialize and ease the implementation of change:

To develop multi-faced businesses, we need managers who could deal with different industries at the same time. It is not domain-specific knowledge but 'solution-centric knowledge. This is a new way of looking at business. So, the new product development, product distribution, serviceability, after-sales support, and others need to converge towards the solution. Though we can learn from existing capabilities we need to add a digital mindset and modify these capabilities (Semicon, Inc.).

Some of the respondents also indicated that the emerging technologies are influencing a data-driven cultural transformation, describing this as "key for digital transformation" (Semicon Inc). The interviewees also emphasized a data-driven decision-making capability for digital transformation. Since product and service innovation are key differentiators for a company, managers need to adapt to these changes:

The Industrial IoT business is a different business and the managers must have a digital mindset for the business. One of the characteristics of the digital business is that the pace of innovation is very high, so managers should adopt an agile methodology for product development, alliance, marketing, sales, customer support, and all related businesses (Industrial, Inc.).

In our third interview round, all respondents recognized the changing of collective mindset as culture change and highlighted the importance of cultural transformation (a mindset change) capability for DT influenced by IIoT and emerging technologies. The elite informants also described the difficulty in changing the mindsets of managers and employees (company culture) and emphasized the process to be a gradual one:

Cultural transformation is a key for DTC and the emerging technology is influencing cultural transformation within an organization. You cannot develop new business models and change your current operating model unless you have digital mindsets in the organization. The mindset of the managers and the employees must change to accept the new solutions driven by emerging technologies (Health, Inc.).

Based on these findings, culture change capability, as reflected by such aspects as a mindset change, appears to be a key capability for digital transformation. As companies are executing digital transformation initiatives, the industrial managers and employees need to develop digital mindsets for successful digital transformation and the emerging technologies, including IIoT motivate this transformation. A similar view is expressed by McKinsey and Company (2018): "digital is not merely an add-on; it's a way to think differently about business models, customer journeys and organizational agility". The interviewees also discussed the ability of managers to make business decisions based on real-time digital information available from IIoT and emerging technology solutions and this type of mindset refer to as managerial cognitive capability (or dynamic managerial capability), essential for strategic changes in uncertain times (Helfat and Peteraf, 2015). Our interviewees also suggest that digitization offers a new way of looking at the business environment. Businesses with a digital mindset (e.g., CDOs, Digital Managers) should be able to sense the opportunities from physical and digital information (strategic sensing) and then seize upon and reconfigure the firm towards digitization. To do so demands the right culture and mindset to be in place in the firm. A similar observation is made by Tabrizi et al. (2019) and they suggest that digital transformation initiatives can be successfully implemented if the managers focus on changing the mindset of its members, and thereby, organization cultures and processes. Based on our discussion, we propose:

Proposition 5. *Cultural transformation capability is a key DTC responsible for digital transformation*.

To conclude our discussion concerning DTC, an important point related to the IIoT business was raised by an interviewee from Semicon Inc.

Capabilities are like concentric circles which help in product innovation. We have some core capability and then we have multiple concentric circles, consisting of extended capabilities. In this modular capability approach, each organization needs to protect and enhance the core capabilities and add extended capabilities to expand the business and develop new products and services (Semicon, Inc.).

We draw from this that the capabilities identified within each sphere of Digital Sensing, Digital Seizing, and Digital Reconfiguring capabilities are complementors and extended capabilities that enable the three facets of DTC for digital transformation to be successfully undertaken. Such a conclusion is consistent with the Teecian perspective of dynamic capabilities being supported by other capabilities. The themes and capabilities identified in the results from interviews with elite executives at world-leading technology companies provide useful evidence in support of prior research (e.g., Warner

and Wäger, 2019) *and simultaneously extends that research for a more nuanced understanding of what is entailed within DTC and to succeed at digital transformation. We now move forward to discuss the external and internal contingencies of DTC that arise from our analysis.*

4.1.4. External and internal contingencies for DTC

(Heine and Rindfleisch, 2013: 14) note that contingency theories remain "Pollyannaish, emphasizing appropriate managerial adaptation … [but] … contain no explanation of the mechanisms". We draw upon the interviewees' experiences to identify critical external and internal factors that could influence DTC development and have special significance for digital transformation initiatives in a changing environment.

4.1.4.1. Ecosystem partnership. Most interviewees (18 out of 20) mentioned ecosystem partnership as an enabler for digital transformation influenced by IIoT and emerging technologies (Fig. 1). They highlighted the importance of strategic partnerships in developing and deploying business solutions leveraging IIoT and emerging technologies.

Ecosystem partners play an important role in developing total IIoT solutions. For example, for Smart Airport, our three internal businesses and partners are involved. We are contributing 30%–40% of the offerings, and the rest 60%–70% are offered by the partners (Industrial Inc.).

One theme that emerged from the interviews is that partners help develop a complete IIoT solution for the customer. Interviewers indicated that one company could not deliver all components, and partners are critical for solution delivery. During our discussion, the participants noted they had entered strategic partnerships to fill the gaps in their existing IIoT solution(s). Since Industrial IoT/Industry 4.0 was still evolving, one company could not provide all components for a particular solution. Health Inc. participant expressed her views as follows:

We have developed a Healthcare cloud, but it won't be successful unless other third-party solution providers are using our Healthcare Cloud and develop applications on top of that. Unless we fulfill the product gaps, customers may not use our solution (Health Inc.).

Ecosystem partnerships can be difficult to manage, and the partners may have competing interests. So, companies are forming a limited key strategic partnership and exploring opportunities with early adopters. Some of the participants expressed this view:

Our strategy early on was good to have a limited number of partners like GE, AT&T, Cisco, etc. So, for IIoT based solutions, the companies need to have a limited set of partners otherwise partner management will be difficult. We should not make ourselves too thin. Get some early adaptors and go with them, develop solutions, and go with a set of partners (Semicon Inc.).

All interviewees (5 out of 5) in the third phase expressed the importance of ecosystem partnership for digital transformation through IIoT and emerging technologies. However, it has become evident from the interviews that ecosystem partners are frequently intra-industry competitors, as in the case of Semicon Inc above, or complementors (e.g., Health Inc., Software Inc.). Ultimately, ecosystem partnerships are crucial as the company alone cannot succeed at digital transformation by doing everything itself:

In the case of IIoT, a company can offer one piece of the puzzle, but to solve the whole puzzle (Data collection by the sensors, transport to the cloud, analysis, sending information back to the field, etc.), companies are relying very heavily on strategic partnership, and this could be a key differentiator (Software Inc.).

Although ecosystem partnership is important for any business, it has special significance for IIoT initiatives responsible for DT. Since IIoT/Industry 4.0 initiatives are relatively new, managers do not have significant track records working with their partners, and they are very selective in their partner choices (not least as the potential risks escalate in such high-velocity environmental conditions). Our findings align with Papert and Pflaum (2017) and Eisenhardt and Martin (2000), who suggest that in a high-velocity market with significant uncertainty, firms tend to form strategic alliances to serve the market and try to hedge risks in the business the development of dynamic capabilities. Our interviewees suggest that for digital transformation, ecosystem partnership is not only about sharing resources, but it is more strategic to the organization, and the partners jointly decide on new product developments and innovations. A similar view is articulated by He et al. (2020) as they suggest that strategic alliance is shifting from skill/resource substitution to jointly developing new products and services by capitalizing on emerging technologies. Another important finding is that the managers consider digital transformation initiatives *as* digital business, whereby ecosystems and strategic partnerships are critical factors for *developing and deploying* digital businesses (Subramaniam et al., 2019). Based on these observations, we propose:

Proposition 6. *Ecosystem partnerships are a key contingency for DTC development, where (a) greater ecosystem embeddedness through partnerships is associated with faster and more sophisticated DTC development but where (b) the realized development depends on the industrial business' ability to strategically manage these ecosystem relationships.*

4.1.4.2. Technology disruption. Most participants (16 out of 20) highlighted technology disruption as an important factor in DTC (Fig. 1). Emerging technologies and IIoT are accelerating digital transformation by changing the markets, customers, partners, and products of these firms, and doing so quite dramatically. In our case, industrial organizations are trying to transform their businesses from a traditional product/machine-centric business into a digital business. This new business depends on new emerging technologies. For example, an industrial conglomerate like General Electric (GE) is rebranding itself as a 'digital industrial company'. Technology disruptions are, somewhat ironically given the serious challenges they pose, in fact helping companies to transform their businesses.

IIoT business is different from our core businesses as IIoT is about connecting machines with intelligent information or, in other words, 'Software Defined Machines'. It has game-changing effects across the industry, and we are at the forefront of this revolution. This will improve the productivity of industrial businesses and improve the lives of the people. It will have significant effects across the industrial world. The current technology disruption is influencing this change (Network Inc.).

Indeed, most participants (4 out of 5) in the third interview phase indicated that technology disruption and usage of new and emerging technologies are helping them in their DT journey:

IIoT and emerging technological disruptions are impacting businesses mostly in a positive way. The IIoT and other technologies are not only helping businesses to transform their business models, but it is also significantly impacting operational efficiencies and it is also impacting the people (cultural) side of the businesses. Companies can build quality products faster, cheaper and it is helping a company to be more competitive (Industrial Inc.).

All interviewees agree that technology disruption (or a high-velocity market) accelerates the digital transformation process because it creates a high state of urgency, consistent with (Teece, 2007, 2014) arguments. However, what is problematic is that while recognition of the need to change and digitally transform exists, the severity of the disruption creates problems. The organizations studied struggled to understand 'what' was needed for such a transformation. This problem was exacerbated by trying to ensure short-to-medium term competitiveness in their markets without knowing what the future markets will look like or need them. GE seems to have particularly struggled with this issue. Kane (2019) suggests successful digital transformation demands attending to and navigating through, technological disruption. Accordingly, we propose:

Proposition 7. *The rate of technology disruption is a key contingency for DTC development, where (a) greater rates of change are associated with more aggressive and sophisticated DTC development but where (b) the realized*

development depends on the industrial business' ability to manage the complexity of technology disruption in its business.

4.1.4.3. Strategic focus and intent. 75% of respondents (Fig. 1) implied an influence by strategic focus and intent on senior managers in developing digital transformation capabilities as new technologies emerge. Since the scope of DT is widespread and enterprise-wide, senior managers and the executive team should pay special attention to such initiatives:

Digital transformation is a resource-intensive initiative, and without board-level approvals, it is difficult for us to initiate large DT projects. When we decided to develop a health cloud where we could integrate patient's imaging and monitoring data, we have a total blessing from the top, and it was one of their top business priorities (Health Inc.).

Without proper strategic focus, a company may not be able to take advantage of IIoT and Industry 4.0, as expressed by one respondent at Software Inc.

We do not have strategic plans for the IIoT business. The managers are not clear how IIoT and Cloud could change their businesses. They still think IIoT products are an extension of their existing software products, and they do not have a comprehensive strategy.

In our third interview phase, all respondents expressed the importance of strategic focus and intent and its influence on DTC. All of them emphasized that DT initiatives cannot be successful without the focus and attention of senior managers. We revisited this issue with the elite informant of Software Inc., and they specified that the company has changed its strategy and now the company has a strong IIoT-based product strategy leveraging emerging products.

In conclusion, strategic intent and realization are a pre-requisite for successfully realizing DTC. Intentions to change, and actual realized change, are two very different things. The firm may have an intention to change but lack the resources to do so (Covin et al., 1997) or seek to make changes but scale these back to minor, second-order, strategic changes consistent with pre-existing strategic archetypes (Fox-Wolfgramm et al., 1998). Consequently, many aspects of the strategic intent toward digital transformation become unrealized and our findings support this view. Based on this discussion, we propose:

Proposition 8. *Strategic intent and focus by senior management is a key contingency for DTC development, where (a) greater strategic intent and focus are associated with successful DTC development as new technologies emerge but (b) a misalignment between strategic intent and the realized strategy is an inhibitor of DTC development in the IIoT industry*.

4.1.4.4. Path dependency. 16 out of 20 interviewees mentioned that path dependency impedes developing DTC (Fig. 1). This is the 'lock-in' problem as expressed by Heine and Rindfleisch (2013). Respondents agreed that developing capabilities for digital transformation is difficult if a firm is successful in a particular path and in a particular way of doing business. Path dependence paralyzes the ability of the company and its senior managers to change away when faced with technology disruption and as other business conditions change:

We are very successful in a license-based business model, and due to severe market pressure, we are slowly moving towards a cloud-based business model. Still, most of our customers are in traditional business models and we will try to extend it as much as we can (Software Inc.).

Though managers agree to the changes they needed to make for digital transformation, they remained skeptical across the first two interview phases regarding changing their business value creation and delivery models at that time. They were, however, cautiously optimistic. As one participant expressed:

Our medical devices business is high dollar value and low volume, and our manufacturing, sales, marketing, and other people are experienced in this business. This business (of selling machines to hospitals) still exists and is very profitable. It is difficult for us to switch to a cloud-based business, which is high volume and low margin, and we need to transform our existing capabilities or acquire new capabilities for such transformation (Health Inc.).

In the third interview phase, the elite informants were less skeptical about the prospect of digital transformation. All of them expressed the importance of digital transformation and how it could influence business growth.

No, it is not hype, people are realizing that digitization is a competitive advantage. You have seen that in e-commerce. Many customers have adopted digital transformation technologies and digitization as part of their e-commerce strategy, and they are growing faster and outwitting their competition (Network Inc.).

Although managers are seemingly embracing digital transformation initiatives in their organization, path dependency and the historical tendencies of these organizations appear to impede the successful implementation of IIoT projects in the organizations studied here. Indeed, some of the elite informants are still skeptical about the success of IIoT and related technologies because they feel comfortable with existing paths. This can hinder capability development, as suggested by Madhok and Osegowitsch (2000) based on their research with pharmaceutical companies. We find that industrial managers are interested in engaging in digital transformation initiatives by leveraging IIoT and emerging technologies. However, they are still influenced by their past successes, which exacerbates the lock-in problem (Heine and Rindfleisch, 2013). Wang and Ahmed (2007) observed similar patterns and concluded that capability development is path-dependent, and a firm's future direction is determined by the path it has traveled. However, Teece (2014) suggests that although path dependency may pose a constraint, firms should pivot and take a new path when they face technology disruption and other external factors that force them to change strategy through business model innovation, thus, develop DTC. This is easier said than done. Accordingly:

Proposition 9. *Path dependency is a key contingency for DTC development, where (a) path dependency is an inhibitor of DTC development despite the urgency created by technological disruption and the need for flexibility in the IIoT industry, and (b) requires careful strategic management by senior management to overcome the inertial tendencies created by path dependencies*.

4.1.4.5. The recurring consequence of digital transformation. We recognize a recurring system feedback loop between digital transformation and IIoT and emerging technologies to complete our analysis. Vial (2019) specified in his building blocks of the digital transformation process that digital technologies (such as IoT) fuel disruptions in customer and consumer behaviors and expectations and in the competitive landscape that trigger strategic responses, including a digital transformation strategy among industry players. This digital transformation relies on innovating technologies that replenish and grow the number of digital technologies in the market, fueling further disruption (see Vial, 2019, p.122, Fig. 1). Thus, implementing digital transformation begets new emerging IIoT and technologies that exacerbate external environment disruption and suggest looped or circular relationships. Digital transformation generates innovations that disrupt firms and call for further change. We suggest that this continuous iteration of the technology is one reason why industrial organizations find digital transformation so challenging. For example, as industrial organizations compete to create platforms that will form the basis for new standards, innovations, and changes in the form and use of technologies call for a continuous digital change process. A static view of digital transformation misunderstands the intertwined and looped nature of digital transformation within one industrial organization and among other industrial organizations. Digital transformation fuels more technologies that cause additional disruptions that then require further digitalization. Our interview organizations bore out this challenge, with each struggling to manage digital transformation content against a backdrop of continual change in IIoT and emerging technologies.

Proposition 10. Digital transformation among industrial organizations fuels new IIoT and technologies to emerge, fueling further disruptions that trigger further digital transformation.

4.1.5. An integrative DTC framework: implications and directions

Despite advances in digital transformation research, how digital transformation materializes has been addressed in a limited fashion (Warner and Wäger, 2019). In responding to this issue, this study conceptualizes DTC and extends the boundary conditions of dynamic capability theory (Teece et al., 1997, 2007). Based on dynamic capability theory, our interviews with senior executives in some of the world's leading technology companies, data structures (Fig. 1), and propositions, we present an integrative framework in Fig. 2 that captures the core capabilities required for digital transformation and the critical aspects that need to be in place for success in developing DTC. Since it is difficult to measure the degree of digital transformation in a company, the study has identified key drivers and inhibitors of DTC development. Thus, the study advances the body of knowledge on the application of digital transformation in the IIoT industry.

Through this integrative framework for DTC development, we offer several contributions to theory development and understanding of digital transformation and dynamic capability. First, we add much-needed new knowledge and understanding of the mechanisms for sensing, seizing, and reconfiguring in the Teecian dynamic capability tradition. Second, we extend past revelations by authors such as Tabrizi et al. (2019) of the importance of rapid prototyping, structural reorganization, mindset, and culture change and then extend this by understanding wherein the dynamic capability spectrum these key aspects feature. For instance, in Digital Seizing and Digital Reconfiguring. Third, we extend the digital transformation framework developed by Warner and Wäger (2019), by incorporating additional factors for Digital Sensing, Digital Seizing, and Digital Reconfiguring capabilities. In addition, we contribute fresh insights into the boundary conditions of DTC and digital transformation, expanding on critical contingencies that act in favor of, or against, the development of DTC in industrial businesses. External to the firm, ecosystem partnerships with competitors and complementors, and technology disruption motivate digital transformation in DTC development. However, evidence also indicates that technology disruption, by its very nature, causes confusion in how to transform and what is needed for digital transformation. While it is straightforward for scholars such as (Correani et al., 2020: 37) to argue for managers to "assimilate the disruption ensuing from the introduction of digital technologies", this is very much easier said than done. This is the case, in part, due to the internal contingencies revealed in our data as, internally, both voids in strategic intent (and misalignment with strategy) and path dependencies inhibit the development of DTC and digital transformation itself. By revealing these contingencies, more nuance is given to our understanding of digital transformation. For instance, as ecosystem partnerships develop and as disruption occurs, the centrality of Digital Sensing and Digital Seizing for transformation becomes important. Simultaneously, historical tendencies can block meaningful reconfigurations and adaptations required for digital transformation.

A system is generally seen as a complex set of integrated, interdependent, interconnected, and interactional elements such that firms may be thought of as systems of interdependent choices (e.g., O'Connor, 2008; Siggelkow, 2011; Von Bertalanffy, 1968). Some of the elements discovered concerning DTC, such as identifiable organization structure in Digital Seizing and culture concerning Digital Reconfiguring are also elements reflective of major innovation dynamic capabilities as discussed by O'Connor (2008) within a system's context. A systems theory lens would enable researchers to make finer-grained advice for managers on organizational design and configurations for digital transformation, while enriching its theoretical underpinnings, not least as the focus of systems thinking is to understand the 'whole' (and not the parts) and map relationships and configurations (Capra and Luisi, 2014). As the application of systems theory in digital transformation research is scant, we advocate advancing theoretical developments into digital transformation through the merging of systems theory with dynamic capability theory (O'Connor, 2008). Doing so can increase our collective understanding of how firms can develop digital transformative capabilities and enable major strategic changes, such as those created by digital transformation initiatives.

The study holds important managerial contributions. Industrial managers can use the integrative framework and concentrate on three core DTCs of Digital Sensing, Digital Seizing, and Digital Reconfiguring and associated capabilities of Strategic Sensing, Rapid Prototyping, Organization Structure, Business Model Transformation, and Cultural/Mindset Transformation to set a platform for success at digital transformation. Managers should investigate the cultural aspects of the organization and a data-driven decision-making culture should be encouraged. Industrial managers are developing new business models, but operating models should also be changed to align with the business model changes. Special attention needs to be paid to the inhibitors of DTC development and digital transformation. Historical path dependencies are not easily overcome but a focused strategic intent and embracement of disruption can ease this transition. In the absence of such an approach, managers engaged in digital transformation projects may have done this largely by intuition without fully appreciating the internal and external factors which could affect DTC development.

Managers in industrial businesses should pay special attention to the cultural aspects of digital transformation initiatives. Since most of these industrial businesses are operating for decades, the managers and employees may not be trained with data-driven decision-making processes, and they may still follow manual checks and balances. For successful implementation of DT initiatives, employees need to have basic knowledge about statistics, analytics, key performance indicators, social networking, etc., and the organization should organize skill development programs for them. The industrial company that can change the collective managerial mindset quickly will have a competitive advantage against others.

The study has several limitations. First, the study has been designed to understand how industrial businesses are developing DTCs by leveraging IIoT and emerging technologies for digital transformation. We interviewed elite informants from five different high technology companies, all of which are engaged in large-scale digital transformation initiatives. However, a large sample of companies from different industries should be considered for validating the propositions arising from our results. For instance, there may be segment-specific features and relationships that are not accounted for. Second, our respondents are managing high-value digital transformation initiatives. However, a larger number of interviews and multiple informants within either (a) the same industrial businesses, or (b) across firms with lower-value digitization initiatives could have added further insights and nuance to those presented. Third, the purpose of the study was to offer exploratory knowledge on an important and limited research area, but we recognize that causal evidence of the drivers of DTC would be highly beneficial for practitioners in the field. Fourth, other capabilities such as strategic agility, change management, balancing digital portfolios, and execution have been identified in current research as capabilities to digital transformation. Though we do not find these in our results, it is possible that additional elements, or dynamic capabilities, could be required in different industries and contexts. Further investigation would be valuable. Finally, digital transformation is a potentially larger construct that we can parsimoniously depict here and may extend to value chain transformation towards platform ecosystems. By implication, an organization's digital transformation may rely on current digital transformation by others in its ecosystem and the extent to which these align. A networked view of digital transformation among ecosystem partners is likely to prove insightful to theory and practice.

5. Conclusion

Digital transformation is changing business paradigms. It is redefining existing businesses and creating new business ventures and IIoT and emerging technologies are acting as catalysts, but how can industrial businesses succeed at digital transformation? Despite increased academic attention, industrial businesses are failing more than succeeding at digital transformation (Tabrizi et al., 2019). We addressed this question through an exploratory qualitative study of five of the world's largest technology companies undertaking digital transformation, drawing attention to the DTC development process which is identified as a potential gap in the current DT literature. We went direct to the source and gathered interview data over time to derive an integrative framework for DTC. Based on our qualitative data, we identify a series of themes that are largely integrated into depicting the challenges and conditions underpinning the DTC development process. We have also addressed how IIoT and emerging technologies are influencing DTC development, which is another gap in the current literature. Despite our efforts, however, the optimal model for DTC development is not well-defined based on the practitioner realities depicted in this study. Thus, it remains a gap, and filling this gap will help managers assess the success of their DT initiatives.

Appendix 1. Representative studies on Digital Transformation

Author(s) Year	Method	Data Type	Objective	Key Findings
Carcary et al. (2016)	Literature Survey	Secondary	Core learning concerning key foundational capabilities for digital transformation	Four foundational capabilities: - Agile digital culture - Digital leadership skills - Building digital talent - Developing and implementing a digital business strategy
Sousa-Zomer et al. (2020)	SEM	Survey	Conceptualization and investigation of antecedents for digital transforming capabilities	Three main micro foundations when combined, built digital transforming capability: Digital savvy skills (digital savvy officers, directors, workforce), digital intensity (external partnership, technology-based acquisitions, and digital investments), and conditions for action and interaction (risk-taking culture, agile structure, and multi-divisional structure)
Verhoef et al. (2019)	Literature Survey	Secondary	Identify different stages of digital transformation	Three stages of digital transformation: digitization (analog to digital format), digitalization (IT or digital technology to alter existing business processes) and digital transformation (company-wide change for better efficiency)
Sebastian et al. (2017)	Case Study	Secondary (25 sample companies)	How big old companies navigate digital transformation?	Two digital strategies (customer engagements and digital solutions) that provide direction for digital transformation. Two technology assets such as an operational backbone and a digital service platform are required for such strategies.
Nwankpa and Roumani (2016)	SEM	Survey (100 participants), Secondary company data	How digital transformationmediatese the relationship between IT capability and firm performance?	IT capabilities positively influence firm performance and digital transformation mediate the relationship between IT capabilities and firm performance.
Vial. G. (2019)	Literature Survey	282 studies referencing digital transformation	Inductively build a framework of digital transformation.	8 building block of the digital transformation process: Use of digital technology, Disruptions, Strategic Responses, Change in value creation path, Organization barriers, Structural changes, Negative impacts (security) and Positive impacts (organizational efficiencies)
Warner and Wäger (2019)	Case Study	18 interviews and (1 case study) and Secondary data	How a firm in traditional industries build dynamic capabilities for digital transformation?	9 micro-foundations (sub capabilities for DT): digital sensing (scouting, scenario planning, and mindset crafting, digital seizing (strategic agility, rapid prototyping and balancing digital portfolio), and digital transforming (innovation ecosystems, redesigning internal structure,s and improving digital maturity).
Li et al. (2018)	Case Study	Semi-structured interview of 7 SMEs	How SME's with inadequate capability and resources drive digital transformation	SME entrepreneurs drive digital transformation through managerial cognition, renewal, and managerial social cognition development.
Mendonça and Andrade (2018)	Quantitative, Non-parametric Chi-square, Spearman Correlation)	Quantitative, Survey	To identify the relationship between IoT, Big Data, and AI and the micro-foundationsions of dynamic capability.	Big Data has a very strong correlation with Seizing capability, IoT and Big data have a strong correlation with Seizing capability. Big Data and AI has a moderate correlation with Seizing capability
Rossmann A. (2018)	Empirical study, literature survey	Secondary	Influence of IoT in digital transformation	Addition of strategy-driven approach (complementary technology and innovations, barriers to transformation and develop countermeasures) into technology implementation.
Lee et al. (2017)	Focus Group	Qualitative survey 10 participants	The implication of digital transformation in industry 4.0	Six critical issues were suggested (digital maturity, pilot projects, capabilities needed for new business models, right data, ecosystem approach).
Li (2020)	Literature survey	Secondary		The study suggested four different variants of portfolio business models influenced by digital technologies and

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(*continued*)

Author(s) Year	Method	Data Type	Objective	Key Findings
			A holistic framework of business model innovation influenced by the digital transformation for the creative industry	these are, market portfolio, product portfolio, multi-sided, and different business models sequentially over time.
Frank et al. (2019)	Literature survey	Secondary	A conceptual framework that connects servitization and industry 4/0.	The study looked into three servitization levels (smoothing, adapting, and substituting) and three digitalization levels (low, moderate, and high) and developed manual, digital, and industry 4.0 related smoothing, adapting, and substitution services.
Kiel, Arn, old and Voigt (2017)	Qualitative study	Case study and Secondary company information	The influence of the industrial internet of things on business models for manufacturing companies	The study analyzes the impact of IIoT on business models for manufacturing company and the study identified the changes in the business model elements such as new value propositions based on new products and/or services, changes in value configurations but no changes in customers or revenue models.

Appendix 2. Case Organizations

Software Inc.: A leading software company with a diverse portfolio of products in databases, cloud infrastructure, and cloud-based enterprise business applications. Traditionally, the software products are on premise-based software (where software is installed and operated from a company's servers and computing infrastructure, and the company purchases licenses for the solution provider, in this case, from Software Inc.) and the company is transforming all software products in the cloud. The digital transformation processes are in phases and the persons interviewed were responsible for business application delivery and sales in the cloud as their business models are changing from a license-based model to a subscription-based Software-*as*-a-Service (SaaS) model.

Health Inc.: A healthcare diagnostics equipment and software solutions provider that offers healthcare imaging and patient monitoring solutions. Like Software Inc., most of the software components are on-premises solutions and the company has started multi-year digital transformation initiatives. One such initiative is to develop a cloud-based healthcare management solution, where hospitals could store and analyze patient diagnostic data and imaging data to get a 360-degree view of a patient. The persons interviewed were responsible to develop and market cloud-based solutions to their customers.

Semicon Inc.: A leading semiconductor manufacturing company that offers computing, networking, data storage, and communication solutions. It has different business groups including the Internet of Things (IoT) group. The respondents were developing an IIoT platform such that developers can build IoT solutions leveraging Semicon's IIoT platform. This is a critical multi-year transformation initiative and the company is also working with its partner's ecosystem to promote the platform.

Industrial Inc.: An industrial company with multiple business interests in aviation, power, oil & gas, healthcare, utility, and energy. Industrial Inc. pioneered the development of an IIoT platform for industrial customers. The company has undertaken multi-year digital transformation initiatives across all businesses leveraging the company's IIoT platform. The person interviewed was responsible for platform development, strategic alliance, and marketing the platform within the company businesses.

Network Inc.: A leading network equipment and solution provider that is developing an IIoT operations platform to manage thousands of devices and sensors, which are collecting data from different locations. The team from which study participants were drawn is responsible for developing and marketing the IIoT operations platform and working with ecosystem partners to deploy the innovative solutions in the field.

Appendix 3. Indicative Interview Questions

First Interview Phase (Relevant questions only).

1. How is your IIoT business different from other core businesses in your organization?
2. Do you think the definition of the customer has changed for the IIoT business?
3. What new challenges are facing in the IIoT business? How are you overcoming these challenges?
4. How do you sense/figure out business opportunities in the IIoT business? Are they like your traditional business?
5. Is there a change in the organization structure for the IIoT business? Is it centralized or de-centralized?
6. How are your IIoT business models different from other business models?
7. According to you, what are the key success factors for the IIoT business? Do you have the capabilities to meet those success factors?

Second Interview Phase (Relevant questions only).

1. IIoT Business Overview for digital transformation (DT)
   A. What are your DT initiatives?
   B. Are you developing your IIoT platform using emerging technologies, or do you plan to use IoT platform(s) from others? How is that impacting your DT initiatives?
   C. Do you have a separate business group (with profit and loss, P&L responsibility) for IIoT? If so, why? Do you have a separate sales/business development organization for product/service sales?
   D. Do you have a proper organization structure and skillsets for adopting IIoT and emerging technologies?
   E. Whether your DT initiatives are organization-wide? If so, what are your plans to implement it?
2. Intra-firm collaboration for DT

A. Why do you collaborate within the organization for your IIoT business? Do you collaborate for technology knowledge?
B. Do you have a formal process for collaboration? (For example, you may like to create a task force or working group from different businesses to work on specific IIoT initiatives for a while)
C. Could you list some of the significant intra-firm collaboration initiatives for DT?

3. Inter-firm collaboration for DT
   A. Do you think collaboration among eco-system partners is a key success factor for DT initiatives? If yes, please explain your answers.
   B. How do you decide on your collaboration partners? (For example, when you are collaborating in developing an IIOT platform leveraging emerging technologies, or developing a new product/service, or selling your products through Independent Software Vendors (ISVs) or System Integrators.
   C. Do you think inter-firm collaboration is helping you to create a specific intellectual property (for example, a reference architecture for IoT, or an IoT development platform), which you could leverage in the future?
   D. What are some of the impediments of inter-firm collaboration?
4. Organizational change and DT
   A. Are you changing your business models? Are you moving towards an outcome-centric pay per use model?
   B. How internal operations are changing for implementing IIoT business models for DT?
   C. Do you have buy-ins from the senior management team? Are they committed to DT initiatives?
   D. Do you think cultural changes are required for a successful DT?
   E. What are the internal and external factors are affecting your DT?

Third Interview Phase (Relevant questions only).

1) Do you think businesses are actively engaged in digital transformation by leveraging IIoT?
2) Companies are developing new businesses by implementing IIoT. Is this an essential capability for future growth? Can you give me some examples of that?
3) What is the impact of IIoT in the internal operation (business operations, infrastructure, organization structure, customer-centricity) of a company? How are these operational changes affecting digital transformation?
4) What is the role of culture in this transformation journey? How is this influenced by IIoT?
5) How IIoT and other technology disruption are influencing businesses and their internal operations? How is technology disruption influencing digital transformation?
6) How IIoT is influencing ecosystem partnership? Do you think ecosystem partnership is critical for developing new businesses? How can it impact the internal operations of a company?
7) Do you think the executive management team has a strong focus to utilize IIoT and change their businesses? Do you think they are committed to digital transformation?
8) Is there skepticism about the success of IIoT and digital transformation? Are there any success stories?

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