DELFT UNIVERSITY OF TECHNOLOGY

MSC THESIS MANAGEMENT OF TECHNOLOGY

Digital transformation in traditional companies

COMBINING AMBIDEXTERITY AND DYNAMIC CAPABILITY PERSPECTIVES

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July 10, 2023

DIGITAL TRANSFORMATION IN TRADITIONAL COMPANIES

MASTER THESIS SUBMITTED TO DELFT UNIVERSITY OF TECHNOLOGY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN MANAGEMENT OF TECHNOLOGY

FACULTY OF TECHNOLOGY, POLICY AND MANAGEMENT

BY

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TO BE DEFENDED IN PUBLIC ON JULY 13, 2023

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Executive Summary

Organizations that do not embrace digital transformation may find themselves falling behind on competitors and losing out on potential innovation and growth opportunities. As the business environment is changing at an unprecedented pace, it is becoming increasingly important to balance continuity and change to achieve long-term success. By employing a qualitative case study design including semi-structured interviews with twelve employees across different hierarchical levels and business units, this thesis aims to serve a threefold objective. Firstly, it aims to determine the main barriers to digital transformation for traditional organizations. Secondly, it will elaborate on how ambidexterity and dynamic capabilities can be applied in the context of digital transformation. Lastly, the research integrates both perspectives and derives success factors that can guide traditional organizations towards successful digital transformation. The following main research questions has been formulated to guide the research:

What are the barriers to digital transformation in traditional organizations such as COMPANY and how can ambidexterity and dynamic capabilities be applied to overcome these barriers and thus pave the way for successful digital transformation?

The barriers to digital transformation are categorized based on their level of origin and their barrier category. Levels of origin include intra-level, inter-level, and meta-level. The intra-level refers to interactions that occur inside an organization, inter-level interactions refer to interactions between an organization and external actors, and meta-level interactions are high level and involve policy-makers and governments. Findings show that the most prominent barriers for COMPANY are knowledge and skills, organizational, and cultural barriers on the intra-level and technological and environmental barriers on the inter-level.

Ambidexterity and dynamic capabilities provide two powerful lenses to approach the challenge of digital transformation for traditional companies. Ambidexterity refers to "an organization's ability to be aligned and efficient in its management of today's business demands (exploitation) while simultaneously being adaptive to changes in the environment (exploration)" (Raisch & Birkinshaw, 2008). Although there are multiple ways to balance exploration and exploitation activities, it is argued that structural separation of exploring and exploiting activities is the best form of ambidexterity for an organization seeking to engage in digital transformation. According to Eisenhardt and Martin (2000), companies must develop sensing, seizing and reconfiguring capabilities to take full advantage of digital transformation. For the sensing capability, it is important to involve people that are the closest to the market. The sensing capability should not be limited to one market, because there might also be interesting developments in adjacent markets. The reconfiguring capability can be considered a higher-order capability. As reconfiguring includes "consistently implementing renewal activities by assigning responsibilities, allocating resources, and ensuring that the workforce possesses the newly required knowledge" (Kump et al., 2019), the management team should play a prominent role in the reconfiguring capability.

While these approaches on their own provide valuable insights, integrating both approaches point to three success factors that should take center stage in digital transformation. To deal with environmental barriers, organizations should take customers by the hand in the process of change. During the sensing process, customer can be a useful source of information, whereas in the seizing process, it is really important to acquire feedback from customers. The second identified success factor is an innovation funnel that is a tool to guide the innovation process to overcome organizational, environmental, and technological barriers. The last success factor is a steering group that oversees the whole process, including exploration and exploitation. This is also a way to involve internal stakeholders and thereby resolving cultural barriers.

Acknowledgments

This thesis marks the end of my time as a student at the TU Delft. Looking back at the past years in Delft, I feel incredibly proud of what I have achieved. This would not have been possible without several people. I would like to dedicate this part of my thesis to express my gratitude towards those people.

At first, I would like to express my appreciation to my graduation committee. I would like to thank Dr. ing. Victor Scholten, as chair and first supervisor, for the numerous meetings and insightful discussions. Your expertise and experience helped me a lot to guide my research. In addition, I would like to thank Dr. Sander Smit who has taken on the role of second supervisor. I really liked your clear and helpful way of providing feedback. I really hope to keep in touch with both of you during my professional career.

I would also like to thank all people at COMPANY for providing me with the opportunity to carry out my thesis research at a unique company that aims to make the world a better place. You have really made me feel part of the organization. To begin with, I'm extremely grateful to my company supervisor for his excellent guidance during my thesis period. I truly appreciate all the time you have devoted to our meetings in your busy schedule. I couldn't have imagined a better company supervisor. I am also thankful for all the people from COMPANY who participated in the interviews for my thesis.

This endeavor would not have been possible without the continuous support of my friends and family. I really felt that you believed in me which gave me a lot of motivation to bring my research to a good end. Finally, I would like to thank all my fellow students and professors from the TU Delft for the amazing years during my studies.

Max Versteeg
Amsterdam, July 2023

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1 Introduction

Staying at the top of the industry when technologies and markets change, is one of the hardest things in business for leading companies. IBM and Xerox are two classic examples of companies who failed to keep up with change. IBM had dominated the mainframe market for years, but missed the emergence of the technologically much simpler minicomputers, as they saw no immediate use for it. Xerox found itself in a comparable situation in which they dominated the market for plain paper photocopiers in large centers, but missed huge opportunities for growth and profit in the market for small table top photocopiers (Bower & Christensen, 1995).

The way companies do business is only successful for a limited amount of time, if successful at all. In order to stay successful companies have to adapt to changes in their business environment quickly and develop new ideas, products and services to keep up with technology and new trends. Today's rapidly changing world makes this even more important as change opens up new opportunities for existing companies, but also for new companies to emerge. Not keeping up with the environment can, worst case scenario, even result in bankruptcy. For example, American movie and game rental company Blockbuster failed to keep up with competitors like Netflix, who shifted to a digital model, which resulted in bankruptcy in 2010. Likewise, Airbnb and Uber revolutionized respectively the travel industry and the taxi industry with a platform that directly connects hosts and drivers with customers. Disney took a different approach to adapt to their environment. The company understood very well that digital technologies could improve a customer's physical visit to their theme parks (Van der Pijl et al., 2021).

1.1 Digital shift

Van der Pijl et al. (2021) describe the shift from physical to digital in their book about business model shifts. At its core, the digital shift is about "figuring out how to use digital technologies to drive value creation as well as deliver that value to current and new customer segments" (Van der Pijl et al., 2021). Businesses in every industry are "under intense pressure to rethink their customer value propositions and operations" (Berman, 2012). According to Hess et al. (2016), digital transformation has a high priority for business leaders and the majority expects IT and digital technologies to play a role in the strategy of the overall business in the coming decade. Another remarkable trend in the light of digital transformation is that companies are increasingly establishing an additional position at top management level, the Chief Digital Officer (CDO) (Singh & Hess, 2017). Until recently, the Chief Information Officer (CIO) was mainly responsible for digital innovation. The main difference between both functions is that while the CIO takes the role of strategic IT specialist, the CDO is the company's digital transformation specialist. "Transformation is at the core of the CDO's role, not a responsibility in addition to others" (Singh & Hess, 2017).

Additionally, many consultancy firms have a department that focuses on digital transformation, which shows the importance of digital transformation in the current business environment. For example, McKinsey Digital (2023) "drives transformation and builds businesses by bringing together the capabilities needed to help organizations grow and thrive in the digital age", Deloitte (2023) sees digital transformation as "the essential bridge between the business of today and the business of tomorrow", and KPMG (2023) admits that "companies face a massive challenge of achieving continuity in a fast-changing world and digital transformation offers real opportunities to do so".

1.2 Barriers to digital transformation

In the beginning of this chapter, Netflix, Airbnb, and Uber have already been mentioned as companies that have successfully responded to this fast-changing world and digital transformation. These three companies have in common that they were all digital from inception. Companies like these are also called born digital firms. Shaheer (2020) defines born digital firms as "the firms whose core value proposition is enabled by digital infrastructures". Born digital companies have characteristics that allow for quick expansion on international markets and staying competitive for sustained periods of time. Jarosiński et al. (2023) reveal various sources of born digitals' competitive advantages, such as innovativeness, creativity, responsiveness to customers' needs, digital technology, and digital skills of their employees.

However, for already existing companies that are not born digital and have more traditional characteristics, it can be hard to go through this process of digital transformation (Haffke et al., 2016). Where the previously mentioned born digitals have completely digital operations, the operations of traditional companies usually include a physical aspect. Hanelt et al. (2015) make an important observation regarding this difference. They state that "the key difference between industries that can completely digitize their products and those that need to rely on physical elements as a core element is the inevitable need to deal with the tensions that result from interweaving physical and digital layers into business models that originate from a pure physical world" (Hanelt et al., 2015). The result of this physical aspect of the operation is that there are certain barriers to digital transformation.

Vogelsang et al. (2019) conducted interviews with 46 experts to identify barriers to successful digital transformation in the manufacturing industry. Their findings revealed important barrier categories, including missing (digital) skills of employees, technical barriers such as the current infrastructure and security, and individual barriers mainly relating fears and acceptance problems. Although the categorization is a bit different, Lammers et al. (2019) identify similar barrier categories in the context of industrial supply chains through a systematic literature review. Next to the lack of digital skills and knowledge, they argue that some of the most recurrent barriers are represented by financial factors. "This generally refers to high costs of innovation and investment costs" (Lammers et al., 2019). Another recurrent barrier is the lack of time spent on innovation initiatives. The barriers identified by Tripathi and Gupta (2019) relate heavily to technology. For example, an important barrier is that the data that is collected, transferred, processed, and stored is often insufficient and unreliable. Additionally, they found that there is often a resistance to change, as "transformation is often associated with loss of jobs, individual obsolescence and developing new skills among existing staff who resist it strongly" (Tripathi & Gupta, 2019). Another big difference between born digitals and traditional organizations is that traditional organizations usually have a large existing operation which results in considerable inertia. According to Vial (2019), "inertia is relevant where existing resources and capabilities can act as barriers to disruption".

1.3 Ambidexterity

Organization willing to embrace digital transformation run into the problem of balancing their current business with their innovative business. One way to approach this problem is through the lens of ambidexterity, which has received increasing attention in the past decades. Although Duncan (1976) was the first to use the term organizational ambidexterity, March (1991) is frequently cited as the catalyst for the current interest in the concept. March argues that exploration

and exploitation are two fundamentally different learning activities. While both activities are essential for organizations, organizations have to divide their attention and resources between the two. In other words, exploration of alternative technologies hampers the development of current technologies, and the other way around.

Exploration relates to terms like "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation", while exploitation relates to terms such as "refinement, choice, production, efficiency, selection, implementation, execution" (March, 1991). Over time, a large amount of different definitions for ambidexterity have emerged. For example, Venkatraman et al. (2007) understand ambidexterity as an "organization's capability to manage contradictions and multiple tensions in dealing with today and tomorrow, efficiency and effectiveness, alignment and adaptation, and optimization and innovation". Another definition is shaped by Raisch and Birkinshaw (2008), ambidexterity is "an organization's ability to be aligned and efficient in its management of today's business demands while simultaneously being adaptive to changes in the environment".

Common to most definitions encountered in literature is the emphasis on the balance between continuity and change to achieve long-term success. Too many change actions could initiate organizational chaos if continuity is ignored, whereas the opposite could result in inertia (Raisch & Birkinshaw, 2008). As focusing on exploitation activities results in short-term advantages and exploration activities only become apparent in the long run (March, 1991), it is very tempting for managers to only invest in exploitation activities. However, these advantages will diminish in the long run. The increasing environmental dynamism and intensifying competition requires firms to become ambidextrous (Raisch & Birkinshaw, 2008). Companies using ambidextrous structures are more successful than companies using other organizational structures, according to O'Reilly and Tushman (2004). Similarly, Van Looy et al. (2005) found that ambidextrous organizations outperform companies that are short-term oriented by focusing only on the most profitable part of their portfolio.

1.4 Dynamic capabilities

In today's rapidly evolving business landscape, digital transformation has become a crucial imperative for organizations to remain competitive in the digital age. However, merely adopting digital technologies is not enough to become successful. To take full advantage of digital transformation, organizations must develop dynamic capabilities to prevent core capabilities becoming core rigidities that hinder digital transformation (Eisenhardt & Martin, 2000). In their initial paper, Teece et al. (1997) define dynamic capabilities as "the firm's ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments". In a follow up paper, Teece (2007) breaks the dynamic capabilities concept down into sensing, seizing, and reconfiguring activities to achieve sustained competitive advantage. These microfoundations will be discussed in detail in subsection 2.3.

1.5 Problem statement

Companies that do not embrace digital transformation may find themselves falling behind on competitors and losing out on potential innovation and growth opportunities. However, for some organizations it is easier than others. The main reason for this is the conflict between the desire to innovate, but at the same time the need to continue to serve clients by maintaining the current operations. Inertia and resistance can hinder the digital transformation in traditional companies.

Kimura et al. (2019) from the Boston Consulting Group argue that the logic of competition has changed to a dynamic game and notice that the competition between traditional and born digital companies is getting more intense. This is confirmed by Verhoef et al. (2021) who state that traditional businesses are under tremendous pressure from digital transformation.

As the business environment is changing at an unprecedented pace, it is becoming increasingly important to be aligned and efficient in the management of today's business demands while simultaneously being adaptive to changes in the environment. Ambidexterity literature describes that organizations should focus on exploration as well as exploitation activities in order to be successful. However, it is difficult to find the right balance between both activities (Birkinshaw & Gibson, 2004). On the one hand, existing operations should not be jeopardized. But on the other hand, organizations should prevent their core capabilities becoming core rigidities. Although there are different forms of ambidexterity (Birkinshaw & Gibson, 2004) (O'Reilly & Tushman, 2004), a lot remains unknown about how exploration and exploitation should be balanced in traditional organizations.

To prevent core capabilities becoming core rigidities that hinder digital transformation, Eisenhardt and Martin (2000) argue that dynamic capabilities should be developed in order to achieve successful digital transformation. While Teece (2007) breaks the dynamic capabilities concept down into sensing, seizing, and reconfiguring activities, remarkably little attention is paid to how to build these capabilities into a traditional organization.

1.6 Objective and deliverable

This research is carried out at COMPANY, a large engineering company. The practical context of the research will be discussed more extensively in subsection 3.2.

The objective of this research is threefold. Firstly, although many barriers are already identified in this introduction, it aims to determine the main barriers to digital transformation for a traditional organization like COMPANY. Secondly, it will elaborate on how ambidexterity and dynamic capabilities can be applied in the context of digital transformation. The research will focus on the balance between exploration and exploitation activities, as well as on how to develop dynamic capabilities in a traditional organization. Lastly, the research integrates both perspectives and derives success factors that can be used to pave the way for successful digital transformation.

The deliverable of this research will be a thesis that can serve as direct input for the utility division of COMPANY in their process of achieving successful digital transformation. Additionally, the outcomes of this research may also be useful to accelerate digital transformation in the other divisions of COMPANY and thereby contribute to their mission to make the world a better place. Taking a broader perspective, the findings can also be useful for other traditional organizations in their journey towards successful digital transformation.

1.7 Main research question and sub-questions

The following main research question is formulated to guide the research:

What are the barriers to digital transformation in traditional organizations such as COMPANY and how can ambidexterity and dynamic capabilities be applied to overcome these barriers and thus pave the way for successful digital transformation? (MRQ)

Five sub-questions have been formulated in order to answer the main research question:

- What is digital transformation? (SQ1)
- What are barriers to digital transformation for traditional organizations? (SQ2)
- How can exploration and exploitation activities be balanced in a traditional organization? (SQ3)
- How can dynamic capabilities be developed in a traditional organization? (SQ4)
- How can ambidexterity and dynamic capabilities be applied to overcome the barriers to digital transformation? (SQ5)

2 Theoretical framework

This chapter aims to develop a theoretical framework that will be employed in the context of digital transformation (subsection 2.1). It will outline the key theories that are considered to be a powerful lens in this context, ambidexterity (subsection 2.2) and dynamic capabilities (subsection 2.3). By examining the existing body of knowledge and relevant literature, this chapter seeks to establish a solid foundation for the research.

2.1 Digital Transformation

In today's rapidly changing world, digital transformation has become a critical topic for businesses across industries. As technology continues to advance at an unprecedented speed, organizations must adapt to remain competitive. This subsection will explore the concept of digital transformation, the closely related terms of digitization and digitalization, and the difference between born digitals and traditional firms.

2.1.1 Digitization and digitalization

The search for scientific sources resulted in some ambiguities which can lead to terminological confusion around the topic of digital transformation. Terms like digital transformation, digitalization, and digitization are often used interchangeably. While these terms are certainly closely related, they are definitely not the same.

Definitions for digitization are comparable across different scientific sources. Brennen and Kreiss (2016), for example, define digitization as "the technical process of converting analog streams of information into digital bits", Legner et al. (2017) define it as "the technical process of converting analog signals into a digital form, and ultimately into binary digits, and is the core idea brought forward by computer scientists since the inception of the first computers", and Yoo et al. (2010) define it as "the encoding of analog information into digital format".

Definitions of digitalization on the other hand are more broad. For example, Brennen and Kreiss (2016) define digitalization as "the way many domains of social life are restructured around digital communication and media infrastructures", Legner et al. (2017) use the term digitalization to "describe the manifold sociotechnical phenomena and processes of adopting and using these technologies in broader individual, organizational, and societal contexts", and Gartner (2023) defines digitalization as "the use of digital technologies to change a business model and provide new revenue and value-producing opportunities, it is the process of moving to a digital business". All definitions revolve around the idea of turning simple organizational processes and tasks into a digital format.

2.1.2 Defining digital transformation

While the amount of research on digital transformation in the recent years is huge, a clear definition is still lacking. Table 1 shows some definitions of digital transformation that were encountered in literature.

Table 1: Definition of digital transformation

Source	Definition
Berghaus and Back (2016)	"Digital transformation is a technology-induced change on many levels in the organization that includes both the exploitation of digital technologies to improve existing processes, and the exploration of digital innovation, which can potentially transform the business model."
Bouée and Schaible (2015)	"We understand the digital transformation as the seamless, end-to-end connectivity of all areas of the economy, and as the way in which the various players adapt to the new conditions that prevail in the digital economy."
Clohessy et al. (2017)	"Digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which result in modifications to organizational structures, processes and skills sets that are necessary to cope and exploit new technologies."
Demirkan et al. (2016)	"Digital transformation is the profound and accelerating transformation of business activities, processes, competencies, and models to fully leverage the changes and opportunities brought by digital technologies and their impact across society in a strategic and prioritized way."
Fitzgerald et al. (2014)	"The use of new digital technologies (social media, mobile, analytics or embedded devices) to enable major business improvements (such as enhancing customer experience, streamlining operations or creating new business models)."
Hess et al. (2016)	"Digital transformation is concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes."
Mazzone (2014)	"Digital transformation refers to the deliberate and ongoing digital evolution of a company, business model, idea, process, or methodology, both strategically and tactically."
Kane (2017)	"The best understanding of digital transformation is adopting business processes and practices to help the organization compete effectively in an increasingly digital world."
Li et al. (2018)	"We define digital transformation as transformation precipitated by a transformational information technology. Such transformation involves fundamental changes in business processes, operational routines, and organizational capabilities, as well as entering new markets or exiting current markets."
Nwankpa and Roumani (2016)	"Digital transformation is characterized by changes and transformation which are driven and built on a foundation of technologies. Within an enterprise, digital transformation is defined as an organizational shift to big data, analytics, cloud, mobile and social media platforms."
Solis and Littleton (2017)	"The investment in and development of new technologies, mindsets, and business and operational models to improve work and competitiveness and deliver new and relevant value for customers and employees in an ever-evolving digital economy."
Stolterman and Fors (2004)	"The digital transformation can be understood as the changes that the digital technology causes or influences in all aspects of human life."
Westerman et al. (2011)	"The use of technology to radically improve performance or reach of enterprises."

While digitization is about encoding analog information into a digital format and digitalization is about turning organizational processes and tasks into a digital format, digital transformation goes beyond these aspects. Although there are many definitions, it becomes clear that digital transformation is technology-driven and goes hand in hand with organizational change. In other words, it affects the organization as a whole and thereby goes beyond digitization and digitalization. Verhoef et al. (2021) confirm this view and identify digitization, digitalization, and digital transformation as three separate stages of digital transformation. The first two phases are more or less incremental phases which are needed to attain the most pervasive phase of digital transformation. See Table 2 for examples of each phase.

Table 2: Phases of digital transformation (Verhoef et al., 2021)

Phase	**Examples**
Digitization	Automated routines and tasks; Conversion of analog into digital information.
Digitalization	Use of robots in production; Addition of digital components to product or service offering; Introduction of digital distribution and communication channels.
Digital transformation	Introduction of new business models like product-as-a-service, digital platforms, and pure data-driven business models.

2.1.3 Digital transformation framework

In order to get a better understanding of digital transformation, Vial (2019) built an inductive framework digital transformation using eight building blocks, see Figure 1. The framework "foregrounds digital transformation as a process where digital technologies create disruptions triggering strategic responses from organizations that seek to alter their value creation paths while managing the structural changes and organizational barriers that affect the positive and negative outcomes of this process" (Vial, 2019).

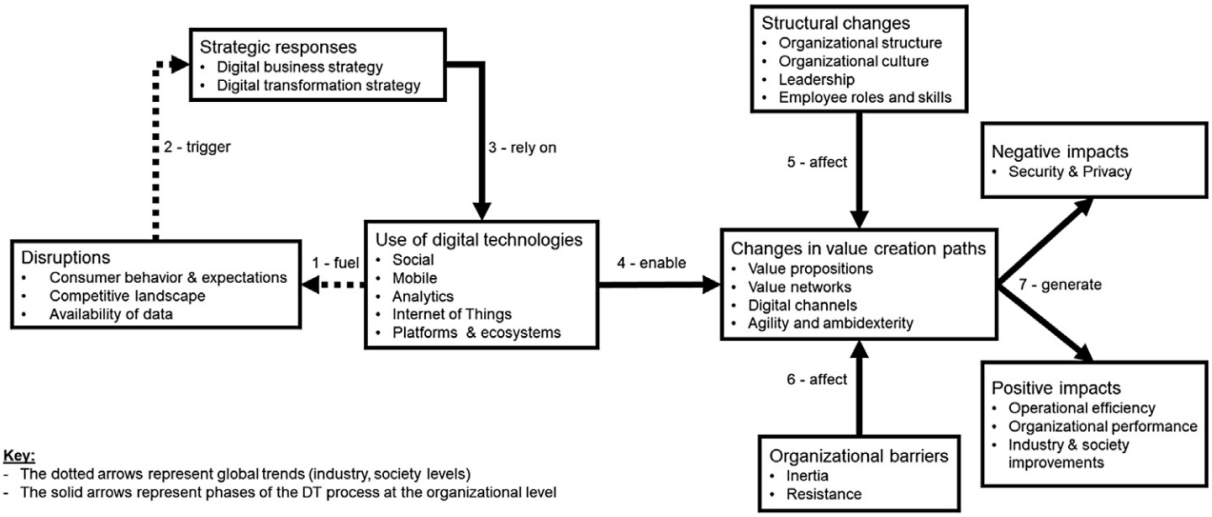

Figure 1: Building blocks of the digital transformation process (Vial, 2019)

According to Vial (2019), "organizations use digital technologies to alter the value creation paths they have previously relied upon to remain competitive. To that end, they must implement structural changes and overcome barriers that hinder their transformation effort". Regarding this way of creating value for customers, there is a difference between companies that are born

digital and traditional firms. This research focuses on the 'changes in value creation paths', 'structural changes', and 'organizational barriers' blocks.

2.1.4 Digital transformation of traditional organizations

As digital technologies have accelerated the speed of change, digital transformation has become a crucial topic on top management agendas of traditional organizations to protect themselves against competitors (Sebastian et al., 2017). According to Warner and Wäger (2019), digital transformation differs from traditional forms of strategic change in the sense that the unprecedented evolution of digital technologies has resulted in much more environmental volatility, complexity, and uncertainty. Loonam et al. (2018) help to understand digital transformation within traditional organizations by distinguishing four different themes: strategic-centric, customer-centric, organization-centric and technology-centric. These themes are the result of combinations between internally and externally focused perspectives and strategic and operational perspectives, see Table 3.

Table 3: Digital transformation perspective. Adapted from (Loonam et al., 2018).

	Operational perspective	**Strategic perspective**
Externally focused	Customer-centric	Strategy-centric
Internally focused	Technology-centric	Organization-centric

Furthermore, Svahn et al. (2017) identify four competing concerns that traditional companies face as they embrace digital innovation, being innovation capability, focus, collaboration, and governance.

1. Innovation capability: "firms must develop new capabilities without jeopardizing existing product innovation practices".
2. Innovation focus: "firms must strike a balance between developing new design and management processes and leveraging digital technology in products and services".
3. Innovation collaboration: "firms must develop the skills and relationships of the people operating within internal work arrangements while also engaging external partners and resources".
4. Innovation governance: "firms must strike a balance between control and flexibility to afford exploration of digital options".

2.1.5 Barriers to digital transformation

Scholars use different categories to cluster barriers to digital transformation. Lammers et al. (2019) define a framework in which barriers to digital transformation in a supply chain context can be clustered. The framework is comprised of two dimensions, the level of origin and barrier categories. The first dimension (level of origin) uses the model of Heilig et al. (2017) which is derived from game theory principles. As digital transformation involves many players, "it can be modelled by using the organizational levels in which different interactions occur" (Lammers et al., 2019). The levels that are distinguished are intra-level, inter-level, and meta-level interactions, see Figure 2. The intra-level refers to interactions that occur inside an organization. For example, horizontal interactions between business units and vertical interactions between different hierarchical layers. Inter-level interactions refer to interactions between an organization and external actors. For example, interactions with other organizations such as competitors or collaborators and interactions with customers. At the meta-level, interactions are high-level and

involve policy-makers and governments (Lammers et al., 2019).

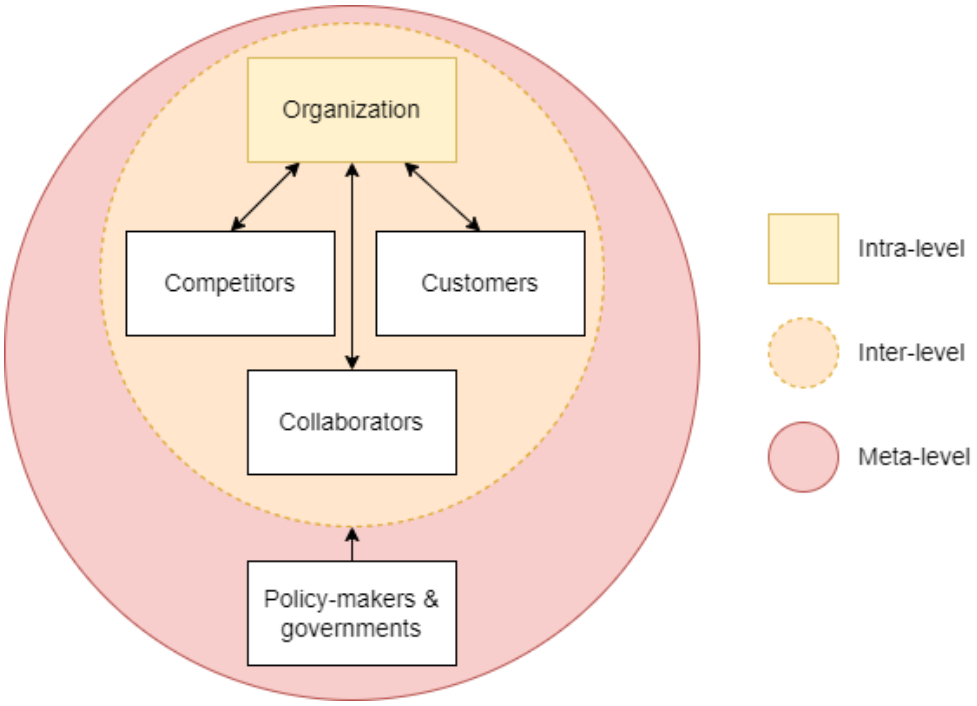

Figure 2: Level of origin. Adapted from Heilig et al. (2017).

Through a systematic literature review Lammers et al. (2019) identify six barriers categories for digital transformation in industrial supply chains, being financial, knowledge and skills, regulatory, technological, environmental, organizational, and cultural barriers. Although the barrier categories are extracted from literature in the field of industrial supply chains, it is argued that these are also applicable to other traditional industries. The identified barrier categories will be used as the second dimension for the framework in which barriers to digital transformation for traditional organizations can be clustered. Table 4 shows the framework of barriers to digital transformation.

Table 4: Framework barriers to digital transformation

		Level of origin		
		Intra-level	Inter-level	Meta-level
Barrier category	Financial			
	Knowledge and skills			
	Regulatory			
	Technological			
	Environmental			
	Organizational			
	Cultural			

2.1.5.1 Financial

A frequently mentioned barrier to digital transformation is the lack of financial resources (Vogelsang et al., 2019) (Müller & Voigt, 2017). In order to realize successful digital transformation, financial investment is required, which can be either internally (intra-level) or externally

funded (meta-level) (Erol et al., 2016). The costs associated with the implementation of digital technologies are often considered too high by organizations (Kiel et al., 2017).

Organizations often have short-term economic, monetary and financial policies regarding investments into digital technologies. Digital technologies cannot meet the need for immediate return for organizations. Because the profitability of digital technologies is still uncertain (Kiel et al., 2017), cost-benefit analyses are difficult and investments are often considered too expensive (Pflaum & Gölzer, 2018).

2.1.5.2 Knowledge and skills

Knowledge and skills barriers often originate on the intra-level. According to Erol et al. (2016), successful digital transformation requires the availability of qualified staff on all organizational levels that is able to take advantage of digital technologies. In reality, personnel that is inadequate to implement digital innovation is a frequently mentioned barrier in literature (Pflaum & Gölzer, 2018) (Hjalmarsson et al., 2014). Pflaum and Gölzer (2018) state that "data scientists and other specialists are not commonly available in a company, and the competition for such talent is fierce. Hence, quickly finding qualified staff is difficult". Hjalmarsson et al. (2014) confirm this statement, "competition for IT talents is very high and recruiting qualified staff is difficult".

2.1.5.3 Regulatory

Policy-makers and government can pose significant regulatory barriers to digital transformation. Vogelsang et al. (2019) mentions the lack of laws and and lack of standards regarding the exchange of information as major barriers to digital transformation. Existing laws were often designed for a pre-digital era and may be unable to address the complexity of digital technologies. Government policies and regulations and inefficient intellectual property processes can hinder digital transformation (Hjalmarsson et al., 2014). Regulatory barriers mostly originate at the meta-level. On the other hand, governments' actions can also be a driver for digital transformation as they can provide incentives that stimulate the adoption of digital technologies for different purposes (Lammers et al., 2019).

2.1.5.4 Technological

Although technology is mostly considered as an enabler of digital transformation, it can also be seen as a barrier in some ways. The main technological barriers revolve around privacy and security concerns regarding digital technologies (Vogelsang et al., 2019). Kiel et al. (2017) mention data security as one of the biggest barriers to digital transformation. Early stage and poorly tested technologies could lead to problems regarding privacy and security. In other words, a low maturity level of digital technologies is a barrier to digital transformation (Raj et al., 2020). "Organizations find it difficult to accept the risk of implementing new technologies and the costs involved" (Tsiavos & Kitsios, 2021).

Other technological barriers are that the benefits of the use of digital technologies is unclear, so customers don't see the added value of these technologies (Peansupap & Walker, 2005), and lack of infrastructure (Vogelsang et al., 2019) or outdated IT infrastructure (Tsiavos & Kitsios, 2021).

2.1.5.5 Environmental

Environmental barriers often originate on the inter-level and refer to collaborations between organizations with competitors, collaborators, and customers. Lammers et al. (2019) identifies a lack of collaborations and cooperation between actors. Low cross-company cooperativeness, low trust, and limited compatible technologies form a large barrier to digital transformation. It is hard to closely involve customers and suppliers in the process of value creation (Kiel et al., 2017). This is, to a large extent, caused by the lack of standards in the business environment, according to Vogelsang et al. (2019).

2.1.5.6 Organizational

Last but not least are organizational barriers that hinder successful digital transformation, which relates to barriers on the intra-level. One of the main reasons for these barriers is that there is often a lack of time within organizations. Especially in those with large existing operations (Lammers et al., 2019). Digital transformation gets too little time and attention from employees. Kiel et al. (2017) state that it is hard to create an adaptable and flexible hierarchical structure. Additionally, it is hard to realize digital transformation involvement across all hierarchical levels and to persuade internal company stakeholders (Kiel et al., 2017). For example, it is important that management "ensures that adequate technical resources are made available" (Peansupap & Walker, 2005).

2.1.5.7 Cultural

The last category of barriers to digital transformation are cultural barriers. A lot of traditional organizations have an unsupportive organizational or insufficient innovation culture (Vey et al., 2017). This is characterized by a poor organizational attitude towards innovation (Vey et al., 2017), insufficient team commitment and an adversarial relationship among the staff (Lammers et al., 2019). Employees are fundamentally risk averse (Vogelsang et al., 2019) and organizations as a whole often lack the "willingness to take risks and to regard mistakes as an opportunity for learning" (Vey et al., 2017).

According to Peansupap and Walker (2005), management often plays in important rule in the organizational culture of an organization. A lack of leadership in driving digital transformation is one of the biggest barriers towards successful digital transformation. Employees should be supported and supervised by their direct managers (Peansupap & Walker, 2005). Another barrier is that employees generally have a fear of change. Especially in the case of digital technologies, some have the feeling that it might disrupt their existing jobs (Raj et al., 2020). This could result in a negative attitude towards innovation (Pflaum & Gölzer, 2018).

2.2 Organizational ambidexterity

Berghaus and Back (2016) define digital transformation as "a technology-induced change on many levels in the organization that includes both the exploitation of digital technologies to improve existing processes, and the exploration of digital innovation, which can potentially transform the business model". March (1991), who is frequently cited as the catalyst for the current interest in the concept of ambidexterity, argues that exploration and exploitation are two fundamentally different learning activities. Ambidexterity refers to an organization's ability to simultaneously pursue these two activities. The alignment of exploitation and exploration, as described by O'Reilly and Tushman (2004), is shown in Table 5.

Table 5: Alignment of exploitation and exploration (O'Reilly & Tushman, 2004)

	Exploitation	**Exploration**
Strategic intent	Cost, profit	Innovation, growth
Critical tasks	Operations, efficiency, incremental innovation	Adaptability, new products, breakthrough innovation
Competencies	Operational	Entrepreneurial
Structure	Formal, mechanistic	Adaptive, loose
Controls, rewards	Margins, productivity	Milestones, growth
Culture	Efficiency, low risk, quality, customers	Risk taking, speed, flexibility, experimentation
Leadership role	Authorative, top down	Visionary, involved

Bråthen and Doan (2021) identify three dimensions that contribute to an understanding of the link between organizational ambidexterity and digital transformation, being internal orientation, external orientation, and structural integration.

The main idea of the internal orientation is that a high degree of involving employees is crucial to succeed with digital transformation. This dimension can be linked to ambidexterity in the sense that the internal orientation means exploitation of existing human resources. Active communication, a decentralized structure, and continuous learning are important aspect in the process of digital transformation (Bråthen & Doan, 2021). To manage digital transformation it is important for companies to search for new knowledge and capabilities outside the organization, Bråthen and Doan (2021) refer to this as the dimension of external orientation. As this dimension involves exploring new opportunities, it can be linked back to the concept of ambidexterity. Partnerships, networks, and internship are important aspects for this external orientation. Structural integration involves integrating the internal and external orientation and is thus similar to ambidexterity in the sense that it balances exploration and exploitation.

It is difficult to find the right balance between exploration and exploitation (Birkinshaw & Gibson, 2004). Even though the concept of ambidexterity has been around for years, many companies are struggling to apply it. Raisch et al. (2009) identify four central tensions regarding ambidexterity:

1. Differentiation versus integration
2. Individual versus organizational
3. Static versus dynamic
4. Internal versus external

The first tension relates to differentiation versus integration, where differentiation refers to the separation of exploration and exploitation and integration refers to addressing both activities within the some organizational unit.

The second tension relates to the level where ambidexterity plays a role. This can be either on the individual or organizational level. On the individual level, bounded rationality can be considered as the underlying problem to explore and exploit simultaneously. Bounded rationality refers to "rational choice that takes into account the cognitive limitations of the decision maker limitations of both knowledge and computational capacity" (Simon, 1997). The result of

bounded rationality is that people generally innovate close to the known, which mostly comes down to exploitation rather than exploration. On the organization level, ambidexterity refers to formal organizational structures that enable to pursue exploration and exploitation simultaneously (Raisch et al., 2009).

The third tension relates to the perspective on ambidexterity, which can be either static or dynamic. Static perspectives assume that organizations can become ambidextrous by adopting certain configurations, while dynamic perspectives emphasize the importance of dynamic elements given the dynamism of markets and organizations (Raisch et al., 2009).

The last tension relates to the consideration of an internal or external orientation of ambidexterity. Exploration and exploitation activities can be addressed both internally, but one of the suggestions to resolve the tensions between the activities is to externalize one of the two. Organizations can also acquire external knowledge in order to facilitate exploration and exploitation activities (Raisch et al., 2009).

It has become clear that an organization should deal with several tensions in order to become an ambidextrous organization. Different forms of ambidexterity can be distinguished in literature to deal with these tensions, namely structural ambidexterity, contextual ambidexterity, and sequential ambidexterity, see Figure 3.

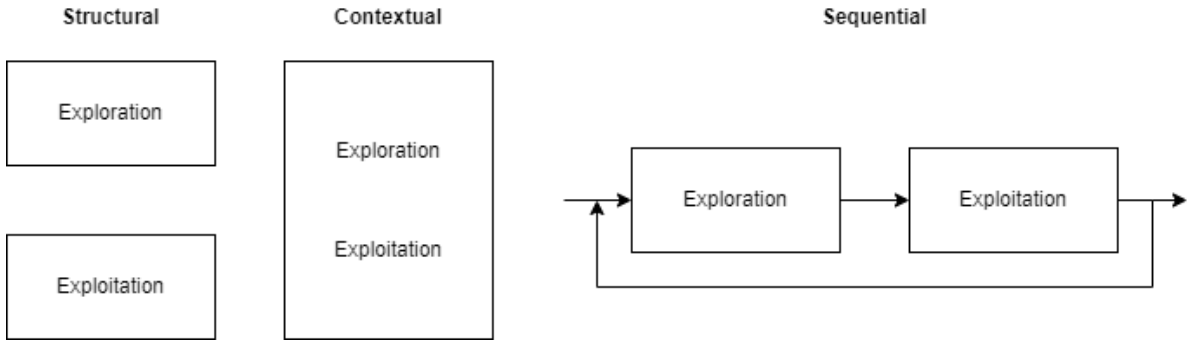

Figure 3: Ambidexterity approaches

2.2.1 Structural ambidexterity

Structural ambidexterity is characterized by segregation of exploratory units from traditional exploitative units. Segregating these units enables them to develop their own unique processes, structures, and cultures (O'Reilly & Tushman, 2004). A disadvantage of this approach is that the structural separation can lead to isolation (Birkinshaw & Gibson, 2004), leading to useless innovation because it lacks alignment with the core business. To solve this, tight integration at the senior executive level is required (O'Reilly & Tushman, 2004).

Multiple scholars argue that structural separation of these unit is the best form of ambidexterity for digital transformation. For example, Schiffer (2021) investigated concrete mechanisms to manage the tension between exploration and exploitation against the backdrop of digital transformation through a case study of an established German insurer. She argues that a separate legal entity with autonomous decision-making is a mechanism that can help to overcome the inertia of traditional organizations and explore new digital ways to generate revenue. The structural separation allow traditional companies to "create a structure, culture, leadership, and

employee skills similar to those of their born-digital competitors allowing for speed and innovation while at the same time using selected assets of the exploitative entity to create an unfair advantage" (Schiffer, 2021).

Hess et al. (2016) describe two other examples of structural separation at board games publisher Ravensburger and TV broadcaster ProSiebenSat.1 Media SE (P7S1). At Ravensburger, digital technologies successfully enriched their existing analog products and stabilized their core business. The digital department of Ravensburger "has been deliberately separated from the core business and is physically separated from the headquarters to make it more appealing to applicants with different skill sets and to foster innovation" (Hess et al., 2016). At P7S1, the need for immediate digital transformation was low as their core business was highly profitable. Nevertheless, they saw the potential of digital technologies for their current operation as well as for new business opportunities. P7S1 decided to apply structural separation and explored new business opportunities in a separate digital business unit. An interesting aspect of this case is that P7S1 launched an incubator in order to involve startups in an early stage (Hess et al., 2016).

The main reason why organizations choose for a structural ambidexterity approach is because they believe that exploration and exploitation require fundamentally different organizational structures. As shown in Table 5, exploration focuses on breakthrough innovation, while exploitation focuses on incremental innovation. While a rigid and inflexible structure is often beneficial for incremental innovation, this structure is often too slow and conservative to come up with breakthrough innovation, which requires autonomy and flexibility (Kelley, 2009) (Donada et al., 2021).

2.2.2 Contextual ambidexterity

Gibson and Birkinshaw (2004) define contextual ambidexterity as “the behavioral capacity to simultaneously demonstrate alignment and adaptability across an entire business unit”. In this approach, decisions about dividing time between exploration and exploitation activities are made by individual employees at the front-line of the operation instead of at the top of the organization (Birkinshaw & Gibson, 2004). The nature of the roles of the individual employees is therefore more flexible, while the role of top managers is to build the organizational context through the systems, incentives and controls they put in place. Although contextual ambidexterity is very different from structural ambidexterity, Birkinshaw and Gibson (2004) argue that the approaches are best viewed as complementary.

As mentioned before, in the contextual form of ambidexterity, the choice between exploration and exploitation is made on the individual level. An example is the 20% rule by Google. The rule describes that Google’s employees should dedicate 20% of their time working on projects that they are interested in and what they think would most benefit Google (Vise, 2007). In this way, Google aims to generate breakthrough ideas.

Another example is news publisher Mittelbayerische. The motivation for Mittelbayerische to embrace digital transformation was to secure their position of leading provider of local news and information (Hess et al., 2016). In order to realize this, they did not have a separate department focusing on innovation. Instead, they believed that "the competencies needed for digital transformation should come from within the company" and they established "a thorough personal development program that helps foster the necessary digital mindset and skill set among existing staff" (Hess et al., 2016).

The main reason why organizations choose for contextual ambidexterity is because they believe that employees know best when to perform exploration activities and when to perform exploitation activities. It allows business units to respond quickly to market changes and emerging opportunities without having to manage the tensions between separate units. However, with this decentralized decision making it is hard for an organization to make a bold change in its overall direction (Schilling, 2012)..

2.2.3 Sequential ambidexterity

When the term ambidexterity was first used by Duncan (1976), he suggested that firms have to change their organizational structures over time to accommodate conflicting demands for innovations and efficiency. This form of ambidexterity, in which organizations alternate between different organizational designs, is called sequential ambidexterity.

Several companies are mentioned in literature that applied sequential ambidexterity, for example Ford (Nickerson & Zenger, 2002), Hewlett-Packard (Boumgarden et al., 2012), and BMW (Birkinshaw et al., 2016). O'Reilly and Tushman (2013) find that "studies of sequential ambidexterity often focus on large-scale examples with the changes taking place over long time periods" (O'Reilly & Tushman, 2013). Therefore they suggest that sequential ambidexterity "may be most useful in stable, slow-moving environments and for smaller firms that lack the resources to pursue simultaneous or sequential ambidexterity" (O'Reilly & Tushman, 2013). However, a lot remains unknown about how sequential ambidexterity occurs and what the transition looks like.

2.3 Dynamic capabilities

Strategic management in an organization aims to formulate a strategy that lead to sustained competitive advantage. Understanding the sources of sustained competitive advantage has been a major area of research in the past decades (Barney, 1991). A well-known approach to sustained competitive advantage is Porter's five forces analysis. Porter (1980) argues that the state of competition in an industry depends on five competitive forces, being rivalry among existing firms, threat of new entrants, threat of substitute products, bargaining power of suppliers, bargaining power of buyers. A weakness of this approach is that it sees all other organizations as threats to profitability, while interactions between firms can also enhance profits or other opportunities.

Another approach that received a lot of attention in the area of strategic management research is the resourced based view. Unlike Porter's five (external) forces, the resource based view focuses on internal sources of a firm's sustained competitive advantage. Barney (1991) argues that in order to achieve a sustainable competitive advantage a firm must posses resources and capabilities that are valuable, rare, inimitable, and non-substitutable.

The dynamic capabilities theory builds upon the resource based view. However, it is more than a simple addition to the resource based view (Zott, 2003). While the resource based view is inherently static (Teece, 2007), dynamic capabilities "manipulate the resources and capabilities that directly secure rents" (Zott, 2003). Eisenhardt and Martin (2000) argue that the resource based view holds in stable and slow-moving environments, but fails to address long-term competitive advantage in dynamic markets. Opposing ordinary capabilities, dynamic capabilities can be defined as "the firm's ability to integrate, build and reconfigure internal and external

competencies to address rapidly changing environments" (Teece et al., 1997). "Dynamic capabilities can be seen as an emerging and and potentially integrative approach to understanding the newer sources of competitive advantage", according to Teece et al. (1997).

Given the rapid technological and market developments, it is argued that the dynamic capabilities framework can be a powerful lens for examining the digital transformation of incumbent firms in traditional industries. Eisenhardt and Martin (2000) argues that organizations must develop dynamic capabilities in order to be able to take full advantage of digital transformation. In addition to his previous work, Teece (2007) breaks down the dynamic capabilities into sensing, seizing, and reconfiguring activities to achieve a sustained competitive advantage. This categorization of dynamic capabilities is widely used in literature (Warner & Wäger, 2019)(Konopik et al., 2022)(Iden & Bygstad, 2021) and will also be used as the foundation for the dynamic capabilities aspect of this research.

2.3.1 Sensing

In order to respond to rapid technological and market change, organizations must develop the capability to continuously scan the organizational environment for opportunities and threats (Teece, 2007). Teece and Linden (2017) argues that sensing takes place at all levels of the organization, "with lower levels helping to provide information and insights about external developments to middle and top managers". According to Kump et al. (2019) an organization with high sensing capacity is able to "systematically, continuously, and reliably acquire strategically relevant information from the environment, including market trends, best practices, and competitors' activities, that is, information from outside the organization". Customers can be consulted to acquire this information, as they are among the first to perceive the potential for applying new technology (Teece, 2007). If an organization fails to understand their customers' needs, it is unlikely that they will develop a successful product or service. Another important category to focus on while scanning the environment are restrictions and rules imposed by regulatory mechanisms such as the government.

In order to achieve successful digital transformation, organization must be able to detect digital opportunities (Lukito et al., 2022) and disruptions (Feroz et al., 2023) in an early stage. Organizations must be aware of their internal and external environment and be highly responsive to the ongoing changes in the market. Ellström et al. (2021) mention cross-industrial digital sensing as an important dynamic capability. Digital innovations do not have to be completely new, but may also be something copied from another industry or something old being done in a new way. Furthermore, Weritz et al. (2020) stress the importance of speed, agility, and flexibility in sensing activities "to adjust very fast to new business opportunities, changing markets and customer needs".

2.3.2 Seizing

Once a new technological or market opportunity or threat is sensed, the next step is to address it through new products, processes, or services (Teece et al., 1997). Seizing refers to "developing and selecting business opportunities that fit with the organization's environment and its strengths and weaknesses" (Kump et al., 2019). "The capacity for seizing within an organization is high if it is able to decide whether some information is of potential value, to transform valuable information into concrete business opportunities that fit the organization's strengths and weaknesses, and to make decisions accordingly" (Kump et al., 2019). It might be useful

to test a new product or services on a segment of potential users before further roll-out to test the concept behind it (Teece & Linden, 2017). In this way, companies have the opportunity to finetune their product or service before large-scale commitments are made. A downside to this strategy is that it can alert competitors, which gives them the time to better position themselves to compete (Teece & Linden, 2017).

One of the most frequently mentioned digital seizing capabilities in literature for digital transformation is that organizations must be able to formulate a digital strategy that is aligned with the changing business environment and the overall business objectives (Ellström et al., 2021)(Lukito et al., 2022). Part of this strategy formulation is to determine enterprise boundaries. In other words, "what to do in-house and what to outsource, based on an understanding of current competence in the firm and the necessity of competence for the digital strategy" (Ellström et al., 2021). When developing a product or service in-house, Warner and Wäger (2019) argue that rapid prototyping is a really important digital seizing capability as it allows organizations to gather customer feedback in almost real-time and thereby being able to strategically prioritize digital initiatives based on the alignment to digital strategy (Feroz et al., 2023)(Ellström et al., 2021).

2.3.3 Reconfiguring

The reconfiguring or transforming capability is crucial for a sustained competitive advantage. Organizations must be able to enhance, recombine, protect and reconfigure assets and organizational structures as the enterprise grows, and as markets and technologies change (Teece, 2007). According to Kump et al. (2019), an organization with a high transforming capacity "consistently implements decided renewal activities by assigning responsibilities, allocating resources, and ensuring that the workforce possesses the newly required knowledge". Reconfiguring also includes selectively phasing out old products and services that do not align with the company's strategy any more (Al–Aali & Teece, 2014).

Reconfiguring the organizational architecture is one of the most frequently mention digital reconfiguring capabilities in literature for digital transformation (Warner & Wäger, 2019)(Lukito et al., 2022). According to Warner and Wäger (2019), organizations must build a leadership team and business model that adopts a digital focus. Important aspects of this digital focus are continuous learning and development, ethics and data governance, and a new digital leadership throughout the whole organization (Weritz et al., 2020). Another important digital reconfiguring capability is that organizations should be able to create a unified digital infrastructure (Ellström et al., 2021). As digital transformation requires interconnection of things, people, and data in the organization, a unified digital infrastructure could enhance communication and collaboration allowing for accelerating digital transformation (Ellström et al., 2021).

2.4 Integrating ambidexterity and dynamic capabilities

Ambidexterity and dynamic capabilities literature has widely contributed to strategic management discussions about how firms can achieve a sustained competitive advantage. While both concepts provide interesting insights into digital transformation separately, there are certainly links between the two theories. Several attempts have been made to bridge ambidexterity and dynamic capability literature. Although several vague comparisons were made before, O'Reilly and Tushman (2008) were the first to combine both concepts in a systematic way. This marks the beginning of a set of different views on the relationship between ambidexterity and dynamic

capabilities. These different views include:

- Ambidexterity as a dynamic capability
- Ambidexterity as an antecedent of dynamic capabilities
- Dynamic capabilities to operationalize ambidexterity
- Ambidexterity as a means to build dynamic capabilities
- Ambidexterity and dynamic capabilities as complements

Among other scholars, O'Reilly and Tushman (2008) understand ambidexterity as a dynamic capability (García-Lillo et al., 2016)(Gao et al., 2020). Ancona et al. (2001) state that "dynamic capabilities are rooted in simultaneously exploiting and exploring" and Jansen et al. (2009) conceptualize organizational ambidexterity as an organizational-level dynamic capability. Furthermore, Kriz et al. (2014) argue that ambidexterity is a dynamic capability on the basis that "firms must reconfigure their competences in order to maintain a balance between exploring new opportunities and exploiting the firm's current routines in order to adapt to the demands of volatile environments". However, ambidexterity only becomes a dynamic capability "if management is consciously able to orchestrate firm assets and resources in a repeatable way" (O'Reilly & Tushman, 2008).

However, different views also exist. Pasamar and Alegre (2015), for example, see ambidexterity as an antecedent of dynamic capabilities. They adopt a structural approach to ambidexterity based on the view that "dynamic capabilities need different organizational units with diverse architectures for their development" (Pasamar & Alegre, 2015). Pasamar and Alegre (2015) argue that the sensing capability needs an exploration architecture, seizing needs a dual architecture of exploitation and exploration, and reconfiguring needs an exploitation architecture. Another view is represented by Maijanen and Virta (2017), who apply a capability-based approach to ambidexterity. They use operational and dynamic capabilities to operationalize ambidexterity. Guerra et al. (2016), on the other hand, argue that becoming ambidextrous is a means for organizations to build dynamic capabilities.

While Teece (2007) argues that ambidexterity as a dynamic capability help organizations to gain a competitive advantage in a changing business environment, Birkinshaw et al. (2016) approach ambidexterity and dynamic capabilities as complementary, see Figure 4.

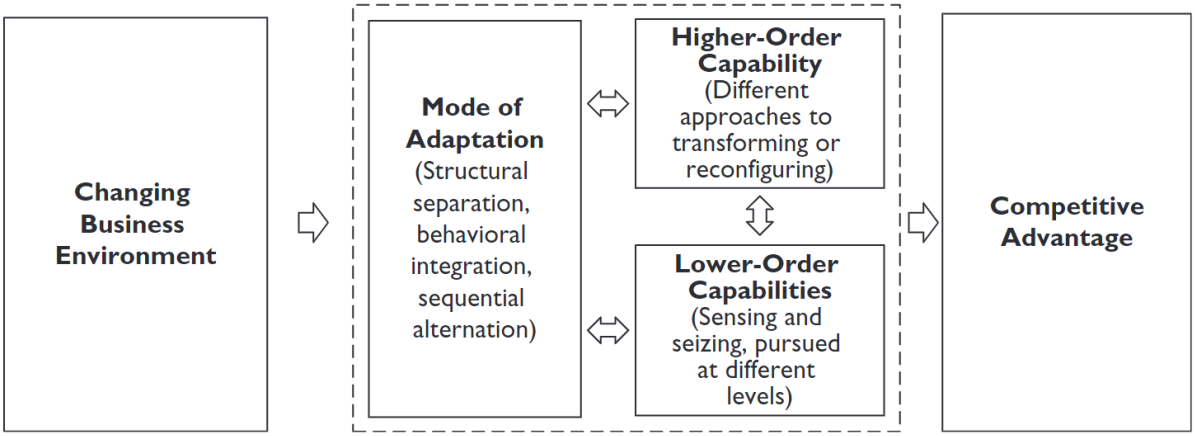

Figure 4: Ambidexterity and dynamic capabilities as complements (Birkinshaw et al., 2016)

Along the same lines as Pasamar and Alegre (2015), Birkinshaw et al. (2016) equate sensing and seizing capabilities, the lower-order capabilities, to respectively exploration and exploitation. Birkinshaw et al. (2016) argue that reconfiguring can be considered as a higher-order capability that involves choosing the mode of adaptation. Although they use slightly different names, the three different modes of adaptation as proposed by Birkinshaw et al. (2016) are the same as the forms of ambidexterity discussed in subsection 2.2. Structural separation involves placing exploration and exploitation activities into different organizational units, behavioral integration emphasizes bringing the conflicting activities together in a single unit by designing a supportive behavioral context, and sequential alternation involves deliberately vacillating between exploration and exploitation over time (Birkinshaw et al., 2016).

The complementarity of ambidexterity and dynamic capabilities will be used as the foundation of this research. Table 6 will be used as a theoretical framework to understand how traditional organizations can overcome the barriers to digital transformation using the concepts of ambidexterity and dynamic capabilities.

Table 6: Framework ambidexterity and dynamic capabilities

	Exploration	**Exploitation**
Sensing	A	B
Seizing	C	D
Reconfiguring	E	F

The letters in Table 6 represent combinations between the microfoundations of dynamic capabilities and the two components of ambidexterity. The combination of sensing and exploration (A) refers to "scanning future markets and technologies", while the combination of sensing and exploitation (B) refers to "scanning existing markets and technologies" (Maijanen & Virta, 2017). Furthermore the combination of seizing and exploration (C) refers to "making proactive decisions for long-term success by investing in new assets and capabilities", while the combination of seizing and exploitation (D) refers to "making decisions for short-term success based on existing knowledge, resources, and capabilities" (Maijanen & Virta, 2017). The combination of reconfiguring and exploration (E) refers to enhancing, recombining, protecting, and reconfiguring assets and organizational structures in future markets and technologies, while the combination of reconfiguring and exploitation (F) refers to enhancing, recombining, protecting, and reconfiguring assets and organizational structures in existing markets and technologies (Teece, 2007).

3 Methodology

This section will elaborate on the methodology of this research by describing the research design (3.1), company (3.2), data collection (3.3), participants (3.4), interview protocol (3.5), and data analysis (3.6).

3.1 Research design

The research employs a qualitative case study design to investigate the barriers to digital transformation in a traditional organization and how ambidexterity and dynamic capabilities can be combined to overcome these barriers to digital transformation. A single case study design is adopted to focus on COMPANY specifically, as it is currently facing the challenges of digital transformation in a sector that is among the lowest degree of digitization. COMPANY aims to tap into the opportunities for value creation using digital technologies by the establishment of a smart services business unit. Carrying out this research at COMPANY using a case study approach allow for an in-depth investigation in a real world setting. The next subsection will describe COMPANY as a company and why it is a suitable company for this research.

3.2 Company description

COMPANY is a large engineering company with approximately 3000 employees.

COMPANY is a suitable company to carry out this research for several reason. In the first place, COMPANY is an example of a traditional company. As mentioned before, where born digitals have completely digital operations, the operations of traditional companies usually include a physical aspect. The markets in which COMPANY is active are among those with the lowest degree of digitization, according to McKinsey & Company (2015). This means that there is still a lot to gain in this respect and make it interesting to analyze the company's digital transformation. The second reason is that COMPANY currently has a project about setting up a smart services business unit, which is closely related to digital transformation. The relationship between smart services and digital transformation will be discussed further in section 4.

With the establishment of a smart services business unit, COMPANY aims to tap into the opportunities for value creation using digital technologies. The establishment of this business unit is still in the very early stages of development and little is known about an effective structure as well as an efficient implementation. On the other hand, COMPANY has its existing operations that should not be jeopardized.

3.3 Data collection

Twelve semi-structured interviews are conducted with managers, directors, and consultants to gain in-depth insights in digital transformation in a traditional organization. The majority of these interviews are conducted in a face-to-face setting. However, two of the interviews were done using Microsoft Teams as it was not possible to arrange a face-to-face meeting. All interviews were audio-recorded with permission of the interviewees and transcribed in Dutch afterwards.

The main goal of the interviews is to identify barriers to digital transformation in traditional organizations and to investigate how ambidexterity and dynamic capabilities can be used to

overcome these barriers to digital transformation. The framework as shown in Table 4 will be used to categorize the different barriers and to determine on what level of origin these barriers arise, intra-level, inter-level, or meta-level. Subsequently, the focus of the interviews will shift to the ambidexterity and dynamic capabilities perspectives. The insights regarding these perspectives will be integrated in the framework as shown in Table 6 to determine success factors that can be used to pave the way for digital transformation.

3.4 List of participants

As dynamic capabilities consist of higher- and lower-order capabilities and these capabilities have different positions within a firms it is desirable to conduct interview with employees across different hierarchical layers. These employees on different layers might also have different views on what would be the best form of ambidexterity to achieve successful digital transformation in the company. Several directors, managers, and consultants from the utility division of COMPANY are consulted in order to gather qualitative data for the research. As these people fulfill a wide variety of functions across different hierarchical layers and business units within COMPANY, a comprehensive perspective on the researched phenomena can be given. An overview of the research participants can be found in Table 7.

Table 7: Overview of research participants

Team	**Name**	**Function**
Management	M1	Director
	M2	Director
Core	C1	Business Unit Manager
	C2	Business Unit Manager
	C3	Contract Manager
	C4	Manager Digital Transformation
Additional	A1	Consultant
	A2	Consultant
Internal Stakeholders	IS1	Region Director
	IS2	Region Director
	IS3	Region Director
	IS4	Region Director

All participants are assigned to teams that will be used for data analysis. The management team consists of two directors, the core team mostly consists of business unit managers that are involved in the smart services project, the additional team consists of consultants from the utility division, and the internal stakeholder team consists of four region directors.

3.5 Interview protocol

The interviews starts with an introduction of the researcher and the purpose of the research. Before the recording is started, it is stressed that the interview is confidential and will only be used for research purposes. Important to note is that the predefined teams have different expertise on the topic. This can affect the degree of guidance and explanation in the interview.

The first block of questions of the interview relate to digital transformation within COMPANY and the role of smart services. These questions are meant to introduce the concept of digital

transformation and to understand the participant's view on digital transformation within COMPANY and smart services.

- *What does digital transformation mean for COMPANY?*
- *What is the relationship between digital transformation and smart services?*
- *What is the position of smart services in relation to COMPANY as whole?*

Although in most cases, interview participant already mentioned some, the second block of the interview focuses on the enablers and barriers to digital transformation. This block relates to the barrier framework as shown in Table 4.

- *What are enablers and barriers to digital transformation?*

The third block of questions aims to shed light on organizing for digital transformation, the role of smart services and the people that are involved in smart services. These questions serve as an introduction towards the main part of the interview about ambidexterity and dynamic capabilities.

- *What characteristics are important for an organization in the context of digital transformation and why?*
- *What do you think of the balance within smart services between exploring new opportunities and keeping the current operation running?*
- *Who are involved in smart services and what is their role?*

The main part of the interview focuses on a discussion about ambidexterity and dynamic capabilities. The questions below are used as starting point for the discussion. While the questions are rather brief, in fact the concepts were explained more elaborately, as they were new for most of the participants they required more explanation. This block of questions relates to the framework for ambidexterity and dynamic capabilities as shown in Table 6.

- *A lot has been written in literature about ambidexterity, which is about exploring new opportunities, but at the same time exploiting the current business. Three forms are differentiated, being structural separation, behavioral integration and sequential alternation. Which of the previously mentioned forms suits smart services best?*
- *Another subject that is getting a lot of attention in literature is the concept of dynamic capabilities. Three tasks are distinguished, being sensing, seizing, and reconfiguring. Do you think these tasks fit smart services?*

To close the interview with, the participants are asked of they still have anything to add. After the participant has been thanked for their time and participation, the recording will be turned off.

3.6 Data analysis

All participants are assigned to a team based on their position within COMPANY. After transcribing the interviews, the findings are analyzed between and across the predefined teams. The qualitative data collected from the interviews has been coded in an anonymous way to identify concepts, ideas, and themes related to digital transformation. Using the frameworks mentioned

in section 2, a deductive coding approach will be used to group similar codes together into multiple categories.

4 Results

This chapter aims to summarize the findings of the conducted interviews and thereby providing an answer to the main research question that was formulated in the beginning of the research:

What are the barriers to digital transformation in traditional organizations such as COMPANY and how can ambidexterity and dynamic capabilities be combined to overcome these barriers and thus pave the way for successful digital transformation?

To provide an answer to this question, digital transformation at COMPANY will be analyzed in subsection 4.1, followed by the barriers to digital transformation in subsection 4.2. Subsequently, the theoretical lenses of ambidexterity and dynamic capabilities will be discussed in respectively subsection 4.3 and subsection 4.4. Both lenses will then be combined to identify success factors for digital transformation in subsection 4.5.

4.1 Digital transformation and COMPANY

This subsection analyzes what digital transformation means for COMPANY and what the relationship is between digital transformation and smart services.

4.1.1 What does digital transformation mean for COMPANY?

In addition to subsubsection 2.1.2, the findings of how the interviewees understand digital transformation are summarized in Table 8. Important to note is that the interviewees focus on digital transformation at COMPANY specifically.

Three recurrent aspects have been identified in order to understand digital transformation at COMPANY, being data, the supportive nature of digital transformation, and the difficulty to achieve successful digital transformation.

Interviewees often mention the aspect of data in their view on digital transformation. Digital transformation is seen as a useful tool and revolves around the idea that collecting and analyzing data will help to gain more relevant insights into the day-to-day operations.

"*Our work is becoming more and more data-driven. On the one hand because that is what we want ourselves, but on the other hand the market forces us to become more and more data-driven.*" (M1)

"*It is not only about capturing and collecting data but also about what you are going to do with it.*" (C2)

The second aspect is the supportive nature of digital transformation. At COMPANY, digital transformation is not a goal in itself, but rather the foundation for improvement and the next steps towards the future. On the one hand digital transformation could help to improve what we are doing already, especially because the work is becoming more and more data-driven. Digital transformation could improve the current operation by making it simpler, smarter, or more efficient. On the other hand, it also opens up opportunities for new business proposition as the increasing amount of digital technologies allows for more integrated solutions. At the management level, digital transformation is seen as an important strategy for COMPANY and

therefore as a high priority for its management team.

"*We need digital transformation to take new steps towards the future.*" (M2)

Table 8: Digital transformation and COMPANY

Interviewee	**Explanation**
M1	I approach digital transformation at COMPANY along two axes. Number one is that our work is becoming more and more data-driven. Number two is that digital transformation helps us to develop new business propositions.
M2	Digital transformation is a big management topic at COMPANY. We need digital transformation to take new steps towards the future.
C1	Digital transformation at COMPANY is a huge challenge. I think that we do not acknowledge the importance and the power of digital transformation as we have an traditional way of thinking.
C2	It is a really broad topic at COMPANY. From my perspective, it is about collecting data, analyzing data, and gaining insights from data.
C3	Currently, we miss a lot of opportunities because digital transformation is sometimes neglected. Digital transformation enables us to manage a lot of things remotely and get more relevant insights from the information that it gives us.
C4	Digital transformation at COMPANY is not a goal in itself, but rather the foundation for everything. For most people it is still intangible. It is my task to make it more tangible.
A1	Digital transformation means using all the tools that the digital transition gives us, including data analysis and Artificial Intelligence, to improve what we are doing and maybe even building new things on top of our business propositions.
A2	Digital transformation means combining stand-alone solutions into a integral digital platform or concept. We have seen the shift from analog to digital, but digital transformation means adding an extra layer with smarter en more integrated solutions.
IS1	Digital transformation at COMPANY mainly concerns automation of the secondary processes to make it as easy as possible. Taking it even a step further, it could also mean robotization.
IS2	Digital transformation means simplifying what we are currently doing through adopting digital technologies. So, making it easier, faster and less prone to error.
IS3	Digital technologies are increasingly becoming available. I think that digital transformation will help us towards the future. For example, automation and digitalization could help us to address shortage of manpower.
IS4	Digital transformation means converting information to output that you can work with.

The third aspect is the difficulty to achieve successful digital transformation. As also widely discussed in literature (Kimura et al., 2019)(Verhoef et al., 2021), digital transformation can be hard for traditional companies. Especially because these companies often have a physical aspect to their operations. Although subsection 4.2 will take a close look at why it is so difficult for traditional companies to achieve successful digital transformation, some exemplary quotes

will be provided below.

"*Digital transformation at COMPANY is a huge challenge. I think that we do not acknowledge the importance and the power of digital transformation as we have an traditional way of thinking*" (C1)

The large majority of interviewees argues that COMPANY is a traditional organization in a traditional sector with traditional customers. However, COMPANY is less traditional if you compare it to its competitors.

"*Basically, all installation companies are traditional companies. COMPANY is a traditional company, but the market is even more traditional.*" (IS3)

"*We are a traditional sector, but compared to its competitors COMPANY is not that traditional.*" (IS1)

"*At the core, I would say that COMPANY is a traditional organization in a traditional market. Where we come from is mainly traditional but also relies for a big part on craftsmanship. However, it is also a company that really has the focus to go through that transformation.*" (M2)

4.1.2 What is the relationship between digital transformation and smart services?

Smart services is a new business unit that is a combination of previous business units. The establishment of smart services revolves around the idea that these business unit where some what doing the same things in a different way and that combining the business units would lead to stimulating cross-fertilization within the main contracting department.

In general, the interviewees agreed that there is a strong relationship between smart services and digital transformation. For the business units that are accommodated in smart services, using digital technologies is part of their day-to-day work.

"*Certainly, there is a relation between smart services and digital transformation.*" (M1)

"*Smart services will create the foundation to be able to transform digitally*" (M2)

"*Smart services and digital transformation are closely intertwined. For example, at energy consulting, which is part of smart services, we are working with digital technologies every day. One does not work without the other.*" (A2)

A few years ago, the utility division of COMPANY has compiled a digital agenda.

"*From a HOLDING COMPANY perspective, digital transformation is part of the digital agenda. Next to the digital transformation, the agenda also concerns optimization and disruption.*" (C4)

At first, the digital agenda was positioned apart from the other business units. Using this structure, it turned out that it was hard to create a link between the digital agenda and the operation. Because the biggest digital developments take place within the maintenance department, it has been decision to address the digital agenda in smart services.

"*One of the decisions that we have made is that we want to address the digital agenda within smart services. Our manager digital transformation is the driving force in this process.*" (M1)

"*It turned out that the connection to the operation was hard to make. I think that smart services is a business unit where data issues and solutions are connected to each other. This is also the reason why the digital agenda, and thus digital transformation, is better positioned within this business unit.*" (C4)

4.2 Barriers

Although several barriers to digital transformation have already been identified in literature, this subsection aims to get a better understanding of the barriers to digital transformation within COMPANY. The framework, as described in subsection 2.1 will be used to categorize the barriers. Table 9 gives an overview of the identified barriers mentioned in the interviews per barrier category and level of origin.

Table 9: Barriers to digital transformation at COMPANY

		Level of origin		
		Intra-level	Inter-level	Meta-level
Barrier category	Financial	1	2	
	Knowledge and skills	7	1	
	Regulatory			1
	Technological	2	5	
	Environmental	1	10	1
	Organizational	16		
	Cultural	13	1	

4.2.1 Financial

In order to realize successful digital transformation, financial investment is required. Financial barriers play a role on the intra-level as well as on the inter-level. As digital technologies cannot meet the need for immediate return for organizations (Kiel et al., 2017), they are often neglected. Digital transformation initiatives in traditional organizations often run into this problem on the intra-level.

"*There has to be a balance between new opportunities and the existing operations. Being embedded in an existing organizations makes it even more important that investments are recouped.*" (M2)

These financial barriers do not only arise on the company's side, but also on the customer's side, the inter-level. Only a hand full of customers are willing to pay what current solutions cost due to their limited available budgets. In some cases customers don't think that digital technologies are worth the investment or customers only have little understanding of what they can achieve with these digital technologies. Therefore, a more proactive approach is required to inform customers about the potential benefits. One of the interviewees also mentions internal tensions on the customer's side between facility management and ICT as a barrier to digital transformation.

"*Innovations relating to digital transformation are related to ICT. The people that we're talking with are mainly facility management people and they don't have the budgets for these innovations. Sometimes it seems that ICT gets budgets for everything and the facility department continuously has to cut their expenses.*" (IS3)

4.2.2 Knowledge and skills

Successful digital transformation requires the availability of qualified staff on all organizational levels that is able to take advantage of digital technologies (Erol et al., 2016). A lack of digital knowledge and skills of employees within the organization is often mentioned in the interviews as one of the biggest barriers towards successful digital transformation. Some people are simply not used to working with digital technologies as their work mainly consists of physical tasks. At the moment, the day-to-day operations of COMPANY rely heavily on human work and is therefore closely tied to craftsmanship. This is not necessarily a problem as multiple interviewees argue that maintenance work will always exist, as long as we are alive. In fact, there is a great scarcity of technical people, which makes it important for organizations to retain these people because of their crucial contribution to the organization's success.

"*Where we come from and what we still do every day is really traditional. But it's also closely tied to craftsmanship.*" (M2)

"*As long as we're alive, our maintenance continues to exist. That is not going to suddenly stop.*" (IS2)

However, new digital solutions call for a more advanced digital skill set and thus different kinds of people. As digital transformation relies heavily on data, as discussed in subsection 4.1, organizations should hire people that can streamline the collection of data and are able to do something with this data. Data analists, for example, are really important to turn raw data into valuable insights. Additionally, the aim of these different kind of people should be to make the physical operations of technical people as easy as possible.

"*When looking at branches that are further developed in terms of digitalization and automization, they consist of completely different people.*" (IS1)

4.2.3 Regulatory

Regulatory barriers play a role on the meta-level. Although government policies and regulations can hinder digital transformation, the majority of the interview participants mentions these regulations as an important enabler for COMPANY. The main reason for this is that COMPANY offers solutions to other organizations that help them to comply with these regulations. Sometimes governments stimulate sustainable digital solutions by providing subsidies. However, there are also examples where regulations act as a barrier towards digital transformation. For example, when it is mandatory to perform physical maintenance checks, instead of monitoring equipment remotely.

"*Laws and regulations are becoming more strict. There are more and more requirements which open up opportunities for us as a company.*" (A2)

4.2.4 Technological

Technological barriers to digital transformation at COMPANY are identified on the intra-level and inter-level. The main technology related barrier on the intra-level is the old ICT environment as also found by Tsiavos and Kitsios (2021). This barrier hinders digital transformation in the sense that in order to do new things, there are certain requirements to the level of digitalization of the existing operations.

"*At the moment, we are often restricted by the old ICT environment.*" (M1)

"*If we want to explore new things, we have some requirements. If we want smart services to succeed, we need the existing organization to reach a certain level digitization.*" (C4)

At the inter-level, technological barriers relate to privacy and security concerns and unclear benefits of digital technologies. For example, although digital technologies are rapidly being developed, prices are still higher than customer want to pay. More importantly, organizations find it difficult to accept the risks of implementing new technologies as early stage and poorly tested technologies could lead to privacy and security problems (Tsiavos & Kitsios, 2021).

"*Technology is widely available, but the costs to apply a technology is still something that customers don't want to pay.*" (IS1)

"*Many ICT departments do not want a digital connection to the outside world due to cybersecurity. This becomes increasingly important for organizations.*" (IS3)

4.2.5 Environmental

The most frequently mentioned barrier on the intra-level is the lack of collaboration and cooperation, which is in line with the findings of Lammers et al. (2019). One of the reasons for this is the traditional sector in which COMPANY operates. The sector will only start to move when it is mandatory and checked and is characterized by long development periods. Although this is definitely a barrier, it also creates opportunities to stand out.

"*The only way in which the commercial real estate world starts moving is when they are forced. That is not even true because when there is no auditing, it will still not move.*" (IS1)

"*The traditional sector is a barrier on the one hand, but also creates opportunities distinguish yourself from competitors.*" (M2)

One of the most important barriers to successful digital transformation is the internal orientation of COMPANY. This internal orientation draws away the attention from the crucial role that, for example, customers have, while these people play an important role in the digital transformation process.

"*In the end it is all about the market, the demand of the market and not the demand of the technology.*" (IS3)

In other words, there is a lack of customer centricity in the digital transformation. As said before, it is all about the demand that customers in the market have. It is a waste to develop a

product which customers are not interested in. However, it should be noted that most customers are used to traditional markets and should be taken by the hand in the digital transformation process.

"*I don't believe in innovation without any direction where it's heading.*" (IS2)

"*We have to be closer to the process of the end user.*" (C1)

"*The customer is used to a traditional market. They need to be taken by the hand in process of change.*" (M2)

Next to customers, other organizations might also be useful for COMPANY to enhance collaboration and cooperation. Multiple interview participants argue that COMPANY should not be willing to do everything on its own. In some cases, collaborating with, for example, start-ups or organizations from other markets could substantially decrease development times or drastically improve parts of the operation.

"*We only use adjacent technologies or markets to a limited extent for development.*" (M2)

"*We are trying to solve things internally, but I think that you can not avoid involving other companies.*" (IS4)

To conclude this barrier category, the impact of another recession, like COVID-19, should not be neglected as it could also impact the development of new initiatives. In times of a recession, these initiatives are often among the first ones to be discontinued.

4.2.6 Organizational

The company itself has been mentioned most frequently as a key barrier to digital transformation. One of the reasons is the traditional hierarchical structure. The organization is vertically- and function-oriented. On the one hand, it is useful that there is a large organization backing up the plans for digital transformation. For some cases, this means that you don't have to start from scratch and that you are in the position to use the company's resources. On the other hand, a large organization may also stifle innovation. In general, development happens slower resulting in long periods for team creation and starting to create business. Another potential downside of a large organization is that the innovation projects get only little attention, because the main focus is on the existing business. This could result in new developments being jeopardized by the current operation and thus falling back into old patterns.

"*I think that the traditional hierarchical structure and way of organizing at COMPANY can be an obstacle.*" (M2)

"*Everything is organized by function. In the current organizations, it is only vertically-oriented.*" (C1)

"*A barrier is to keep doing things the way we have been doing them for years.*" (A1)

"*The people working in smart services are still to some extent part of the existing operation.*" (M2)

"*The shift from running the business to changing the business is something that is not achieved with only one training. You need this stimulation every week, every day, every time.*" (IS4)

For successful digital transformation, smart services heavily depends on the region companies. In order to be successful, the current operation needs to adapt. The problem for the region companies is that altering its process will drive up the costs and make it less competitive in the short run. As these directors are assessed based on how much money they bring in and their margins are small already, they are not much willing to adapt their operations. The internal stakeholders thus form a critical group of people within the organization due to the traditional KPI structure.

"*In order to be successful with smart services we are heavily depend on our colleagues in the traditional part of COMPANY in the sense that the data capturing process should be improved.*" (C1)

"*Margins are too small to transform digitally.*" (IS1)

"*I think that the traditional way of thinking is a big barrier for us. Everything is immediately related to money.*" (IS4)

4.2.7 Cultural

Along the same lines of the traditional organization, the people working at COMPANY have a traditional way of thinking. Technicians in general have a tendency to solve everything on their own and focus on a big problem as a whole instead of cutting it into smaller pieces. Sometimes this way of thinking results in long development times.

"*We rather have a problem than a question and then we are going to try to fix it ourselves. Sometimes that is possible, but sometimes it is not.*" (M1)

In addition to the traditional KPI structure, the internal stakeholders only have a limited amount of trust in the digital transformation initiatives, due to previously failed projects. Solutions were sold but not delivered in the end. Obviously, this had a negative impact on the organizational attitude towards innovation.

"*There have been initiatives in the past that were discontinued even though a lot of time and work have been put in.*" (C3)

"*It is important to really finish a project. We have had quite a few experiments, especially from the smart area, that failed.*" (IS2)

The management team recognizes this skepticism and stresses that organizations should not promise things that it can not live up to. Previously failed project have resulted in reluctance to share unfinished products or services with customers. However, carrying out experiments with clients is an essential part of the development process.

"*It is part of our DNA that we are a bit reluctant to share something that is not completely finished with customers.*" (M1)

"*We want to do everything ourselves, but we should not be reluctant to use external help.*" (M1)

4.3 Ambidexterity

This subsection will present an overview of the main findings from the interviews relating the ambidexterity. As mentioned in subsection 2.2, organizations using ambidextrous structures are more successful than organizations using other organizational structures. However, it is difficult for organizations to find the right balance between exploitation and exploration activities. Basically, COMPANY can roughly be split up into a traditional organization and smart services. Along the two dimensions, exploitation and exploration, it will be discussed how ambidexterity can play a role in digital transformation at COMPANY.

4.3.1 Exploitation

Exploitation relates to terms such as efficiency and optimization. COMPANY has a successful history in their traditional sector. As COMPANY has proven to be successful in its traditional sector, region companies and current contract teams should continue to focus on serving their customers as they have been doing for years.

"*We have a really strong organization that is good in providing service, executing projects, but also in maintenance. We have proven that we can make a living by doing this. However, we can do much more and it can be done in a much more efficient way*" (C3)

Most of the employees of COMPANY that participated in the interviews are conservative when discussing things relating to innovation. A typical answer is that the best way forward is to improve what there already is. An entrepreneurial mindset lacks in most of the cases. Especially people close to the operation have a tendency to focus on exploitation rather than exploration.

"*The biggest mistake that we make is that we think optimization is innovative. But it's not.*" (IS4)

4.3.2 Exploration

To avoid doing things as we have always done and thereby losing ground to competitors, COMPANY should also focus on exploration, which relates to terms such as innovation, flexibility, and adaptability. Interviewees from the management team state that the main reason to establish smart services is to have a look into the future. A flat organizational structure should provide room for innovation and development of new business.

"*Digital transformation helps us to develop new propositions. But new can also mean a combination of already existing propositions.*" (M1)

The majority of the interviewees agrees that smart services should not be hindered by the traditional organization. However, internal stakeholders and contract managers emphasize that it is really important that smart services provides input for their current business. The conservative mindset can also be identified here.

"*Smart services should strengthen the current operation*" (C3)

"*We are not a software developer. We are not an organization that is continuously taking big*

innovative steps. We are very conservative." (M1)

In general, smart services should focus on new opportunities and show entrepreneurship and courage. It should be a group of people that are creative and think differently than the traditional organization. Therefore, it is important to create a certain degree of separation with the traditional organization.

"*Smart services should be a group of people that is innovative and thinks in a creative way, while considering what is going on in region companies.*" (A2)

"*Smart services needs people that are creative, think differently, and act as a guide for the rest of the organization for digital opportunities.*" (IS3)

As mentioned before, technicians in general have a tendency to solve everything on their own. In order to overcome this barrier the management team stresses that smart services should not hesitate to use external help. The choice between internal and external development depends on the subject. If it is something that the organization already has plenty of knowledge about, it can be done internally. Otherwise, external expertise has to be sought.

"*We don't have to do everything ourselves.*" (M1)

It is extremely important to make a careful make or buy decision regarding digital solutions. Development time is often an important consideration in this decision. As mentioned in subsection 4.2, the development times in the sector are relatively long. Buying external solutions is much faster than developing it yourself. On the other hand, if a technology is of strategic importance, a company should aim to internalize it.

"*I have customers asking me a lot of things. I don't have the time to wait before we have developed it ourselves.*" (IS1)

4.3.3 Structuring exploration and exploitation

The traditional structure and way of organizing at COMPANY form an important barrier to digital transformation, as discussed in subsection 4.2. As existing business often gets priority over exploring activities it can be argued that structural separation of exploring and exploiting activities is the best form of ambidexterity for an organization seeking to engage in digital transformation. This is in line with Schiffer (2021) who argues that structural separation is the best strategy because adaption of digital technologies is so fundamental.

"*Existing business often gets priority over exploring activities.*" (A2)

The management team of COMPANY argues that smart services is established to have a look into the future and act as a separate business unit, whilst the traditional organization focuses on optimizing the current business. The main reason for the separation is because it might fade away because of the large existing operation. The large majority across the different teams agrees that smart services should not be affected to much by the current operation.

"*The main reason to establish smart services is to have a look into the future. So, developing towards the future."The focus of the other business units is on optimizing the current business.*"

(M1)

"*Smart services should focus on renewal, separate from the rest of the organization.*" (M2)

"*Smart services can operate as a separate business unit next to the current operation.*" (C3)

"*I think that it should not be affected to much by the current operation.*" (IS2)

Moreover, the traditional organization has a need for control and stability, while smart services has a strong commitment to the development of new things. This requires fundamentally different approaches, being operational excellence and customer intimacy.

"*COMPANY definitely has a need for stability.*" (A1)

"*The existing business focuses on operational excellence, whilst smart services is more customer intimacy. Customer intimacy should be separated from the existing business.*" (C1)

However, especially in the situation where smart services is embedded in a larger organization, it is important to maintain a close connection between the two. It is really important that exploration and exploitation activities are aligned. Smart services provides input for maintenance companies and transfers knowledge and skills before exploring new projects.

"*If we are only focusing on new things, then there is a big risk that those new things do not fit the existing business.*" (C1)

"*Smart services is a group of front runners that are given room for development, but at the same time experience the need to deliver useful things to the organization*" (M1)

In order for smart services to be successful, it should have some degree of autonomy according to interviewees across different teams. However, it should not be ignored that there is a large dependency on the traditional organization, as described in subsection 4.2, that should be addressed.

"*If we want to explore new things, we have some requirements. If we want smart services to succeed, we need the existing organization to reach a certain level digitization.*" (C4)

4.4 Dynamic capabilities

Dynamic capabilities are a powerful lens to examine digital transformation of incumbent firms in traditional industries. Teece et al. (1997) argue that organizations must develop sensing, seizing, and reconfiguring capabilities in order to be able to respond to changing internal and external environments. In the interviews, the participants were asked where these capabilities should be accommodated. The results can be found in Table 10.

Overall, interview participants agree that smart services should have all three dynamic capabilities. For the sensing capability, region companies and customers are frequently mentioned as these are closest to the market. Additionally, the management team of COMPANY should play a role in the reconfiguring capability.

Table 10: Dynamic capabilities in COMPANY

Participant	Sensing	Seizing	Reconfiguring
M1	Smart Services	Smart Services	Management team
M2	Smart Services	Smart Services	Smart Services + Management team
C1	Smart Services	Smart Services + Third parties	Specialists in the organization
C2	Smart Services	Smart Services	Smart Services
C3	Region companies + Customers in the market	Smart Services	Smart Services + Management team
C4	Region companies + Customers in the market	Smart Services	Management team
A1	Smart Services	Smart Services	Smart Services
A2	Smart Services + Region companies	Smart Services	Smart Services + Management team
IS1	Smart Services	Smart Services	-
IS2	Smart Services + Region companies	Smart Services + Region companies	Smart Services + Management team
IS3	Smart Service + Region companies	Smart services + Customers	-
IS4	Region Companies	Smart Services	Management team

4.4.1 Sensing

Sensing refers to "the ability to acquire strategically relevant information from the environment" (Kump et al., 2019). The role of smart services is that it is some kind of desk where questions can be asked. The core team of smart services includes a contract manager in order to be close to the operational field.

"*Smart services can be seen as a knowledge center where questions can be asked.*" (C4)

"*With smart services we want to be close to the operational field. That is also the reason why we have included a contract manager in the core team.*" (M2)

"*I'm part of smart services as contract management is a source of information. This also applies to region managers and site managers.*" (C3)

In line with the philosophy of Teece (2007), interview participants also mention customers as important players for the sensing capability. Considering internal resources, region companies are among the people who are the closest to the customer and thus play an important role in the sensing capability. However, detecting digital opportunities and disruptions should not be limited to the market of COMPANY as there might also be interesting developments in adjacent markets. Digital innovations do not have to be completely new, but may also be copied from another industry (Ellström et al., 2021).

4.4.2 Seizing

Seizing refers to the ability to decide whether some information is of potential value and to transform the information into concrete business opportunities that are aligned with the organization's goals (Kump et al., 2019). Smart services is in the lead in the process of seizing opportunities from the market.

"*Smart services is a focal point where everything needs to come together and where connections within the existing organization are made.*" (M2)

Although employees of COMPANY are sometimes reluctant to share something that is not completely finished with customer, opportunities for testing products and services in collaboration with clients is frequently mentioned in the interviews. Customers are often willing to develop new products and services together. As COMPANY has a large client base, it is easy to make a shortlist of customers that are willing to be launching customer.

"*In our company, there is the opportunity to test and execute things that have been developed.*" (C3)

"*For the testing phase, you can approach potentially interested clients. Clients often feel flattered of they are asked for these kind of activities.*" (C3)

Findings from the interviews show that employees see this development as an iterative process, like the the plan-do-check-act cycle. During the development, COMPANY should make sure that innovations are aligned with the company's objectives. After successful development, newly developed products and services can be pushed into the organization.

"*I think that it will be an iterative process, conform the plan-do-check-act cycle.*" (A2)

4.4.3 Reconfiguring

Reconfiguring, which can be considered as a higher-order capability, refers to "consistently implementing renewal activities by assigning responsibilities, allocating resources, and ensuring that the workforce possesses the newly required knowledge" (Kump et al., 2019). Although a low degree of hierarchy is experienced in smart services, the centralized structure makes it easier to implement bold change. Smart services and the management team are the most frequently mentioned teams for this capability.

"*Reconfiguring is something that smart services and management are involved in. Smart services is responsible for monitoring the process and the management team should in the end make the decision to continue or stop certain initiatives.*" (C3)

The management team for smart services consists of two directors. Because one of those director is closely involved in the establishment of smart services, he is seen as a linking pin on the tactical and strategic level. Tasks of the management team include creating a unified digital infrastructure (Ellström et al., 2021). Weritz et al. (2020) state that digital transformation required a new digital leadership throughout the whole organization.

"*From my position, it is also about given confidence and to protect the people within smart*

services from the existing organization." (M2)

4.5 Success factors

This subsection integrates the concepts of ambidexterity and dynamic capabilities using the theoretical framework as described in subsection 2.4. The combinations of exploration and exploitation with the micro foundations of dynamic capabilities point us towards several success factors that can help to overcome the barriers to digital transformation in traditional organizations. These success factors, that have been identified from the interviews, are shown in Table 11.

Table 11: Success factors for digital transformation

	Exploration	**Exploitation**
Sensing	A: Customer centricity	B: Input innovation funnel
Seizing	C: Innovation funnel	D: Customer centricity
Reconfiguring	E,F: Steering group	

A conceptual structure of the integration of ambidexterity and dynamic capabilities has been made to visualize the innovation process with the focus on digital transformation, see Figure 5.

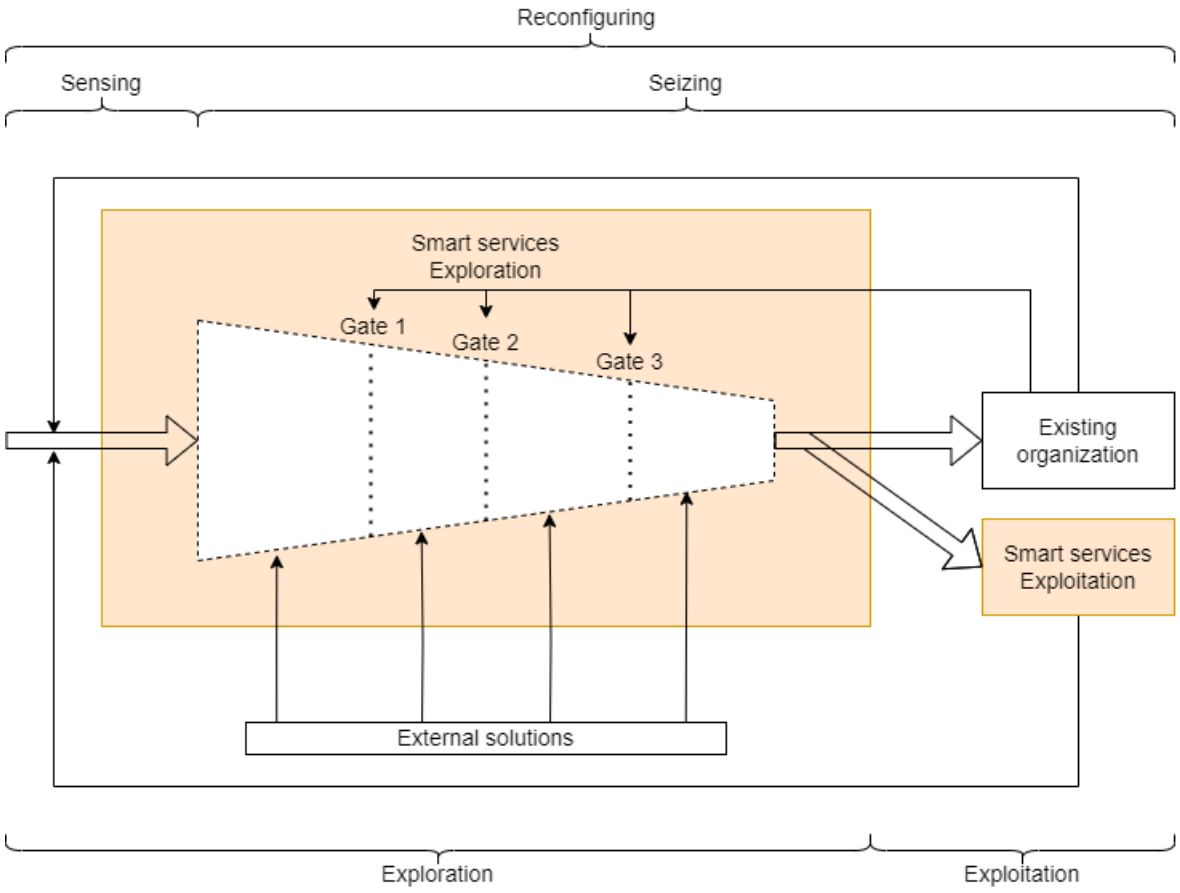

Figure 5: Structure of the innovation process

4.5.1 Customer centricity

The first identified success factor is customer centricity. Customer centricity is most important for the sensing capability during exploration activities (A) and for the seizing capability during exploitation activities (D). As already mentioned in subsection about barriers to digital transformation, subsection 4.2, customer need to be taken by the hand in the process of change. During the sensing process, customers can acts as a useful source of information. As customers are the closest to the market, their insights are useful while scanning future markets and technologies. This information can be gathered through parts of the organization that are close to the customer, such as contract managers and region directors. During the seizing process, it is really important that a product or service meets the customer's needs, as it is all about the demand of the market. It is about market pull instead of technology push. It makes no sense to develop something if there is no demand for it. So, customer centricity is important while making decisions for short-term success.

"*We want to be able to provide an answer to customer demands. So in the process of renewal, it is really important to have a close interaction with our customers to be able to understand their needs.*" (C4)

"*It happened before that we thought that we new what our customers wanted, but that was not the case. Sometimes the customer doesn't even know it himself, so it is important to have this conversation.*" (C4)

4.5.2 Innovation funnel

The second identified success factor is an innovation funnel that can help COMPANY to make proactive decisions for long-term success (C). Such a funnel has been mentioned multiple times by interview participants. The innovation funnel refers to a pipeline to illustrate the process of generating and developing new ideas or innovations within an organization. An innovation funnel consists of multiple stages, ranging from idea generation to successful implementation, that have to be passed in a sequential manner. If the maturity of a new product or service reaches a certain level, it can be pushed into the traditional organization.

"*Smart services can be seen as a funnel within maintenance. In my opinion, it should not be limited to maintenance, but include the utility division as a whole.*" (C4)

The traditional organization focuses mainly on exploitation of current propositions. However, they should be stimulated to deliver input for the innovation funnel (D) when confronted with an opportunity that exceeds exploitation activities. As mentioned in subsection 4.4, smart services is mainly responsible for the seizing capability. However, at different moments in the innovation funnel, which are called gates, the expertise of the traditional organization can be called for to determine the value of certain innovations in brainstorm session and in that way being able to strategically prioritize digital initiatives as described by (Feroz et al., 2023).

"*It is important that the process of brainstorming is guided, because if we are going to brainstorm ourselves, we will stay anchored to the past.*" (IS4)

"*If you are not involved with exploration on a daily basis, you lose sight of it.*" (C4)

If an idea enters the innovation funnel, smart services can either choose to develop a solution themselves or use external solutions, which refers to the buy or make decision in subsection 4.4. External solutions can enter the innovation funnel in different stages based on their maturity and fit to the organization. One opportunity to find these solutions is via partners in a network. It is important for organizations embracing digital transformation to transform into a network organization with excellent partners. Good partners are partners that are not involved because they want to save money, but rather because they want to mitigate risks.

"*We should not do everything ourselves, but rather involve good partners. That will facilitate being agile but at the same time maintain control and stability.*" (IS1)

"*For example, hospitals ask us questions about technology not because they want to save money, but to be able to better control the process.*" (IS1)

The environment of partners can be used as testing ground for new developments during the seizing phase. This provides the opportunity to quickly prove the value of smart services to the internal stakeholders, which is mentioned multiple times as an important enabler of digital transformation by interview participants. In addition, start-ups may also offer valuable opportunities for COMPANY as their products or services can be used for exploration activities. In return, COMPANY can offer use cases for these start-ups to test their product or service.

"*Professionals learn from professionals and quickly adopt something that has proved its value. So we need proof as soon as possible.*" (C1)

"*From my experience I have learned that if you see it as a cost center or competence center, it is hard to demonstrate your added value.*" (M1)

4.5.3 Steering group

In the process of digital transformation, it is important to have a steering group. If the process gets bigger, it is important that someone oversees the whole process, including exploration and exploitation. As reconfiguring is a higher-order capability, the cells for exploration (E) and exploitation (F) have been merged.

"*So I think that a steering group with a leader that can create support on all levels is crucial.*" (IS4)

For the management team, this is also a way to involve internal stakeholder in the process. As they are the sponsors of smart services, they also should be kept up to date regarding the progress. Transparency and clarity are really important aspects in the communication of this steering group to bridge the gap between the traditional operation and innovation.

"*Communication is key to make sure that smart services aligns with the current operation.*" (C3)

"*Clarity is really important. So knowing what someone does and what he or she doesn't do.*" (C3)

5 Discussion

This thesis aimed to serve a threefold objective. Firstly, it aims to determine the main barriers to digital transformation for traditional organizations. Secondly, it will elaborate on how ambidexterity and dynamic capabilities can be applied in the context of digital transformation. Lastly, the research integrates both perspectives and derives success factors that can guide traditional organizations towards successful digital transformation.

5.1 Key findings

Along the key findings of the research, this subsection provides an answer to the sub-questions that have been formulated in the first chapter.

SQ1: What is digital transformation?

Although terms like digital transformation, digitization, and digitalization are often used interchangeably, they are definitely not the same. Verhoef et al. (2021) identifies the concepts as three separate stages of digital transformation. The first two phases are more or less incremental phases which are needed to attain the most pervasive phase of digital transformation. Digitization refers to the conversion of analog into digital information, while digitalization refers to the addition of digital components to product or service offering. Definitions for digital transformation are widely available, but a uniform definition is lacking. Three recurrent aspect have been identified in order to understand digital transformation at COMPANY. The first one is the role of data. Digital transformation is seen as a useful tool and revolves around the idea that collecting and analyzing data will help to gain more relevant insights into the day-to-day operations. The second aspect is the supportive nature of digital transformation. Interview participants stress that digital transformation is not a goal in itself but rather the foundation for improvement and the next steps towards the future as it could make the current operations simpler, smarter, or more efficient. The third aspect is the difficulty to achieve successful digital transformation. The following sub-question will take a closer look at why it is so difficult for traditional companies to achieve successful digital transformation

SQ2: What are barriers to digital transformation for traditional organizations?

The framework for barriers to digital transformation by Lammers et al. (2019) is used to analyze the barriers based on their level of origin and their barrier category. The organizational levels in which different interactions occur are intra-level, inter-level, and meta-level. The identified barrier categories are financial, knowledge and skills, regulatory, technological, environmental, organizational, and cultural. The barriers that were most frequently mentioned by interview participants are knowledge and skills, organizational, and cultural barriers on the intra-level and technological and environmental barriers on the inter-level. Although the barriers are divided into different categories and levels of origin, there is certainly a relationship between these categories and levels of origin. For example, because of the lack of standard in the business environment (regulatory, meta-level) it is hard to closely involve customers and suppliers in the process of value creation (environmental, inter-level).

SQ3: How can exploration and exploitation activities be balanced in a traditional organization?

One approach to dealing with these barriers is through the lens of ambidexterity, which refers

to "an organization's ability to be aligned and efficient in its management of today's business demands (exploitation) while simultaneously being adaptive to changes in the environment (exploration)" (Raisch & Birkinshaw, 2008). Many companies struggle to implement a structure that addresses both of these conflicting activities. Three ways to balance exploration and exploitation activities are through structural ambidexterity, contextual ambidexterity, or sequential ambidexterity. As in traditional organizations existing business often gets priority over exploration activities, it is argued that structural separation of exploring and exploiting activities is the best form of ambidexterity for an organization seeking to engage in digital transformation. This is in line with Schiffer (2021) who argues that structural separation is the best strategy because adaption of digital technologies is so fundamental. Interview participants state that a separate business unit should have a strong commitment to the development new things, while the traditional organization has a need for control and stability. However, especially in the situation where this separate business unit is embedded in a larger organization, it is really important to maintain a close connection between the two. In other words, exploration and exploitation should be aligned.

SQ4: How can dynamic capabilities be developed in a traditional organization?

To take full advantage of digital transformation, organizations must develop dynamic capabilities to prevent core capabilities becoming core rigidities that hinder digital transformation. Teece et al. (1997) argue that organizations must develop sensing, seizing, and reconfiguring capabilities in order to be able to respond to changing internal and external environments. It is argued that the new separate business unit needs all three dynamic capabilities. For the sensing capability, it is important to involve people that are the closest to the market. The sensing capability should not be limited to one market, because there might also be interesting developments in adjacent markets. The reconfiguring capability can be considered a higher-order capability. As reconfiguring includes "consistently implementing renewal activities by assigning responsibilities, allocating resources, and ensuring that the workforce possesses the newly required knowledge" (Kump et al., 2019), the management team should also play a role in the reconfiguring capability.

SQ5: How can ambidexterity and dynamic capabilities be applied to overcome the barriers to digital transformation?

A theoretical framework, based on the combination of the microfoundations of dynamic capabilities and the two components of ambidexterity, is used to identify success factors to overcome the barriers to digital transformation. The first identified success factor is customer centricity. As customers are the closest to the market, their insights are useful while scanning future markets and technologies. In addition, during the seizing process, it is really important that a product or service meets the customer's needs. The second identified success factor is an innovation funnel, which has been mentioned multiple times by interview participants. Such a funnel helps to make proactive decisions for long-term success. By involving employees from the traditional organization at multiple gates, organizations are able to determine the value of certain innovations and thereby being able to strategically prioritize digital initiatives. The third success factor is a steering group. In the process of digital transformation, it is important to have a steering group overseeing the whole process. In addition this is a way to involve critical internal stakeholders in the process.

5.2 Academic reflection

This research makes several contributions to the body of knowledge on digital transformation. For traditional companies in particular it is hard to balance exploration and exploitation in order to become ambidextrous as an organization to realize digital transformation. The main reason for this is that they often have a large existing operation that should not be jeopardized but should also not hinder the exploration of novel opportunities. This research contributes to the academic debate of how to balance these conflicting activities by arguing that a structural separation would be the best way to achieve successful digital transformation. The research also contributes to the literature on dynamic capabilities by stressing the role of customers and other companies in the sensing and seizing activities and the role of management in reconfiguring activities. Although several scholars have tried to integrate ambidexterity and dynamic capabilities, this integration has never been applied to overcome barriers to digital transformation. By identifying three success factors, this thesis adds to strategic management discussions about how firms can achieve a sustained competitive advantage through digital transformation.

5.3 Managerial relevance

In today's rapidly changing world, digital transformation has become a critical topic for businesses across industries and a major topic on management agendas. As technology continues to advance at an unprecedented speed, organizations must adapt to remain competitive. The fact that many large consultancy firms, such as KPMG, Deloitte and McKinsey, are setting up departments that focus specifically on digital transformation shows the increasing importance of digital transformation. Companies that do not embrace digital transformation may find themselves falling behind on competitors and losing out on potential innovation and growth opportunities. Kimura et al. (2019) from the Boston Consulting Group argue that the logic of competition has changed to a dynamic game and notice that the competition between traditional and born digital companies is getting more intense. This is confirmed by Verhoef et al. (2021) who state that traditional businesses are under tremendous pressure from digital transformation.

As the business environment is changing at an unprecedented pace, it is becoming increasingly important to be aligned and efficient in the management of today's business demands while simultaneously being adaptive to changes in the environment. Ambidexterity and dynamic capabilities provide two powerful lenses to approach the challenge of digital transformation for traditional companies. While these approaches on their own provide valuable insights, integrating both approaches has led to three success factors that should take center stage in the process of digital transformation, being customer centricity, an innovation funnel, and a steering group.

5.4 Limitations and recommendations for further research

The limitations of this study mainly relate to the adopted research methodology. This study employs a qualitative single case study design. While this research design allows for an in-depth investigation of digital transformation in a real world setting, it also has its limitations. As the findings are based on a small sample, they might not be replicable or generalizable to other settings. Due to the limited amount of time, it has not been possible to include multiple organizations with different backgrounds in this study.

Further research can focus on employing the same research at organizations in other markets, countries, and cultures to increase validity and reliability. Recommendations for future research

also include building upon the findings of this research. Further research can focus on the following questions:

- How do different levels of origin and different barrier categories interact with each other?
- How can external solutions be used in the seizing process of traditional organizations?
- How to involve employees from the traditional organization in the exploration process?
- What are the (digital) leadership characteristics of top management to enhance the reconfiguring capability of an organization?

6 Conclusion

This chapter aims to answer the main research question as formulated to guide the research:

What are the barriers to digital transformation in traditional organizations such as COMPANY and how can ambidexterity and dynamic capabilities be combined to overcome these barriers and thus pave the way for successful digital transformation?

At COMPANY, digital transformation is not a goal in itself, but rather the foundation for improvement and the next steps towards the future. On the one hand digital transformation could help to improve what we are doing already, especially because the work is becoming more and more data-driven. Digital transformation could improve the current operation by making it simpler, smarter, or more efficient. On the other hand, it also opens up opportunities for new business proposition as the increasing amount of digital technologies allows for more integrated solutions. At the management level, digital transformation is seen as an important strategy for COMPANY and therefore a high priority for its management team.

The barriers to digital transformation are categorized based on their level of origin and their barrier category. Levels of origin include intra-level, inter-level, and meta-level. The intra-level refers to interactions that occur inside an organization, inter-level interactions refer to interactions between an organization and external actors, and meta-level interactions are high level and involve policy-makers and governments. Findings show that the most prominent barriers for COMPANY are knowledge and skills, organizational, and cultural barriers on the intra-level and technological and environmental barriers on the inter-level.

On the intra-level successful digital transformation requires the availability of qualified staff on all organizational levels that is able to take advantage of digital technologies (Erol et al., 2016). However, at the moment, the day-to-day operations of COMPANY rely heavily on human work. Some people are simply not used to working with digital technologies. New digital solutions call for a more advanced digital skill set and thus different kinds of people. Secondly, the organization itself has been mentioned most frequently as a key barrier to digital transformation. On of the reasons is the traditional hierarchical structure which is vertically- and function oriented. On the one hand it an be useful to have a large organization backing up the plans for digital transformation, while on the other hand a large organization may also stifle innovation because the main focus is on the existing business. Along the same lines of the traditional organization, employees of COMPANY have traditional way of thinking. Technicians in general have a tendency to solve everything on their own. Another important cultural barrier is the trust in digital transformation initiatives. Due to previously failed projects from the smart area, employees only have a limited amount of trust in the initiatives.

On the inter-level the main barriers are technological and environmental barriers. The main technological barriers on the inter-level relate to privacy and security concerns and unclear benefits of digital technologies. Customers often find it difficult to accept the risks of implementing new technologies as early stage and poorly tested technologies could lead to privacy and security problems. Another important barrier on the inter-level is the lack of collaboration and cooperation between organizations or between an organization and its customers. This environmental barrier hinders digital transformation within COMPANY.

Given the disruptive nature of digital transformation, ambidexterity can be considered a powerful lens to study the phenomenon. Berghaus and Back (2016) define digital transformation as "a technology-induced change on many levels in the organization that includes both the exploitation of digital technologies to improve existing processes, and the exploration of digital innovation, which can potentially transform the business model". As exploitation and exploration are two fundamentally different learning activities, organizations should find a way to balance these two. As in traditional organizations existing business often gets priority over exploration activities, it is argued that structural separation of exploring and exploiting activities is the best form of ambidexterity for an organization seeking to engage in digital transformation. Interview participants state that a separate business unit should have a strong commitment to the development new things, while the traditional organization has a need for control and stability. However, especially in the situation where this separate business unit is embedded in a larger organization, it is really important to maintain a close connection between the two.

Given the rapid technological and market developments, it is argued that the dynamic capabilities framework can be a powerful lens for examining the digital transformation of incumbent firms in traditional industries. According to Eisenhardt and Martin (2000), companies must develop dynamic capabilities to take full advantage of digital transformation. It is argued that the new separate business unit needs all three dynamic capabilities. For the sensing capability, it is important to involve people that are the closest to the market. The sensing capability should not be limited to one market, because there might also be interesting developments in adjacent markets. The reconfiguring capability can be considered a higher-order capability. As reconfiguring includes "consistently implementing renewal activities by assigning responsibilities, allocating resources, and ensuring that the workforce possesses the newly required knowledge" (Kump et al., 2019), the management team should also play a role in the reconfiguring capability.

Integrating ambidexterity and dynamic capabilities results in three success factors to overcome the barriers of digital transformation in traditional organizations, being customer centricity, an innovation funnel, and a steering group. To deal with the lack of customer centricity barrier, organizations should take customers by the hand in the process of change as most of the times customers are relatively traditional. During the sensing process, customer can be a useful source of information, whereas in the seizing process, it is really important to get feedback from customers on a product or service that is being developed. The second identified success factor is an innovation funnel that can be used as a tool to guide the operation in smart services. Before a new product or service can be pushed into the traditional organization, its maturity should reach a certain level. Important interactions with the innovation funnel are making use of external solutions, building a partner network, and involving experts from the traditional organization. The last success factor is a steering group that oversees the whole process, including exploration and exploitation. This is also a way to involve internal stakeholders.

References

Al–Aali, A., & Teece, D. J. (2014). International entrepreneurship and the theory of the (long–lived) international firm: A capabilities perspective. *Entrepreneurship Theory and Practice*, *38*(1), 95–116.

Ancona, D. G., Goodman, P. S., Lawrence, B. S., & Tushman, M. L. (2001). Time: A new research lens. *Academy of management Review*, *26*(4), 645–663.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99–120.

Berghaus, S., & Back, A. (2016). Stages in digital business transformation: Results of an empirical maturity study.

Berman, S. J. (2012). Digital transformation: Opportunities to create new business models. *Strategy & leadership*, *40*(2), 16–24.

Birkinshaw, J., & Gibson, C. (2004). Building ambidexterity into an organization. *MIT Sloan management review*.

Birkinshaw, J., Zimmermann, A., & Raisch, S. (2016). How do firms adapt to discontinuous change? bridging the dynamic capabilities and ambidexterity perspectives. *California Management Review*, *58*(4), 36–58.

Bouée, C., & Schaible, S. (2015). The digital transformation of industry. *Roland Berger Strategy Consultant/BDI, Munich*.

Boumgarden, P., Nickerson, J., & Zenger, T. R. (2012). Sailing into the wind: Exploring the relationships among ambidexterity, vacillation, and organizational performance. *Strategic management journal*, *33*(6), 587–610.

Bower, J. L., & Christensen, C. M. (1995). Disruptive technologies: Catching the wave. *Harvard Business Review*, *January-February 1995*.

Bråthen, M., & Doan, E. (2021). Ambidexterity to overcome the challenges of digital transformation a bibliometric review.

Brennen, J. S., & Kreiss, D. (2016). Digitalization. *The international encyclopedia of communication theory and philosophy*, 1–11.

Clohessy, T., Acton, T., & Morgan, L. (2017). The impact of cloud-based digital transformation on it service providers: Evidence from focus groups. *International Journal of Cloud Applications and Computing (IJCAC)*, *7*(4), 1–19.

Deloitte. (2023). *Digital transformation*. Retrieved March 23, 2023, from https://www2.deloitte.com/us/en/insights/topics/digital-transformation.html

Demirkan, H., Spohrer, J. C., & Welser, J. J. (2016). Digital innovation and strategic transformation. *It Professional*, *18*(6), 14–18.

Donada, C., Mothe, C., & Alegre, J. (2021). Managing skunkworks to achieve ambidexterity: The robinson crusoe effect. *European Management Journal*, *39*(2), 214–225.

Duncan, R. B. (1976). The ambidextrous organization: Designing dual structures for innovation. *The management of organization*, *1*(1), 167–188.

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: What are they? *Strategic management journal*, *21*(10-11), 1105–1121.

Ellström, D., Holtström, J., Berg, E., & Josefsson, C. (2021). Dynamic capabilities for digital transformation. *Journal of Strategy and Management*, *15*(2), 272–286.

Erol, S., Jäger, A., Hold, P., Ott, K., & Sihn, W. (2016). Tangible industry 4.0: A scenario-based approach to learning for the future of production. *Procedia CiRp*, *54*, 13–18.

Feroz, A. K., Zo, H., Eom, J., & Chiravuri, A. (2023). Identifying organizations' dynamic capabilities for sustainable digital transformation: A mixed methods study. *Technology in Society*, *73*, 102257.

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing digital technology: A new strategic imperative. *MIT sloan management review*, *55*(2), 1.

Gao, S., Hakanen, E., & Rajala, R. (2020). Digital transformation: The interplay of explorative and exploitative capability development.

García-Lillo, F., Úbeda-García, M., & Marco-Lajara, B. (2016). Organizational ambidexterity: Exploring the knowledge base. *Scientometrics*, *107*, 1021–1040.

Gartner. (2023). *Gartner glossary: Digitalization*. Retrieved April 14, 2023, from https://www.gartner.com/en/information-technology/glossary/digitalization

Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of management Journal*, *47*(2), 209–226.

Guerra, R. M., Tondolo, V. A. G., & Camargo, M. E. (2016). What can we (still) learn about dynamic capabilities? *Revista Ibero-Americana de Estratégia*, *15*(1), 44–64.

Haffke, I., Kalgovas, B. J., & Benlian, A. (2016). The role of the cio and the cdo in an organization's digital transformation.

Hanelt, A., Piccinini, E., Gregory, R. W., Hildebrandt, B., & Kolbe, L. M. (2015). Digital transformation of primarily physical industries-exploring the impact of digital trends on business models of automobile manufacturers.

Heilig, L., Lalla-Ruiz, E., & Voß, S. (2017). Digital transformation in maritime ports: Analysis and a game theoretic framework. *Netnomics: Economic research and electronic networking*, *18*(2-3), 227–254.

Hess, T., Matt, C., Benlian, A., & Wiesböck, F. (2016). Options for formulating a digital transformation strategy. *MIS Quarterly Executive*, *15*(2).

Hjalmarsson, A., Johannesson, P., Juell-Skielse, G., & Rudmark, D. (2014). Beyond innovation contests: A framework of barriers to open innovation of digital services. *ECIS 14 22nd European Conference on Information Systems, Tel Aviv, 5-13 June 2014*.

Iden, J., & Bygstad, B. (2021). Managing digital transformation with sociotechnical microfoundations: A dynamic capabilities approach. *Proceedings of the Annual Hawaii International Conference on System Sciences (HICSS)*, 6462–6471.

Jansen, J. J., Tempelaar, M. P., Van den Bosch, F. A., & Volberda, H. W. (2009). Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization science*, *20*(4), 797–811.

Jarosiński, M., Sekliuckiene, J., & Kozma, M. (2023). Born digitals: Understanding the sustainable competitive advantage across different markets. In R. Adams, D. Grichnik, A. Pundziene, & C. Volkmann (Eds.), *Artificiality and sustainability in entrepreneurship: Exploring the unforeseen, and paving the way to a sustainable future* (pp. 41–60). Springer International Publishing. https://doi.org/10.1007/978-3-031-11371-0_3

Kane, G. C. (2017). Digital maturity, not digital transformation. *MIT sloan management review*, *1*(1), 1–15.

Kelley, D. (2009). Adaptation and organizational connectedness in corporate radical innovation programs. *Journal of product innovation management*, *26*(5), 487–501.

Kiel, D., Müller, J. M., Arnold, C., & Voigt, K.-I. (2017). Sustainable industrial value creation: Benefits and challenges of industry 4.0. *International journal of innovation management*, *21*(08), 1740015.

Kimura, R., Reeves, M., & Whitaker, K. (2019). The new logic of competition. *Boston Consulting Group*, *3*, 19.

Konopik, J., Jahn, C., Schuster, T., Hoßbach, N., & Pflaum, A. (2022). Mastering the digital transformation through organizational capabilities: A conceptual framework. *Digital Business*, *2*(2), 100019.

KPMG. (2023). *Digital transformation*. Retrieved March 23, 2023, from https://kpmg.com/nl/en/home/services/advisory/digital-transformation.html

Kriz, A., Voola, R., & Yuksel, U. (2014). The dynamic capability of ambidexterity in hypercompetition: Qualitative insights. *Journal of Strategic Marketing*, *22*(4), 287–299.

Kump, B., Engelmann, A., Kessler, A., & Schweiger, C. (2019). Toward a dynamic capabilities scale: Measuring organizational sensing, seizing, and transforming capacities. *Industrial and Corporate Change*, *28*(5), 1149–1172.

Lammers, T., Tomidei, L., & Trianni, A. (2019). Towards a novel framework of barriers and drivers for digital transformation in industrial supply chains. *2019 Portland International Conference on Management of Engineering and Technology (PICMET)*, 1–6.

Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P., Mädche, A., Urbach, N., & Ahlemann, F. (2017). Digitalization: Opportunity and challenge for the business and information systems engineering community. *Business & information systems engineering*, *59*, 301–308.

Li, L., Su, F., Zhang, W., & Mao, J.-Y. (2018). Digital transformation by sme entrepreneurs: A capability perspective. *Information Systems Journal*, *28*(6), 1129–1157.

Loonam, J., Eaves, S., Kumar, V., & Parry, G. (2018). Towards digital transformation: Lessons learned from traditional organizations. *Strategic Change*, *27*(2), 101–109.

Lukito, D., Suharnomo, S., & Perdhana, M. (2022). Transformation management capabilities for digital transformation initiatives: A construct conceptualization in alignment with the dynamic capabilities framework. *Journal of Organizational Management Studies*, *1*.

Maijanen, P., & Virta, S. (2017). Managing exploration and exploitation in a media organisation–a capability-based approach to ambidexterity. *Journal of Media Business Studies*, *14*(2), 146–165.

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization science*, *2*(1), 71–87.

Mazzone, D. M. (2014). *Digital or death: Digital transformation: The only choice for business to survive smash and conquer*. Smashbox Consulting Inc.

McKinsey & Company. (2015). *Digital america: A tale of the haves and have-mores*. McKinsey Global Institute.

McKinsey Digital. (2023). *Mckinsey digital - how we help clients*. Retrieved March 23, 2023, from https://www.mckinsey.com/capabilities/mckinsey-digital/how-we-help-clients

Müller, J., & Voigt, K. (2017). Industry 4.0—integration strategies for small and medium-sized enterprises. *Proceedings of the 26th International Association for Management of Technology (IAMOT) Conference, Vienna, Austria*, 14–18.

Nickerson, J. A., & Zenger, T. R. (2002). Being efficiently fickle: A dynamic theory of organizational choice. *Organization Science*, *13*(5), 547–566.

Nwankpa, J. K., & Roumani, Y. (2016). It capability and digital transformation: A firm performance perspective.

O'Reilly, C. A., & Tushman, M. L. (2004). The ambidextrous organization. *Harvard business review*, *82*(4), 74–83.

O'Reilly, C. A., & Tushman, M. L. (2008). Ambidexterity as a dynamic capability: Resolving the innovator's dilemma. *Research in organizational behavior*, *28*, 185–206.

O'Reilly, C. A., & Tushman, M. L. (2013). Organizational ambidexterity: Past, present, and future. *Academy of management Perspectives*, *27*(4), 324–338.

Pasamar, S., & Alegre, J. (2015). Adoption and use of work-life initiatives: Looking at the influence of institutional pressures and gender. *European Management Journal*, *33*(3), 214–224.

Peansupap, V., & Walker, D. (2005). Factors affecting ict diffusion: A case study of three large australian construction contractors. *Engineering, construction and architectural management*.

Pflaum, A. A., & Gölzer, P. (2018). The iot and digital transformation: Toward the data-driven enterprise. *IEEE pervasive computing*, *17*(1), 87–91.

Porter, M. E. (1980). Industry structure and competitive strategy: Keys to profitability. *Financial analysts journal*, *36*(4), 30–41.

Raisch, S., & Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of management*, *34*(3), 375–409.

Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization science*, *20*(4), 685–695.

Raj, A., Dwivedi, G., Sharma, A., de Sousa Jabbour, A. B. L., & Rajak, S. (2020). Barriers to the adoption of industry 4.0 technologies in the manufacturing sector: An inter-country comparative perspective. *International Journal of Production Economics*, *224*, 107546.

Schiffer, S. (2021). Structural ambidexterity as an approach for an incumbents digital transformation. *AMCIS*.

Schilling, M. A. (2012). *Strategic management of technological innovation* (4th ed.). McGraw-Hill.

Sebastian, I., Ross, J., Beath, C., Mocker, M., Moloney, K., & Fonstad, N. (2017). How big old companies navigate digital transformation. *MIS quarterly executive*, *16*(3), 197–213.

Shaheer, N. A. (2020). Reappraising international business in a digital arena: Barriers, strategies, and context for digital internationalization. *AIB Insights*, *20*(4), 1–5.

Simon, H. A. (1997). *Models of bounded rationality: Empirically grounded economic reason* (Vol. 3). MIT press.

Singh, A., & Hess, T. (2017). How chief digital officers promote the digital transformation of their companies. *MIS Quarterly Executive*, *16*(1).

Solis, B., & Littleton, A. (2017). *The 2017 state of digital transformation*. Retrieved April 13, 2023, from https://prophet.com/2019/08/state-digital-transformation-2017/

Stolterman, E., & Fors, A. C. (2004). Information technology and the good life. *Information systems research: relevant theory and informed practice*, 687–692.

Svahn, F., Mathiassen, L., & Lindgren, R. (2017). Embracing digital innovation in incumbent firms. *MIS quarterly*, *41*(1), 239–254.

Teece, D. J. (2007). Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance. *Strategic management journal*, *28*(13), 1319–1350.

Teece, D. J., & Linden, G. (2017). Business models, value capture, and the digital enterprise. *Journal of organization design*, *6*, 1–14.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, *18*(7), 509–533.

Tripathi, S., & Gupta, M. (2019). Impact of barriers on industry 4.0 transformation dimensions. *International Conference on Precision, Meso, Micro and Nano Engineering*.

Tsiavos, V., & Kitsios, F. (2021). Technology as driver, enabler and barrier of digital transformation: A review. *European, Mediterranean, and Middle Eastern Conference on Information Systems*, 681–693.

Van der Pijl, P., Lokitz, J., Wijnen, R., & Van Lieshout, M. (2021). *Business model shifts: Six ways to create new value for customers.* John Wiley & Sons.

Van Looy, B., Martens, T., & Debackere, K. (2005). Organizing for continuous innovation: On the sustainability of ambidextrous organizations. *Creativity and innovation management*, *14*(3), 208–221.

Venkatraman, N., Lee, C.-H., & Iyer, B. (2007). Strategic ambidexterity and sales growth: A longitudinal test in the software sector.

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of business research*, *122*, 889–901.

Vey, K., Fandel-Meyer, T., Zipp, J. S., & Schneider, C. (2017). Learning & development in times of digital transformation: Facilitating a culture of change and innovation. *International Journal of Advanced Corporate Learning*, *10*(1).

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The journal of strategic information systems*, *28*(2), 118–144.

Vise, D. (2007). The google story. *Strategic Direction*, *23*(10).

Vogelsang, K., Liere-Netheler, K., Packmohr, S., & Hoppe, U. (2019). Barriers to digital transformation in manufacturing: Development of a research agenda.

Warner, K. S., & Wäger, M. (2019). Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal. *Long range planning*, *52*(3), 326–349.

Weritz, P., Braojos, J., & Matute, J. (2020). Exploring the antecedents of digital transformation: Dynamic capabilities and digital culture aspects to achieve digital maturity.

Westerman, G., Calméjane, C., Bonnet, D., Ferraris, P., McAfee, A., et al. (2011). Digital transformation: A roadmap for billion-dollar organizations. *MIT Center for digital business and capgemini consulting*, *1*, 1–68.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—the new organizing logic of digital innovation: An agenda for information systems research. *Information systems research*, *21*(4), 724–735.

Zott, C. (2003). Dynamic capabilities and the emergence of intraindustry differential firm performance: Insights from a simulation study. *Strategic management journal*, *24*(2), 97–125.