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Digital transformation in incumbent companies: a qualitative study on exploration and exploitation activities in innovation

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Abstract

Digital transformation is a pivotal strategic pillar for companies. Despite its relevance, incumbent companies still face challenges in implementation due to the complex character of transformation processes. We provide a framework serving as guidance for leaders of digital transformations. Based on an explorative research design, we conducted 33 semi-structured interviews with experts of digital transformations of incumbent companies. Our findings indicate that leaders need to understand the terminologies related to exploration, exploitation, and digital transformation, and the complex interaction between all three areas. This includes digital literacy and being aware of differentiated treatment of exploration and exploitation in innovations and the relevance of both. Leaders must acknowledge that industry and organizational characteristics influence organizations' tendencies towards exploration or exploitation in innovations. Exploration in digital transformation is about using digital technologies to rethink business models. Using digital technologies to optimize existing processes, products, and IT infrastructure is associated with exploitation. In sum, we need different target settings and approaches for the required activities.

Keywords: Digital transformation, Digitalization, Exploration, Exploitation, Incumbent companies, Innovation, Learning, Ambidexterity

Introduction

Background and aim of the study

In recent years, the focus on digital technologies and their influence on business activities has increased continuously (Vesna Bosilj Vukšić et al., 2018). The raised interest in digital transformation is shown on the research side by an increasing amount of scientific publications (Vesna Bosilj Vukšić et al., 2018), but also in the growing focus of companies on digital transformation attempts (Kreiterling, 2023; Westerman et al., 2014). Digital transformation is currently one central strategic focus area of companies in most industries (Hess et al., 2016; Kane et al., 2015). The rapidly changing technologies and the rise of new technologies lead to a fast-changing environment (Sewpersadh, 2023; Yoo et al., 2012). To digitally transform the company is no longer a free option for incumbent companies but a necessity to stay competitive (Mirković et al., 2019).

Digital transformation is the most advanced stage of a three stage process for companies to transform their business digitally in a holistic way. Digital technologies enable this transformation in the first step but include a much broader scope aside from technological functionalities in the final stage (Henriette et al., 2016; Hoessler & Carbon, 2022; Singh & Hess, 2020). Digital technologies serve as a baseline for the first stage digitization as they help to transform analog into digital information. The scope in this stage is, therefore, limited to technologies (Yoo et al. 2010a), however expands with the increase of the maturity grade of companies in the digital transformation journey. As many scholars address the topic of digital transformation and the perceived pressure to move into the digital world for incumbent companies, digital transformation has become a buzzword (Hausberg et al., 2019). Digital transformation is characterized by its broad impact on individuals, organizations, and societies and the high variety of definitions (Schallmo et al., 2017). Due to the different layers and multiple areas of implication, it is described as highly complex, thus leading to multiple definitions (Hausberg et al., 2019; Schallmo et al., 2017). In addition, as digital transformation is relevant for multiple disciplines, this leads to an increasing number of publications focused and limited to individual fields (Hausberg et al., 2019). One of the negative consequences is the lack of clear, harmonized and wider definitions of digital transformation, which do justice to the characteristic high complexity of the topic and the respective processes. This makes the concept of digital transformation challenging to comprehend and difficult to derive how to manage it from a practitioner site (Hausberg et al., 2019; Kreiterling, 2023). Especially, traditional incumbent companies are challenged to transform in comparison to start-ups (Page & Holmström, 2023). Looking into barriers to digital transformation, we can see that according to research, an unclear vision and objective and a lack of management in incumbent companies understanding are major barriers (Mirković et al., 2019). Therefore, we aim to provide a more distinct knowledge of activities in digital transformation. This can serve as the baseline to derive organizational structures or required leadership skills without generalizing digital transformation. Also, Tolboom (2016) pointed out that various publications detail the benefits of digital transformation, but he claimed that research on a more deterministic characterization is urgently needed. Looking into the definitions available on digital transformation, we found that, on the one hand, companies enhance or optimize their processes, products, or services with the help of digital technologies during their digital transformation journey. On the other hand, companies target revolutionary new ways of doing business with their digital transformation initiatives (Alghamdi, 2018; Hess et al., 2016; Schiffer, 2021; Vesna Bosilj Vukšić et al., 2018; Wu et al., 2021). This can be connected to the two learning activities in innovations, typically summed up as *exploration* and *exploitation* (March, 1991). Those different learning activities can be used to understand and manage innovation activities in the required manner. Currently, only a few research activities combine the topic digital transformation specifically with exploration and exploitation in innovation, and most of those activities refer to literature reviews but not to primary empirical works, e.g., based on larger-scaled surveys or in-depth interviews.

We aim to fill this research gap with the current study addressing exploration and exploitation in digital transformation of incumbent companies along with influencing factors. We employed semi-structured interviews to combine those two strategic

dimensions. Major goal was to create a framework of exploration and exploitation in digital transformation in incumbent companies on basis of these data. We also include aspects influencing tendencies towards exploration or exploitation in digital transformation. Our contribution is relevant to have a holistic characterization connecting the learning activities exploration, exploitation in innovations and digital transformation and providing guidance for leaders in incumbent companies to better understand activities in digital transformation and how they can be steered. In the following chapters, we derive the theoretical background and introduce our method and study results. We finalize our research with a discussion and a conclusion.

Digital transformation

Our study aims to fill the defined research gap of missing primary empirical works on combining digital transformation, exploration, and exploitation. Therefore, we start by reviewing the existing literature on digital transformation, exploration, and exploitation and the combination of those. This allows us to have a common understanding of the terminologies and to define the research gap in detail. The last one is necessary to specify our study to ensure we address the research gap.

There is no one unified definition of digital transformation. Nevertheless, existing definitions include common aspects (Schallmo et al., 2017). Those overlaps are considered for understanding digital transformation used in the present paper. In the context of digital transformation, terms like digital technologies, digitization, digitalization (Tilson et al., 2010), digital innovation (Yoo et al., 2010a), and digital business model change are frequently used (Schallmo et al., 2017). Hoessler and Carbon (2022) illustrate in their depiction shown in Fig. 1 the three stages of digital transformation. Digital technologies and digitization are basic enablers of digital transformation in the first stage and are looked at from a more technical process perspective (Yoo et al., 2010a).
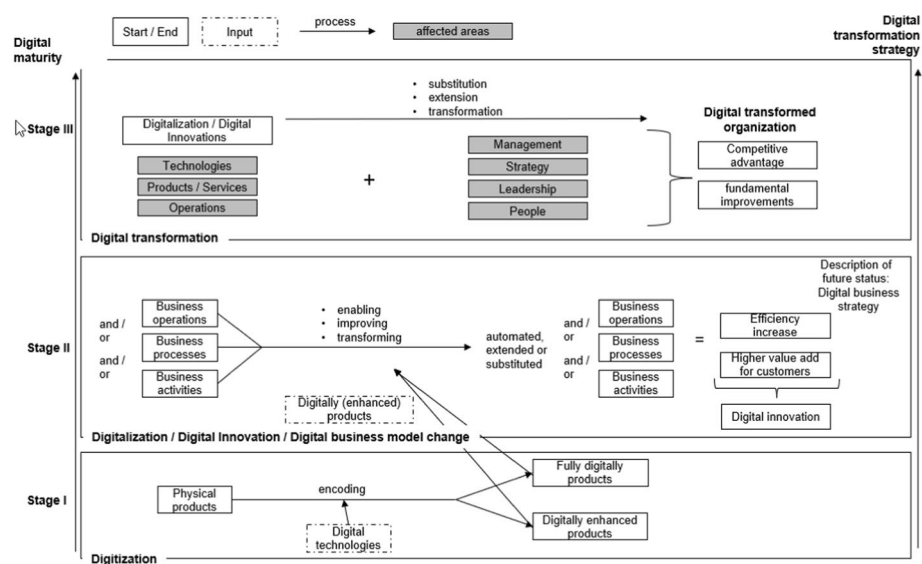
Fig. 1 Three stages of digital transformation and its associated activities, retrieved from Hoessler and Carbon (2022)

Stage I is followed by digitalization which covers more than the technology aspect. It is about new socio-technical structures (Yoo et al., 2010b). It offers new ways of generating value with the help of digital technologies (Gartner, 2021). The result of digitalization can be new revenue streams and improved or transformed processes (Sewpersadh, 2023; Sousa & Rocha, 2019). Digital innovation is similarly defined as digitalization (Hoessler & Carbon, 2022). One difference is that digital innovation refers not only to the process but also can be used to describe the outcome (Nambisan et al., 2017). Also, the digital business model change definition contains similar elements as the one of digitalization (Cavalcante et al., 2011). A more detailed definition of digital business model change differentiates between automation, extension, and transformation of existing business models, covering a holistic change (Cavalcante et al., 2011; Hoessler & Carbon, 2022; Li, 2020). The final stage is digital transformation which describes the overarching process of changing an organization's business enabled by digital technologies (Singh & Hess, 2020). One significant finding of a digital business study shows that digital transformation is not about individual digital technologies. It is about how a company leverages them and alters its business (Kane et al., 2015). Digital transformation is often described as a journey including activities of evolutionary and revolutionary nature (Goerzig & Bauernhansl, 2018; Porfírio et al., 2021), but the overall target is achieving radical or disruptive innovation (Berghaus & Back, 2016; Holotiuk, 2020; Nambisan et al., 2019). Following our research aim to address exploration and exploitation activities along with influencing factors, we use the illustration of Hoessler and Carbon (2022) shown in Fig. 1 as a baseline. The depiction of Hoessler and Carbon (2022) distinguishes between the three stages of digital transformation and its associated activities. The separation into digitization, digitalization and digital transformation allows us to have a distinct look into activities in the digital transformation journey of incumbent companies. The identified activities clustered by the three stages of digital transformation are reviewed in regard to exploration and exploitation characteristics in the existing literature in the following section.

Exploration, exploitation in the digital context

As digital transformation can contain revolutionary and evolutionary activities (Goerzig & Bauernhansl, 2018; Porfírio et al., 2021) and is associated with innovation (Hoessler & Carbon, 2022), we connect digital transformation with the research streams of exploration and exploitation in innovation.

Exploration and exploitation in general

March (1991) distinguishes between two learning activities: Exploration and exploitation. Exploration activities offers the potential to generate radical or even disruptive innovations (Beckman, 2006; Benner & Tushman, 2003), so being of a revolutionary nature (Tushman & O'Reilly III, 1996). Exploring includes experimenting and searching for fundamentally new things (March, 1991), including generating new customer needs (Benner & Tushman, 2003). Therefore, being entrepreneurial is most often part of exploration. Expanding to new knowledge and developing new skills is vital (Benner & Tushman, 2003; Levinthal & March, 1993; March, 1991). As the exploration outcome is unclear, it is characterized by a higher level of risk-taking (March, 1991). Compared

to exploration, exploitation activities result in incremental innovations (Beckman, 2006; Benner & Tushman, 2003) and are evolutionary (Tushman & O'Reilly III, 1996). Exploitation activities, in contrast, focus on efficiency and productivity gains achieved through refinement (March, 1991). Pursuing design improvements, adding features, or reducing costs are all targets of exploitation strategies (Beckman, 2006). The basis for exploitation is the extension of existing knowledge (Benner & Tushman, 2003; Levinthal & March, 1993; March, 1991). The time horizon for exploitation is smaller, and results are more predictable. Therefore, exploitation is more risk-averse (March, 1991).

Exploration and exploitation in the digital context

The concept of exploration and exploitation is mainly looked at without consideration of the digital context. Nevertheless, a few scholars researched exploration and exploitation in digital transformation. Jafari-Sadeghi et al. (2021) break down digital transformation into technology readiness, digital technology exploration, and digital technology exploitation in the national context, not focusing on the organizational level. Looking into their definitions of exploration and exploitation in the digital context, this is limited to the technology aspect. Digital technology exploration is associated with researching and developing new digital technologies (Jafari-Sadeghi et al., 2021). They provide more detailed insights into digital technology exploitation, such as process digitization and automation, digital security, and working with customers (Jafari-Sadeghi et al., 2021). Nevertheless, looking into the baseline of their definition, this is not based on survey results or interviews. Instead, it is based on allocating activities from digitization and digitalization to digital technology exploitation using existing literature independent from the digital context. Princes (2019) looks into one specific technology in digital transformation—artificial intelligence and if this is associated with exploration or exploitation. The study shows that the allocation depends on how and for what artificial intelligence is used. Overall, artificial intelligence tends to be related to exploration in research and development. Also, it is indicated that this can be explained by a low digital maturity of companies, which is why artificial intelligence is not yet used for exploitation activities in most cases. Another study also considers exploration and exploitation in the digital context explicitly related to IT resources (Nwankpa & Datta, 2017). Digital business intensity (DBI) is responsible for developing rising technologies in the company and is assigned to exploration by Nwankpa and Datta (2017). In contrast, IT capabilities are associated with maintaining existing systems and are linked to exploitation. Also here, no details are provided on how this allocation was conducted. The study of Holotiuk and Beimborn (2019) includes aspects of exploration and exploitation in the digital context. However, it focuses more on balancing them and less on clearly understanding exploration and exploitation. The primary differentiation provided is that seizing and reacting to digital technologies is associated with exploration, and the transfer of the innovation into the business is understood as exploitation (Holotiuk, 2020; Holotiuk & Beimborn, 2019). In addition, looking for new technologies, creating higher value added for customers, and extending or substituting existing operations, processes, or products is classified as exploration. In contrast, exploitation is mostly concerned about efficiency increase, cost reduction, also higher value added for customers, and the automation of processes (Holotiuk & Beimborn, 2019). The definitions are derived based on the

literature on exploration and exploitation and applied to the digital context. Aside from the presented studies, van den Buuse et al. (2021) connected exploration and exploitation with Smart City innovations. Their study differentiates exploration and exploitation: Exploration is associated with experimenting, testing, and developing technologies. They consider it as a R&D (research & development) responsibility. Exploitation is about integrating existing technologies into existing processes (van den Buuse et al., 2021). A study limited to the healthcare sector defines exploration as looking for more innovative and better solutions. Exploitation is explained by refining and extending existing routines (Gastaldi et al., 2018). The authors included, aside from literature definitions, also the feedback from participants of the study group (Gastaldi et al., 2018). One existing study significantly focuses on identifying characteristics of exploration and exploitation in digital transformation through a literature review (Hoessler & Carbon, 2022). According to Hoessler and Carbon (2022), exploration is associated with a revolutionary impact, growth through digital technologies, introducing new technologies to the market, substituting the existing with something new, and developing new capabilities (Hoessler & Carbon, 2022). In contrast, exploitation is characterized by an evolutionary impact, increasing efficiency and productivity, reducing costs, higher value added for customers, and automating processes (Hoessler & Carbon, 2022). Nevertheless, also this study does not consider survey results or interviews as a primary source of evidence.

We illustrate in Table 1 if the studies use literature or empirical work to gain insights into exploration and exploitation in digital transformation. Considering that only one publication considers survey or interview results, our research is set up to close this research gap and provide deterministic differentiations. Similar to the understanding of Hausberg et al. (2019), we see fewer publications providing a general overview. This is also an aspect we account for in our study.

Methods

This chapter provides insights into the method used in the present paper. We followed the research design for analyzing a qualitative study of Mayring (2001) for our qualitative content analysis, as shown in Fig. 2. The *purpose* of the present paper is to explore exploration and exploitation activities in digital transformation and influencing factors. This is reasoned by the call for more distinct characterizations that are not limited to one discipline. We provided the *conceptual context* by giving the current status of digital transformation and exploration and exploitation in the digital context. The following

Table 1 Research methods and scope of publications

| Research method	Number (%)	Sources
Applying literature or no details provided	6 (86%)	(Hoessler & Carbon, 2022; Holotiuk & Beimborn, 2019; Jafari-Sadeghi et al., 2021; Nwankpa & Datta, 2017; Princes, 2019; van den Buuse et al., 2021)
Consider survey or interview results	1 (14%)	(Gastaldi et al., 2018)
Scope of publication	**Number (%)**	**Sources**
Focus area	5 (71%)	(Gastaldi et al., 2018; Jafari-Sadeghi et al., 2021; Nwankpa & Datta, 2017; Princes, 2019)
General view	2 (29%)	(Hoessler & Carbon, 2022; Holotiuk & Beimborn, 2019)
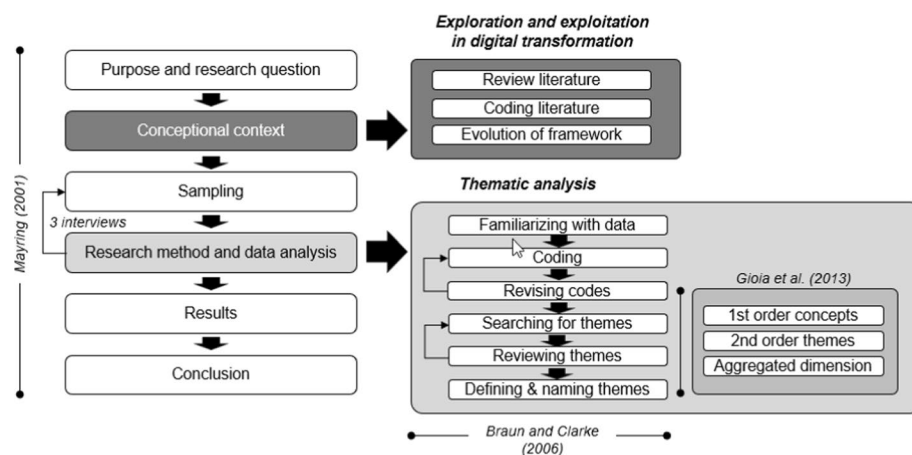
Fig. 2 Research design for a qualitative study based on Mayring (2001), Braun and Clarke (2006) and Gioia et al. (2013)

chapters provide the details on the remaining steps of *sampling, research method, results,* and *conclusion* as described in the research design for a qualitative study based on Mayring (2001).

Conceptional context

Reviewing existing literature on exploration and exploitation in digital transformation is the theoretical foundation of our study. We use the illustration of Hoessler and Carbon (2022) describing the stages of digital transformation as baseline and indicate if the activities are defined as exploration or exploitation by existing literature. Figure 3 summarizes this allocation by showing an evolved framework based on the prior work of Hoessler and Carbon (2022). Based on existing limited literature, the activities in digitization are allocated to exploitation (Hoessler & Carbon, 2022). The second phase, referring to digitalization, digital innovation and digital business model change, contains elements of exploration (Gastaldi et al., 2018; Hoessler & Carbon, 2022; Holotiuk & Beimborn, 2019; Nwankpa & Datta, 2017) and exploitation (Gastaldi et al., 2018; Hoessler & Carbon, 2022; Holotiuk & Beimborn, 2019; Jafari-Sadeghi et al., 2021) as well as elements not clearly associated with one of them (Holotiuk & Beimborn, 2019). This unspecific result explains why our empirical research is needed to be able to distinguish further and provide more guidance for leaders of digital transformations. One aspect not included in the illustration of Hoessler and Carbon (2022) but one of their findings in their literature review is the evolutionary impact associated with exploitation. Nwankpa and Datta (2017) add insights into the IT perspective, which is also not covered by Hoessler and Carbon (2022). We added this in Fig. 3. IT capabilities and system integration are seen as exploitation, and digital business intensity as exploration. The third stage, digital transformation, mainly includes exploration activities. Nevertheless, we want to point out that digital transformation builds on the other two stages, which is why indirect exploitation is also covered. Similar to the second stage, we added elements we identified in the existing literature, not explicitly mentioned by Hoessler and Carbon (2022).
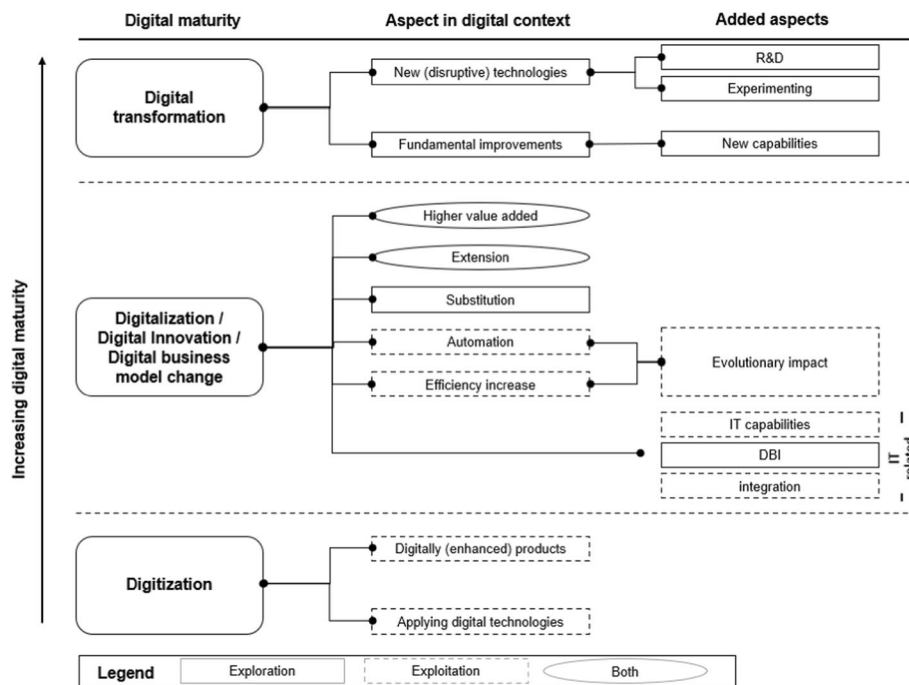
Fig. 3 Three stages of digital transformation and its associated activities mapped to exploration and exploitation in innovation

Sampling

We used a purposive sampling method (Etikan et al., 2016) to select our interview partners. As our research is focused on digital transformations of incumbent companies, we selected study participants with specific expertise in the area of digital transformation in incumbent companies (Misoch, 2019). We provided the expertise of the interview partners with the job title when conducting our acquisition search via the network platform LinkedIn. Furthermore, we considered that the interview partners either hold or held positions in the last two years in an incumbent company. Our interview partners represent different hierarchy levels. In addition, we ensured that we were covering expertise in multiple industry sectors with study participants to get a maximally various view. We used the Global Industry Classification Standard as a baseline to cluster the sectors. To cover the practitioners' perspective and the research side, we interviewed researchers or lecturers on digital transformation topics in universities. Table 2 illustrates the composition of the study participants according to the variables sector experience and hierarchy level.

Research method

We decided to use a qualitative research design. The explorative research design generates detailed knowledge about our research topic, which is needed to answer our research question due to the high complexity connecting multiple topics (Mayring, 2007). Our selected explorative research design accounts for the requirements as the individual research streams digital transformation and exploration and exploitation have not been looked at empirically. As a qualitative approach, the semi-structured

Table 2 Study participants

Variables		Number (%)
Sector experience	Consumer Discretionary Sector *(Automobiles & Components)*	5 (15%)
	Healthcare *(Pharmaceuticals, Biotechnology & Life Science)*	5 (15%)
	Industrials *(Electrical Equipment, Machinery, Transportation, Construction and Engineering)*	10 (30%)
	Materials *(Chemicals, Construction Materials)*	3 (9%)
	Information Technology *(Technology Hardware & Equipment, Software & Service)*	4 (12%)
	Consultancy	3 (9%)
	Research	3 (9%)
	Total	33
Hierarchy level	Senior Executive	3 (9%)
	Vice President	3 (9%)
	Director	7 (21%)
	Head of	10 (30%)
	Manager	4 (12%)
	Consultant	3 (9%)
	University Professor	3 (9%)
	Total	33

interviews allowed us to cover all relevant topics and ensured a certain level of consistency for higher comparability (Misoch, 2019). The open-ended questions were derived from existing digital transformation, exploration, and exploitation literature. The focus is set on combining the research streams and focusing on exploration and exploitation activities in digital transformation. Our interview guidelines included questions about characteristics of exploration and exploitation in digital transformation, including examples and influencing factors. We used Microsoft Teams to conduct the interviews, which allowed us to be flexible in the distance and not limited to close-by locations. The interviews were performed by the first author between May 2023 and July 2023. All interviews have been transcribed and used for the data analysis. We used the transcription function of Microsoft Teams as a baseline and imported the raw data into MAXQDA (VERBI Software, 2021). We went through all raw transcripts and applied the naturalized/ intelligent verbatim approach (McMullin, 2023). This way of transcription permits more readable transcripts but contains all the necessary details to analyze the data (McMullin, 2023). We also included timestamps to map the transcripts to the audio files, and finally anonymized all data to ensure the anonymity of our interview partners. Figure 2 shows how we performed the research describing the individual steps. Following the thematic analysis described by Braun and Clarke (2006), we familiarized ourselves with the transcripts by repeated reading (Braun & Clarke, 2006). After we generated an overview and understanding of the data, we built initial codes. For coding, we used the software MAXQDA (VERBI Software, 2021). Based on the initial coding, we reviewed the codes and revised them by eliminating, rephrasing, or summarizing them. Table 4 provides a detailed overview of the changes made in the revision process. The revised set of codes served as a baseline to generate themes, which also have been reviewed. We used the method described by Gioia et al. (2013) to cluster and arrange our codes and themes. To assess code saturation (Hennink et al., 2017), we reviewed whether

we achieved code saturation after coding three interviews. We achieved this after 33 interviews.

Ethics, consent and permissions

All interviewees gave consent to use their data and the audio files for scientific reasons. All procedures were in accordance with the national ethical standards on human experimentation provided by the German Psychological Society (DGPs) and with the Declaration of Helsinki of 1975, as revised in 2008. The study was in full accordance with the ethical guidelines of the University of Bamberg and was approved by an umbrella evaluation for psychophysical testing of the university ethics committee (Ethikrat) on August 18, 2017. Specific ethical approval beyond these means was not sought for the present study because the study design was not susceptible to trigger negative experiences.

The authors have no competing interests to disclose. The authors declare that they have no conflict of interest.

Results

To answer our research question on characteristics of exploration and exploitation in the course of the incumbent companies' digital transformations, the inductive approach defined by Mayring (2000) functioned as the baseline for our data synthesis. We used the work of Hoessler and Carbon (2022), which identified exploration and exploitation characteristics based on a literature review to abstraction level and scope. The impact, targets and activities (Hoessler & Carbon, 2022) were used to set the level of abstraction for the inductive categories (Mayring, 2000). To ensure scholarly rigor in our analysis, we use the practice described by Gioia et al. (2013) utilizing Mayring's inductive method approach. Multiple categories arise in the first phase of building 1st order concepts. We started with an initial coding and revised the codes by rephrasing, summarizing, or eliminating. The process and the result are shown in Tables 4, 5, 6 in Appendix 1. Those 1st order concepts are reviewed and merged into emerging topics called 2nd order themes (Gioia et al., 2013). The 2nd order themes further emerged into aggregated dimensions (Gioia et al., 2013). We visualize the detailed process for our research in Appendix 1. Table 3 summarizes our results.

Fundamentals for leaders

The results of our interviews show that leaders of digital transformations in incumbent companies must develop an understanding of the terminologies exploration, exploitation, and digital transformation. In addition, differentiated treatment of exploration and exploitation is crucial for a successful digital transformation. Leaders must acknowledge that industry and organizational characteristics influence organizations' tendencies towards exploration or exploitation.

Understanding terminologies

Our study results suggest a basic understanding of the terminologies exploration, exploitation in innovations and digital transformation. We describe the required understanding in the next paragraph with more details. To lead a digital transformation journey in incumbent companies, we identified that showing a certain degree of

Table 3 Exploration and exploitation in digital transformation framework

1st order concepts	2nd order themes	Aggregated dimension
Digital literacy	Understanding terminologies	Fundamentals for leaders in digital transformation
Joint effort and learning		
Relevance of exploration and exploitation in business success		
Awareness of differences in exploration and exploitation incorporated in strategy	Differentiated treatment	
Distinct target-setting for exploration and exploitation		
Interconnection between exploration and exploitation		
Hardware vs. software originated	Awareness of industry-driven tendencies	
Regulation intensity		
Degree of disruption		
Phase in economic cycle		
Decision-making models	Awareness of organization-driven tendencies	
Organizational structures		
Legacy		
Availability of resources		
Attitude towards risk		
Shareholder orientation		
Alternative targets or measurements	Challenging target-setting process	Exploration characteristics
Unclear outcome requires assumptions		
Long-term profit-orientation		
Radical or disruptive change character	Navigating unknown outcome	
Failure culture		
Willingness to take risk & risk mitigation		
Development of new capabilities		
Starting from blank	Using digital technologies to rethink existing business models	
Radically rethinking		
Digital business model innovation		
Digital servitization		
Using data		
New (disruptive) technology		
Addressing external customer needs	Market orientation	
Externally triggered		
Not limited to existing markets		

Table 3 (continued)

1st order concepts	2nd order themes	Aggregated dimension
Quantitative targets	Clear target-setting process	Exploitation characteristics
Increased efficiency, productivity, and cost reduction		
Similar targets to non-digital activities		
Maintaining current state		
Incremental steps	Lower level of complexity	
Less complicated		
Implementation and scaling up		
Internal process automation	Using digital technologies to optimize the existing	
Applying available technologies		
Creating transparency		
Enhancing customer value		
Aligning and harmonizing existing IT infrastructure	Maintain and improve IT infrastructure	
Connecting systems		
Introduce, advance, and maintain existing systems		
Creating a baseline		
Close to existing products and services	Close to existing core business	
Combining analogue with digital component		
More natural for incumbents		

digital literacy is important. One aspect associated with *digital literacy* is to have a basic knowledge of digital and information technologies. It also includes being interested and keeping up with the rise of new digital technologies. Study participants pointed out that each leader does not need detailed technical knowledge; nevertheless, a basic understanding is vital. Aside from the significance and the speed of the availability of new technologies, we found out that people should not be neglected in digital transformation. This is associated with navigating through the digital transformation journey being a *joint effort*. Involving people, understanding their needs, and collecting their ideas is mentioned to us as much as important as technical knowledge. Depending on the maturity grade within digital transformation, providing learning and development is essential to win people for the topic and enable them to support it. Nevertheless, continuous *learning* is important for the whole journey, especially with the fast-changing character of digital technologies. Aside from the aspects related to the digital transformation context, our interview partners emphasized the need for *exploration and exploitation for business success* in digital transformation. Statements like "It's a necessity to drive both" or "you have to have some of both in the mix" provide evidence that it is important that both learning activities are present in the company. We also acknowledged that interview partners identified

a risk that one activity is valued more than the other, whereas they agreed that both contribute to business success and should be equally valued.

Differentiated treatment

We mentioned in the chapter above the importance of understanding the characteristics of exploration and exploitation activities. Aside from this, it is important to be *aware of differences in exploration and exploitation in innovations.* Especially the executive level is required to know the differences in learning activities in digital transformation and openly communicate about it to existing leadership levels within the company. This includes providing a *strategic framing* of digital transformation, considering both learning activities and operationalizing it with financial and personnel resources. Our interview partners mentioned that especially senior leaders need to act as role models. This can include different expectation management for exploration and exploitation activities, selection of key performance indicators, *distinct target-setting,* and reward systems. Traditional incentive systems focusing on key financial performance indicators like EBIT or short payback periods drive employees towards exploitation and can hinder exploration. Therefore, a distinct target-setting process is crucial to motivate employees for exploration or exploitation. Even if we emphasize the importance of being aware of differences and distinguishing between the different learning activities, we also realized that "you can't say this [is] black and white". Whereas our interview partners mentioned activities in digital transformation clearly associated with exploration or exploitation, it was not easy for some activities to draw a clear line. This is also related to the fact that there is an *interconnection between exploration and exploitation* at some point. Successful exploration will merge into exploitation for roll-out or further improvement.

Awareness of industry-driven tendencies

As described above, leaders need to develop an understanding of terminologies exploration, exploitation and digital transformation and be aware of a differentiated treatment. Aside from this, we found out that industry-specific and organization-specific characteristics can explain why companies are drawn more to exploration or exploitation. Leaders' awareness of influencing factors helps them to select digital transformation activities and an appropriate steering of them. It is relevant to see digital transformation as part of the strategy and not as an isolated project. Also, awareness of influencing factors can support leaders in balancing exploration and exploitation.

One differentiation factor is whether a company is *hardware- or software-originated.* For companies that have been growing based on selling hardware, such as manufacturing companies, working with software and other digital technologies is not inherited in their core. Our interview partners also connected this to the maturity grade within digital transformation of companies. The farther away the digital context is from the company's original industry, the more difficult it seems for companies in that industry to work on exploration. Therefore, exploitation activities might even seem to be an exploration for some companies. Nevertheless, it was pointed out that the definitions are the same, but the perception could be different. Another factor explaining these tendencies for more hardware-oriented companies to exploit is the generally lower speed of change. One interview partner explained their thoughts on this: "On the other hand, maybe think

about very traditional industries like agriculture or plant engineering where things move much slower, there's much more heavy capital involved. I think things just move much slower and companies might not be willing to be that explorative, like in more fast-paced industries". Another influencing factor frequently brought up was the *regulation intensity* of an industry. Using the words of one interview partner: "The higher the regulations are in an industry like in healthcare, for example, the lower the exploration part may be, because you are limited." The healthcare (Pharmaceuticals, Biotechnology & Life Science) industry was repetitively mentioned as highly regulated. Regulations are often associated with protecting the customer by ensuring science-based testing, which makes it difficult to disrupt exploration activities. Therefore, incumbent companies active in those industries might tend to favor exploitation. Nevertheless, it was brought up that external factors such as regulation changes can help reduce those exploration barriers. Aside from the hardware versus software origin aspect and the regulation intensity, the *degree of disruption* in an industry can explain companies' tendencies towards more exploration or exploitation. In case of a high fear of new entrants or existing companies disrupting the market, companies feel the pressure to put their effort into exploration. One of our interview partners explains this tendency on exploration in industries with a higher degree of disruption: "I think when you have more pressure about being innovative, you really put a lot of effort into research. But when you don't have the pressure, I think that you don't do it that much." The last aspect regarding industry-driven differences is that the *phase in economic cycles* impacts tendencies. The COVID-19 crisis was brought up as an example explaining the shift to exploitation in times of uncertainty and economic downturn: "Especially in 2015 to 2020, so right before Corona hit, really try to get momentum when it comes to exploration. [Corona] or [the] COVID[-19 pandemic] with all the consequences really was a bummer when it comes to exploration because the companies refocused on core business and most of them jumping from COVID[-19-related problems] into energy crisis into Ukraine war and they are still in that phase of being cautious and at least halting the exploration activities in my eyes." Often, in more difficult times, companies focus on cost savings which are related to exploitation, and therefore also, digital transformation activities lean on exploitation.

Awareness on organization-driven tendencies

Aside from industry driven differences also, the organizational related aspects can have an impact on preferences. One major influencing factor identified in our interviews was differences resulting from different *decision-making models*. A more complex decision-making processes in companies makes it difficult to identify someone who can make the decision and slows down the process. For example, we take a statement from our interview partner: "I see a huge difference. If you talk to decision-makers, you know who the decision-maker is. And in huge companies, it might be completely different because you have eight different levels of decision making and it really depends which level you talk to. You might have the impression that decisions are being made there on that level, but this might not be necessarily true. When it comes to the smaller companies, especially if that they are family run businesses, you understand quickly who is making the decisions." Therefore, a complex decision making process can lead to companies being more hesitant regarding exploration in digital

transformation. We were asking about differences in exploration and exploitation tendencies depending on company size but had been realizing the size is not the difference; it is more associated with factors like decision-making, which is less complex in smaller companies. Another aspect brought up, especially in family-owned businesses, is that exploration and exploitation in digital transformation need to be considered in succession planning. *Organizational structures* impact the speed at which companies change and how easily a more radical change can be implemented. Smaller companies tend to have more agile structures, whereas bigger companies rely on hierarchical structures, making it more difficult to move fast and have a bigger impact. Agile structures allow for more experimentation, which is associated with exploration. In addition, companies' *legacy* influences companies' tendencies toward exploration or exploitation. One interview partner explained this tendency of companies with a high legacy level to favor exploitation with the following statement: "I would say maybe it's a bit black and white, but if the more legacy you have, the more existing systems, the more existing processes you have. The more you are on the exploitation side because you have for sure to respect your existing." If companies have a high amount of legacy, they have existing processes and products to protect and improve, which is part of exploitation. Especially if the business is performing well, companies could be urged to keep everything as is or only make marginal improvements. Aside from the internal legacy, a long-existing conservative customer base can lead to a tendency to exploitation. In addition to the above reasons, the needed cultural change in exploration is bigger which makes exploration more difficult. This can be seen for example, in ways of working and mindsets. To overcome those tendencies, hiring outside employees and managers from the software area or startups can help promote exploration to supplement exploitation in digital transformation. Another influencing factor that was brought up was the *availability of resources*. Companies with more financial resources or employees are seen to have more capabilities to spend efforts in exploration. It could be through buying startups, working with consultants, or hiring employees. Aside from financial resources, it can also be seen in a higher diversification of bigger companies, so they can afford to fail. The connection with *availability of resources*, the size of the company and the possibility to invest in exploration is summarized by the following statement: "I would say the bigger the company is, the more potential you have for exploration because [...] the bigger the company, the more let's call room for error you have. So there's, I don't know, 10 explorative things you could do, and maybe 8 out of those fail." Furthermore, the *risk attitude* influences the tendency to explore or exploit in digital transformation. There cannot be drawn a clear indication if the risk aversion is related more to bigger or smaller companies. Some interview partners argued that smaller companies have less to lose and are willing to take more risk. Others stated that due to the low degree of diversification, the impact of failing is bigger, and smaller companies tend not to take higher degrees of risk. Nevertheless, it was pointed out that the more risk-averse companies are, the more they tend to focus on exploitation in digital transformation. The *dependency on shareholders* can influence the attitude towards risk and the focus on exploitation. This is explained by the following: "And then everyone is just focusing on making things more efficient and trying to serve their quarterly financial targets."

Exploration characteristics

In the following paragraphs, we provide insights into exploration characteristics.

Challenging target-setting process

One aspect brought up in our interviews as a distinguishing factor between exploration and exploitation in innovations was the difference in targets and measuring of success. Due to the characteristics of exploration activities, target-setting is seen as more challenging than exploitation targets. Nevertheless, it is pointed out that exploration in digital transformation should be subject to some kind of goals and measurement, but it was advised to refrain from using traditional financial KPIs to steer. Instead, thinking of *alternative targets and measurements* of success was brought up. Examples are qualitative or soft KPIs, using agile project management methods, being more flexible in how to achieve the target, having proper risk management, and longer timelines. Explained is the difficulty in target-setting to the high degree of uncertainty in exploration activities in digital transformation. This is especially relevant in early stages of exploration activities. The *unclear outcome requires assumptions* for measuring and steering exploration. Especially if traditional financial targets are used despite the criticism, it is important to have assumptions and be transparent about them. Despite the difficulties in target-setting and measuring success, we identified that a *long-term profit orientation* is also relevant for exploration. As one interview partner stated: "There is no company that are ready to put money on those things without having some business case behind it." Companies should still know how the idea can be established and monetized in a market. The interest in this can be internally driven or externally by financial institutes to justify financial funds.

Navigating unknown outcome

We already mentioned the characteristic of unclear outcome in exploration in digital transformation. Our interview partners described the impact of exploration as "bigger jump, where can we do something radical that transforms", "the radical piece of it, would be that you need to go into completely new areas" or "because this should be disruptive". We summarize this as a *radical or disruptive change character* of exploration in digital transformation. Due to this radical or disruptive change character exploration involves a high degree of risk and probability of failing. Therefore, companies need to have a *failure culture* for those activities to navigate through exploration. This includes understanding failure as learning and not as a mistake. Companies should create some safe space to experiment. One participant phrased it like this: "You just have to try out different things. Most often, success will await you where you didn't expect it. So start early, start fast. Try a lot of different things and see and figure out what will work." Nevertheless, linking this to the target-setting it is not about wasting money. Targets need to be established, and deviation management should be in place. Companies should increase their willingness to take risk in exploration activities due to establishing a failure culture. Also, here, we want to emphasize that we do not want to encourage to spend money mindlessly. Limiting the needed risk can be done through doing pilots and minimum viable products. Aside from the *failure culture* and *willingness to take risk*, we found out that

exploration in digital transformation is characterized by a high degree of uncertainty, and therefore there is an increased need for the *development of new capabilities.* This can be more detailed by the fact that exploration is further away from what is currently done in the company, which requires different skills, and involves more creativity and advanced skills in digital technologies.

Using digital technologies to rethink existing business models

Looking into activities in exploration in innovations, the insights from our interview partners have in common that they describe them as *starting from blank* or making a greenfield approach. Exploration is characterized by letting go of the past in innovation and focusing on something completely new. Linked to the *radical or disruptive change character* of exploration in digital transformation, it is associated with *radically rethinking* the existing enabled by digital technologies. One participant explained it with the following words: "Exploration would probably be [...] building on who you are and what you do. We don't want to become a car producer suddenly, but [...] going out of where you are active today and adjacent or even more distant fields." In addition, companies are fundamentally and holistically rethinking when it is associated with exploration in digital transformation and can be described as *digital business model innovation.* The availability of new digital technologies enables companies to develop or make new business models cost-efficient. One example is brought up during the interview: "Ravensburger [a German game and toy company], who completely disrupted their business with digital toys and digital games." This shows that exploration in digital transformation is also associated with a change in the company's unique selling proposition. One specific way of digital business model innovation often referred to in this context was *digital servitization.* As one interview partner stated: "One example for that [is a tool manufacturer], which is well-known, they integrated sensors in their product portfolio being at a drill for example and now they offer fleet management which targets at the desires and the demand of the customers. They don't want to own the different machines, they want to have a certain result, for example, a hole in the wall, and in order to perform that the best way possible they pay for a new defined service of [that tool manufacturer], [...] they control if there are any defects or if anything needs to be checked at the machines, they provide newer machine generations and everything is centered about overtaking the stress of the customers." *Digital servitization* is characterized by moving away from selling equipment to customers to offering product and service bundles. Examples are renting out equipment or providing consultancy based on sensor data, achieving reoccurring revenue streams, and increasing value for the customer. This context explains why the *usage of data* is a characteristic of exploration in digital transformation. It enables detecting defects, predicting specific topics and providing services to generate value for the customer. One great example mentioned was, "So you can get the best weather forecast by using the data out of the wiper systems". Especially for external value generation, *usage of data* has a big leverage. Often brought up as exploration in digital transformation was introducing and applying *new (disruptive) technologies* from outside, such as artificial intelligence, generative artificial intelligence, and quantum computing, to transform the business.

Market orientation

We already indirectly mentioned that exploration enables major changes from an external company perspective, such as different business models. With that, exploration is often used to *address external customer needs.* Exploration in digital transformation was therefore described as "What the customers want. What could be of help for them. What does ease some pains and transfer[ring] that into a new form of business model where not only the product is relevant, [but] the customer and [its] desires [are most] relevant." Concentrating on the customer and not limiting to internal processes is characteristic of exploration. Aside from the focus of the activities on external customers, exploration is also often *externally triggered.* As explained by one interview partner: "Very often you experience disruption from peers or maybe even new players in the market, digital natives and then a company needs to react otherwise they are seeing parts of their value chain disrupted." This explains that the urgency to react to exploration can be triggered by other players. As other players can disrupt the market incumbents are in, exploration also can be associated with not b*eing limited to existing* markets and entering new markets with a successful exploration. Changing customer landscapes, exploring new markets, and diversifying footprint can result from a higher degree of exploration in digital transformation.

Exploitation characteristics

Following exploration characteristics, we provide details on exploitation characteristics in digital transformation.

Clear target-setting process

Due to the incremental nature of exploitation activities in digital transformation and the short-term orientation, the targets are more evident than in exploration. This allows for *quantitative targets.* Those targets are mainly related to *increased efficiency, productivity, and cost reduction.* Quantitative targets can be absolute monetary targets but also targeted quantitative improvements in percentage. Higher efficiency and productivity can be further broken down into reducing throughput time or increasing machine availability. One interview partner summarized the thoughts on target-setting for exploitation with the following words: "I'm going to do an exploitation [...] on digitalization of a process and I want to have 10% efficiency increase for example. So you have a clearer target you want to do and where you want to aim at." Aside from targets directly linked to *increased efficiency, productivity, and cost reduction* there are targets on improving the digital penetration, such as enhancing the share of orders placed through a webshop. If the focus is not on leveraging the focus on digital transformation, we found out that targets for exploitation in digital transformation are often *similar targets to non-digital activities.* The KPIs are similar to non-digital activities in the exploitation area but are achieved through digital technologies and new processes. Return on investment or payback periods were mentioned as KPIs for exploitation projects in digital transformation. It was also brought up that exploitation activities ensure that companies *maintain the current state* and fulfill their customers' expectations. Also, the increasing demand for legally required reporting is why some companies pursue certain exploitation activities in digital transformation.

Lower level of complexity

Associated with the clear target-setting process for exploitation in digital transformation and the shorter time horizon, the level of complexity is lower. One aspect which shows this lower complexity is that exploitation is about *incremental steps*. Our interview partners described exploitation as the following: "We have a low level of uncertainty because […] we have an incremental improvement." or "rely on existing working platform and then improving single function step by step". Exploitation in digital transformation is also compared to continuous improvement in a non-digital world, such as lean manufacturing. Closely connected to the precise target-setting and the shorter time horizon, exploitation is also seen as *less complicated*. There is more known in the process than unknown. In addition, exploitation in digital transformation was connected by our interview partners to *implementation and scaling up*. One example is the development of a new technology in exploration, which is then rolled out to multiple locations in a company, including some adjustments and further improvements. Another example mentioned in the external context is introducing a digital application to more customers and scaling up the usage. Moving away from a piloting phase into roll-out is therefore associated by our interview partners with exploitation in digital transformation.

Using digital technologies to optimize the existing

Whereas we describe exploration by using digital technologies to rethink existing business models, we describe exploitation by using digital technologies to optimize the existing. Linked to *increased efficiency, productivity, and cost reduction targets, internal process automation* is one focus area in exploitation in digital transformation. One example one of our interview partners brought up is that "Even nowadays there are still forms that are being printed out and scanned again so that you try to eliminate media breaks or manual work in between. Setting up and deploying an end-to-end digital process would often be summarized as a digitization initiative and falling under […] exploitation." Robotic process automation technology can leverage it even more to automate mainly repetitive undertakings and increase efficiency and productivity. Derived from the example of introducing robotic process automation, exploitation is associated with *applying available technologies* and not with inventing a new disruptive technology. Therefore, the digital technology can be new to the company but is not disruptive from a market perspective. One interview partner summarized it with the statement that "it is more about a solution which is already available in the market, and it is improved step by step also respecting market requirements". Hence, it is not about limiting itself to only introducing an available technology to the company; instead, it is about making necessary adjustments to make it suitable for the specific context and also further advancing it. Aside from automation, *creating transparency* is a way to use digital technologies to optimize the existing. This can be related to collecting data in the manufacturing process, such as from machinery, making the data accessible, and visualizing it. The increased transparency helps to derive projects to optimize existing processes. Digital technologies in the context of exploitation can also be used externally to enhance the *customer value*. Examples are digitalizing how companies engage with their customers, improving quality through digital control systems, or adding little features as additional

functionalities. For adding small add-ons, one interview partner brought up the following example: "So one could imagine that the company starts thinking about what you do with the data, and if we think about this entertainment system, we could say if the tire pressure gets too low, you might get a pop up saying you want to go to the next garage to check your tires. So this could be an idea, that I have to data and I do a little incremental step showing the pop-up. So this would be, for me, the exploitation."

Maintain and improve IT infrastructure

One major focus in exploitation in digital transformation is maintaining and improving the IT infrastructure. This contains, amongst other topics, *aligning and harmonizing existing IT infrastructure*. We discovered that standards and pursuit harmonization are needed for an efficient and effective digital transformation. Our interview partners connected those activities to exploitation in digital transformation. Often mentioned was the harmonization of ERP systems in bigger companies or customer portals to reduce complexity in the IT landscape. Aside from harmonizing, *connecting systems* is relevant in exploitation. With that, data silos and media breaks can be reduced or eliminated. Especially in interfaces to customers, it is relevant to have connected systems so customers have one interface, even if there are multiple systems in place internally. *Introduce, advance, and maintain existing systems* are characteristics for exploitation in digital transformation. One aspect is introducing new systems to the company to increase transparency or automate processes. However, constant improvement of existing systems is also an essential part of exploitation in digital transformation. One interview partner summarized this by saying: "Exploitation would be compared to the classic Lean approach of further improving existing systems, identifying potentials in new features in existing software, potential in new features in the processes and making things simply easier, more automated, step by step." Therefore, exploitation is associated with improving and maintaining systems, single coding lines, or functions. With those activities, companies *create the baseline* for further activities and leverage the potential of digital transformation. One interview partner stated that "there is a lot [..] to do that is not that fancy and that is not that shiny and brilliant from first point of view probably […] relevant to capitalize on then the bigger things".

Close to existing core business

Talking to our interview partners, we identified that exploitation in digital transformation is characterized by being *close to the existing core business* in incumbent companies, not coming from a software background. It is about evolving the current business with the help of digital technologies. This could be related to existing business processes through automation, products through data-driven quality control systems, or additional digital functionalities adding value for the customer. The proximity to the existing business and the pull from those departments to evolve is summarized by the following statement from our interviews:" Why, when you talk about digitalization or at least the steps towards that, then you have a lot of exploitation because then you have existing production or supply chain processes you do with digital tools a little bit better, you create more transparency on that." As traditional business is connected with digital technologies, exploitation in digital transformation is also about *combining analog with digital*

components. An example brought up was adding sensors to control the performance of the current product portfolio or introducing digital channels. Since exploitation activities in digital transformation build on the existing business, incumbent companies feel more comfortable. Also, due to the lower risk-taking, it can be seen as a conservative approach, especially when starting the digital transformation journey to gain experience, create the baseline and then advance. In addition, it seems more natural to incumbents due to the transparent target-setting process and the associated shorter time horizon to dare to decide to pursue the digital transformation journey.

Comparison to literature review results

Comparing the results of our qualitative study with the literature review, we can mainly confirm the findings and add valuable further details in the digital context. On digitization, our findings confirm the assumptions in the literature review. Our interview partners allocated adding small features to develop digitally (enhanced) products to exploitation. We also identified that it depends on the disruptive character of new digital technologies from a market perspective if our interview partners associate it with exploration or exploitation. This aspect was not recognized in the literature before and can advance the results. The second stage digitalization, digital innovation and digital business model change includes multiple aspects. Higher value added is associated with exploitation and exploration in the literature, and no details are provided to distinguish it further. Our research confirms this understanding, but we provide more details on explaining what activities to increase customer value added are seen as exploration and what as exploitation. Examples of enhancing customer value associated with exploitation are simplifying the interaction through digital channels or adding digital features to advance the customer experience. It can be summarized through incremental improvements to increase customer satisfaction. In contrast to exploitation, in exploration higher value added for customers is achieved through more significant changes, such as major remodeling of the business model with the help of digital technologies. Therefore, the differentiating factor is the degree of change and impact on the customer if higher value added is associated with exploration or exploitation. The same explanation is valid for the extension of processes and operations. If the extension is more radical, like going outside existing markets, we associate it with exploration. We can confirm the allocation of substitution of processes to exploration. Our 2nd order theme, "Using digital technologies to rethink existing business models" details how processes can be substituted in digital transformation. In addition, we agree with the understanding that automation is an exploitation activity. Using existing digital technologies and applying them to use cases to automate processes and make them more efficient is seen as exploitation. Closely connected to this is the target of efficiency increase. We provide further details to this by adding productivity and cost reduction targets. The newly derived topic around IT-related aspects is also covered in our research. Even if our interview partners do not label it digital business intensity (DBI), our study defines new (disruptive) technologies and their development as exploration characteristics. Our 2nd order theme "Maintain and improve IT infrastructure" explains how IT capabilities are used in exploitation. We also agree that it is required to develop new capabilities, especially

in exploration. Nevertheless, we identify that the development of new capabilities is not a one-time effort; instead, we see continuous learning as relevant for exploration and exploitation in digital transformation. Figure 4 shows the expansion of the framework evolution based on Hoessler and Carbon (2022), our literature review, and our empirical study results.

Discussion

Our findings provide details on what fundamentals leaders of digital transformations require. This includes a basic understanding of the individual terminologies exploration, exploitation in innovation, and digital transformation. Leaders need to understand that digital transformation is characterized by collaboration, and both activities, exploration, and exploitation, are relevant for business success. We also recommend acknowledging the differences between exploration and exploitation in innovation and incorporating that knowledge in the digital transformation strategic setting. With this, digital transformation should not be seen as an individual project. The awareness of industry-driven and organization-driven characteristics can explain why companies are drawn more to exploration or exploitation and support leaders in actively steering the direction and the activities. We identified four main characteristics for exploration in digital transformation in our framework. Challenged by the high uncertainty due to the long-term orientation of exploration in digital transformation, the target-setting process seems challenging for incumbent companies. Alternative targets and measurements aside from short-term KPIs should be used to steer the activities. Nevertheless, companies should ensure that exploration still pursues a long-term profit orientation. To navigate the unknown outcome due to the radical character of exploration in digital transformation, companies need to establish a failure culture, be willing to take some risks and develop new capabilities. The
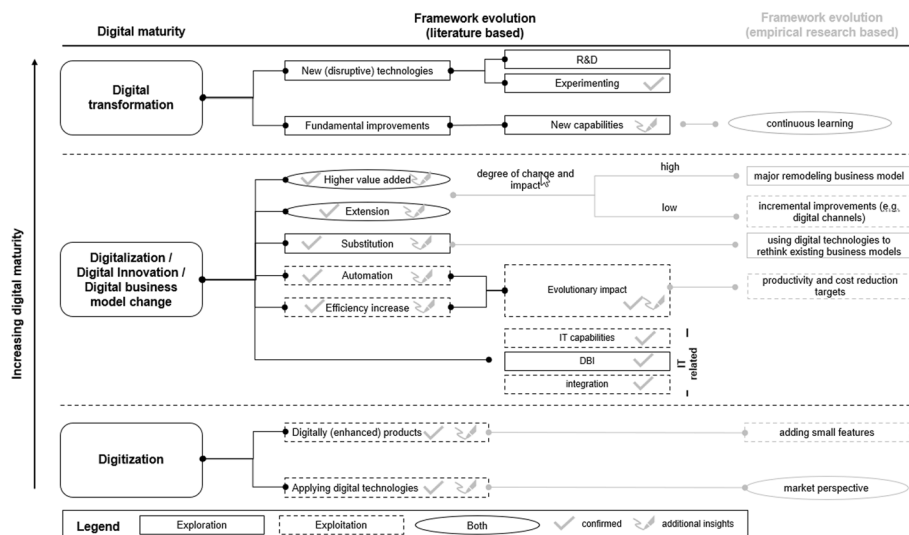

Fig. 4 Stages of digital transformation mapped to exploration and exploitation in innovation empirical research-based

activities in exploration of digital transformation can be summarized by using digital technologies to rethink existing business models. Using data and digital servitization are commonly mentioned activities by our interview partners. Exploration in digital transformation benefits internal activities but is mainly triggered outside the company.

Compared to exploration, the target-setting process for exploitation in digital transformation is obvious. We recommend that companies use quantitative targets such as increased efficiency, productivity, and cost reduction to ensure success. Due to being closer in time, exploitation in digital transformation is described with a lower complexity. We refer to improvements step-by-step and describe exploitation as a conservative approach. The activities are related to using digital technologies to optimize the existing, such as through automation and applying available digital technologies to the existing. In particular, maintaining and improving the IT infrastructure are focus areas in exploitation in digital transformation. The closeness to the existing business is one major characteristic of exploitation in our context. We summarize in Fig. 5 our findings by capturing the dynamic interrelations of the identified aggregated dimensions and 2nd order themes (Gioia et al., 2013).

Most existing studies on exploration and exploitation in innovation are not in the context of digital transformation. In addition, survey results or interviews are not the primary source of evidence. Our research addresses those limitations and provides a more deterministic characterization of digital transformation. As digital transformation is a strategic pillar of many incumbent companies, but those still face implementation challenges, our study provides guidance for incumbent companies' leaders to understand better digital transformation activities and how they can be steered. With our explorative research design, we conducted 33 semi-structured interviews. Our interview partners were selected based on a purposive sampling method. We ensured that we covered a heterogeneous sampling across industry sectors and different hierarchy levels. As sampling and data collection is crucial to the study's success, we clearly derived it from the research goal and included a wide range of appropriate participants. Nevertheless, the number of 33 participants still is a limitation, which we tried to compensate for with a clearly outlined research report. Even if we ensure scholarly rigor in our analysis by using the practice described by Gioia et al. (2013), this is still a limitation of qualitative
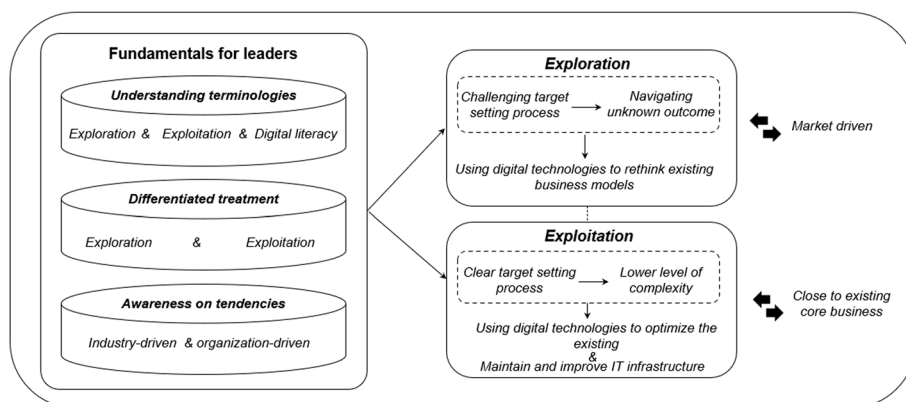
Fig. 5 Dynamic model of exploration and exploitation in digital transformation based on Gioia et al. (2013)

research. Another challenge we face is that we do not consider the digital maturity grade of the companies our interview partners represent. Further longitudinal studies could provide more in-depth insights, also considering the complete journey of digital transformation of incumbent companies. This also refers to the development of their digital maturity and the impact on exploration and exploitation activities. In addition, our framework can be further enriched by researching necessary leadership for steering exploration, exploitation in digital transformation. As exploration and exploitation in innovation is connected with the concept of ambidexterity, we recommend combining the research on leadership with ambidextrous leadership in digital transformation. Together, the current study and the further recommended research serve as guidelines for companies in practice. Going a step further, this also needs further validation through applying it in practice and analyzing it through in-depth case studies. In addition to leadership, we recommend connecting the results with further research on organizationally structuring exploration and exploitation in digital transformation to achieve ambidexterity.

Conclusion

This paper aimed to develop a framework of exploration, exploitation, and influencing factors on tendencies in incumbent companies' digital transformations. Most existing research activities on exploration and exploitation in innovations are not in the context of digital transformation. Nevertheless, incumbent companies face challenges in those innovation activities, impeding the expected progress in digital transformation. We contribute with our framework by guiding leaders to steer those exploration and exploitation activities in their digital transformation. We reveal understanding terminologies, differentiated treatment, and awareness of tendencies as fundamentals for leaders. The distinct treatment of exploration and exploitation uncovers numerous different characteristics. Different target-settings and approaches to exploration and exploitation are essential. Exploration in digital transformation is about using digital technologies to rethink business models, resulting in higher complexity and uncertainty. Using digital technologies to optimize existing processes, products, and IT infrastructure is associated with exploitation. Both activities are necessary in digital transformations of incumbent companies.

Appendix

See Tables 4, 5, 6.

Table 4 Building 1st order concepts

Original code (1st order concepts)	Count	Description of changes	Final code (1st order concepts)
KPIs	6	Summarized	Quantitative targets
Known outcome and target	5		
Increased efficiency, productivity, and cost reduction	19		Increased efficiency, productivity, and cost reduction
Similar targets to non-digital activities	10		Similar targets to non-digital activities
Status quo	3	Summarized	Maintaining current state
Legally required	1		
Standards	6		
Incremental steps	15		Incremental steps
Easier to do	5	Rephrased	Less complicated
Roll out	2	Summarized	Implementation and scaling up
Implementation	3		
Scaling	4		
Internal optimization	3	Summarized	Internal process automation
Automation	7		
Applying available technologies	8		Applying available technologies
Creating transparency	6		Creating transparency
Enhancing customer value	9		Enhancing customer value
Aligning and harmonizing existing IT infrastructure	12		Aligning and harmonizing existing IT infrastructure
Connecting systems	8		Connecting systems
Introduce systems	3	Summarized	Introduce, advance, and maintain existing systems
Advance systems	5		
Ensure systems are running	2		
Baseline/not fancy	5	Rephrased	Creating a baseline
Advance existing	13	Summarized	Close to existing products and services
Pull from business	3		
Combining analogue with digital component	6		Combining analogue with digital component
More natural for incumbents	7		More natural for incumbents
Data	2	One mapped to "Creating transparency" and one eliminated: non-significant	
Conservative	2	Eliminated: non-significant	
Different to tradtional KPIs	10	Summarized	Alternative targets or measurements
no obvious targets	8		
Unclear outcome requires assumptions	7		Unclear outcome requires assumptions
Long-term profit-orientation	11		Long-term profit-orientation
Radical	9	Summarized	Radical or disruptive change character
Disruptive	4		
Failure culture	10		Failure culture
Willingsness to take risk & mitigate	8	Rephrased	Willingness to take risk & risk mitigation
Development of new capabilities	7		Development of new capabilities
Starting from blank	7		Starting from blank
Radically rething how business is done	10	Rephrased	Radically rethinking
Digital business model innovation	21		Digital business model innovation

Table 4 (continued)

Original code (1st order concepts)	Count	Description of changes	Final code (1st order concepts)
Digital servitization	9		Digital servitization
Data usage	22		Using data
New (disruptive) technology	19		New (disruptive) technology
Not only internal/more external	5	Summarized	Addressing external customer needs
Need to address customer needs	5		
Externally triggered	10		Externally triggered
Not limited to company's markets	11		Not limited to existing markets
Innovation phase: exploration	3	Eliminated: non-significant	
Exploitation needed to fully leverage reaults fo epxloration	2	Eliminated: non-significant	
IT/Digital knowledge	11	Rephrased	Digital literacy
Not only IT ⟶ people	16	Summarized	Joint effort and learning
Learning	11		
Both needed	20	Rephrased	Relevance of exploration and exploitation in business success
Understanding needed that different	20	Rephrased	Awareness of differences in exploration and exploitation incorporated in strategy
Target-setting important	10	Rephrased	Distinct target-setting for exploration and exploitation
Interplay	4	Summarized	Interconnection between exploration and exploitation
Not black and white	5		
Hardware vs. software originated	16		Hardware vs. software originated
Regulations	9		Regulation intensity
Disruption factor outside	21		Degree of disruption
Phase in economic cycle	5		Phase in economic cycle
Owner/Family	5	Summarized	Decision making models
Decision maker	5		
Organizational structures	16		Organizational structures
Legacy	19		Legacy
Availability of resources	20		Availability of resources
Attitude towards risk	8		Attitude towards risk
Shareholder results	10	Rephrased	Shareholder orientation

Table 5 Building 2nd order themes

1st order concepts	2nd order themes
Digital literacy	Understanding terminologies
Joint effort and learning	
Relevance of exploration and exploitation in business success	
Awareness of differences in exploration and exploitation incorporated in strategy	Differentiated treatment
Distinct target-setting for exploration and exploitation	
Interconnection between exploration and exploitation	
Hardware vs. software originated	Industry-driven tendencies
Regulation intensity	
Degree of disruption	
Phase in economic cycle	
Decision making models	Organization-driven tendencies
Organizational structures	
Legacy	
Availability of resources	
Attitude towards risk	
Shareholder orientation	
Alternative targets or measurements	Challenging target-setting process
Unclear outcome requires assumptions	
Long-term profit-orientation	
Radical or disruptive change character	Navigating unknown outcome
Failure culture	
Willingness to take risk & risk mitigation	
Development of new capabilities	
Starting from blank	Using digital technologies to rethink existing business models
Radically rethinking	
Digital business model innovation	
Digital servitization	
Using data	
New (disruptive) technology	
Addressing external customer needs	Market orientation
Externally triggered	
Not limited to existing markets	
Quantitative targets	Clear target-setting process
Increased efficiency, productivity, and cost reduction	
Similar targets to non-digital activities	
Maintaining current state	
Incremental steps	Lower level of complexity
Less complicated	
Implementation and scaling up	
Internal process automation	Using digital technologies to optimize the existing
Applying available technologies	
Creating transparency	
Enhancing customer value	
Aligning and harmonizing existing IT infrastructure	Maintain and improve IT infrastructure
Connecting systems	
Introduce, advance, and maintain existing systems	
Creating a baseline	

Table 5 (continued)

1st order concepts	2nd order themes
Close to existing products and services	Close to existing core business
Combining analogue with digital component	
More natural for incumbents	

Table 6 Building aggregated dimensions

1st order concepts	2nd order themes	Aggregated dimension
Digital literacy	Understanding terminologies	Fundamentals for leaders in digital transformation
Joint effort and learning		
Relevance of exploration and exploitation in business success		
Awareness of differences in exploration and exploitation incorporated in strategy	Differentiated treatment	
Distinct target-setting for exploration and exploitation		
Interconnection between exploration and exploitation		
Hardware vs. software originated	Industry-driven tendencies	
Regulation intensity		
Degree of disruption		
Phase in economic cycle		
Decision making models	Organization-driven tendencies	
Organizational structures		
Legacy		
Availability of resources		
Attitude towards risk		
Shareholder orientation		
Alternative targets or measurements	Challenging target-setting process	Exploration characteristics
Unclear outcome requires assumptions		
Long-term profit-orientation		
Radical or disruptive change character	Navigating unknown outcome	
Failure culture		
Willingness to take risk & risk mitigation		
Development of new capabilities		
Starting from blank	Using digital technologies to rethink existing business models	
Radically rethinking		
Digital business model innovation		
Digital servitization		
Using data		
New (disruptive) technology		
Addressing external customer needs	Market orientation	
Externally triggered		
Not limited to existing markets		

Table 6 (continued)

1st order concepts	2nd order themes	Aggregated dimension
Quantitative targets	Clear target-setting process	Exploitation characteristics
Increased efficiency, productivity, and cost reduction		
Similar targets to non-digital activities		
Maintaining current state		
Incremental steps	Lower level of complexity	
Less complicated		
Implementation and scaling up		
Internal process automation	Using digital technologies to optimize the existing	
Applying available technologies		
Creating transparency		
Enhancing customer value		
Aligning and harmonizing existing IT infrastructure	Maintain and improve IT infrastructure	
Connecting systems		
Introduce, advance, and maintain existing systems		
Creating a baseline		
Close to existing products and services	Close to existing core business	
Combining analogue with digital component		
More natural for incumbents		

Declarations

Competing interests
The authors declare that they have no competing interests.

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