Digital transformation and ambidexterity in incumbent companies

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Abstract

Although digital transformation has become an important strategic pillar for incumbent companies, the expected outcome is often not realized. This is primarily driven by the complex character of digital transformation, going beyond technologies and the associated organizational structure changes. This dissertation provides an overarching framework to guide leaders of digital transformations in incumbent companies. Given the correlation between ambidexterity and digital innovation, it includes detailing the exploration and exploitation elements in digital transformation, the role of the leaders, and the ways to achieve structural ambidexterity. The overall research design consists of a literature review, advanced with an explorative research design element of 33 semi-structured interviews. This combination allows for answering the different research questions on the overarching research on digital transformation and ambidexterity. The dissertation concludes that digital transformation includes elements of exploration and exploitation. Leaders guiding digital transformation journeys of incumbent companies need to be aware of the differences, consider tendencies, and strive to balance the paradoxical activities. Considering the digital maturity grade, the closeness to the core business, and the differences between exploration and exploitation is necessary when applying structural ambidexterity to achieve that balance. The dissertation contributes to the lack of empirical research on structural ambidexterity and digital transformation by providing in-depth knowledge to enable structural ambidexterity in the digital context. Furthermore, it guides practitioners in incumbent companies facing challenges in digital transformation.

Obwohl die digitale Transformation ein wichtiger strategischer Bestandteil bestehender Unternehmen ist, liegen viele Unternehmen hinter ihren Erwartungen. Dies lässt sich vor allem durch die Komplexität einer digitalen Transformation begründen, die über den reinen Technologie Aspekt hinausgeht, sowie die damit einhergehenden strukturellen Veränderungen. Diese Dissertation dient Verantwortlichen von digitalen Transformationen als Hilfestellung und Leitfaden. Begründet durch die Korrelation zwischen Ambidexterity und digitaler Innovation, beinhaltet die Dissertation eine Untersuchung der Exploration und Exploitation Aktivitäten in einer digitalen Transformation, die Rollen der Verantwortlichen und Möglichkeiten structural Ambidexterity zu erreichen. Das übergeordnete Forschungsdesign besteht aus einem Literature Review und wird durch 33 halbstrukturierte Interviews als exploratives Element ergänzt. Diese Kombination erlaubt es die Forschungsfragen hinsichtlich digitaler Transformation und Ambidexterity zu beantworten. Die Erkenntnisse der Dissertation zeigen, dass sowohl Exploration als auch Exploitation Bestandteile einer digitalen Transformation sind. Verantwortliche in bestehenden Unternehmen, die die digitale Transformation vorantreiben, müssen sich der Unterschiede der Aktivitäten, Tendenzen und der Notwendigkeit eine Balance der widersprüchlichen Aktivitäten anzustreben, bewusst sein. Es erfordert die Berücksichtigung des digitalen Reifegrades, der Nähe zum bestehenden Geschäft und die differenzierte Behandlung von Exploration und Exploitation. Die Kombination ermöglicht es structural Ambidexterity zu verfolgen, um die Balance der Aktivitäten zu erreichen. Die Dissertation trägt dazu bei die Lücke an empirischen Studien im digitalen Kontext zu structural Ambidexterity, durch das generierte vertiefte Wissen zu verkleinern. Darüber hinaus, dient die Forschung als Leitfaden für Verantwortliche deren Aufgabe es ist bestehende Unternehmen digital zu transformieren und die Herausforderungen zu meistern.

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1 Introduction

The increasing speed of the development of new digital technologies creates new opportunities for incumbent companies but also forces them to rethink business models as existing industries threaten disruption (Klos et al., 2021; Zhang et al., 2023). Additionally, studies show the positive influence of successful digital transformation on the financial performance of companies (Klos et al., 2021; Llopis-Albert et al., 2021). The mentioned financial benefits are driven by, for example, higher efficiency (Gurumurthy et al., 2020; Llopis-Albert et al., 2021; Tsai & Su, 2022), revenue growth (Gurumurthy et al., 2020; Llopis-Albert et al., 2021), and quality improvements (Gurumurthy et al., 2020). Therefore, digital transformation is the focus of numerous incumbent companies (Hess et al., 2016; Hoessler & Carbon, 2024b; Kane et al., 2015). Increasing companies' investments in digital transformation show this priority (Gurumurthy et al., 2020). Also, the growth in scientific publications proves the rising engagement in digital transformation (Vesna Bosilj Vukšić et al., 2018; Zhang et al., 2023). Despite the increasing interest (Gurumurthy et al., 2020; Hess et al., 2016) and the acknowledged necessity of digital transformation, incumbent companies face challenges in their digital transformation journey (Gregory et al., 2019; Klos et al., 2021; Weritz et al., 2025). Motivated by a positive impact on their financial performance (Klos et al., 2021; Llopis-Albert et al., 2021), many incumbent companies are falling behind their targets (Gebauer et al., 2020; Meier et al., 2025). One explanation for falling behind expectations is the complex character of digital transformation (Hausberg et al., 2019). As digital technologies enable digital transformation, it is often studied with a focus on technology (Coreynen et al., 2020; Hoessler & Carbon, 2024a; Kahveci, 2025; Soluk & Kammerlander, 2021). Nevertheless, research results indicate that significant difficulties in achieving a successful digital transformation are rooted in areas aside from technological aspects, such as managerial areas and leadership (Mirković et al., 2019b). It is a leadership responsibility to capture the complex character of digital transformation (Faix, 2020). However, existing research often does not capture the complex character (Kreiterling, 2023) and lacks distinct knowledge of activities (Hoessler & Carbon, 2024a; Tolboom, 2016). Initiated by the increased speed of change driven by the faster development cycle of digital technologies, incumbent companies need to improve the existing and

also focus on the company's future needs (Boer & Gertsen, 2003; Corso et al., 2009; Lohoff et al., 2025). Referring to the existing description of digital transformation, digital transformation includes improving existing products, services, and internal processes incrementally through digital technologies (Hoessler & Carbon, 2024b). In addition, incumbent companies see digital transformation as an enabler of a revolutionary change to their business model (Hess et al., 2016; Hoessler & Carbon, 2024b; Schiffer, 2021; David Soto Setzke et al., 2023; Wu et al., 2021). Therefore, digital transformation can be connected to ambidexterity (Duncan, 1976; Hoessler & Carbon, 2024b; March, 1991).

Ambidexterity covers the two learning activities, exploration and exploitation (Hoessler & Carbon, 2022; March, 1991), and how to balance them (Duncan, 1976; Gibson & Birkinshaw, 2004). Nevertheless, combining the two learning activities and digital transformation is not very present in the scientific literature (Brauer et al., 2021). The limited available scientific work mainly focuses on literature reviews that lack empirical evidence on digital transformation activities (Hoessler & Carbon, 2024a). As exploration and exploitation require different capabilities and resources (Gregory et al., 2015; March, 1991; Smith & Beretta, 2021), gathering further insights on those activities in digital transformation is relevant. The managerial and leadership-related barriers to a successful digital transformation (Mirković et al., 2019b) justify the need for further insights to guide incumbent companies' digital transformation (Hoessler & Carbon, 2024b). In addition, despite the positive influence of ambidexterity on digital innovation (Del Giudice et al., 2021), the combination of the two research streams, digital transformation and ambidexterity, is also narrow (Hoessler & Carbon, 2024b; Wu et al., 2021) and limited to individual areas such as IT structures (Hoessler & Carbon, 2024b; Iho & Missonier, 2020; Jöhnk et al., 2020) or technology (Hoessler & Carbon, 2024b; Shao et al., 2021). One concept within the research area of ambidexterity is related to separation and integration, orchestrated through organizational structures (Benner & Tushman, 2003; Duncan, 1976; Hoessler & Carbon, 2024b; O'Reilly III & Tushman, 2013). Also, the literature indicates that digital transformation influences organizational structure (Holotiuk, 2020), and it is seen as a significant obstacle for incumbent companies in digital transformation (Bjoerkdahl, 2020; Hoessler & Carbon, 2024b). Given the impact on organizational structure in incumbent companies' digital transformation (Holotiuk, 2020) and the contribution of

ambidexterity to digital innovation (Del Giudice et al., 2021), this dissertation identified a research gap in understanding structural ambidexterity and associated integration and separation in digital transformation (Hoessler & Carbon, 2024b; Plekhanov et al., 2023).

2 Research aims and research questions

Motivated by the improvement potential enabled through digital transformation for incumbent companies (Klos et al., 2021; Llopis-Albert et al., 2021) and the challenges they are facing (Gregory et al., 2019; Klos et al., 2021; Weritz et al., 2025), this dissertation focuses on the digital transformation of incumbent companies and ambidexterity. I address the research gap of in-depth knowledge of exploration and exploitation activities in digital transformation with the subsequent research questions:

- “What are the characteristics of exploration and exploitation in digital transformation?” (Hoessler & Carbon, 2022, 2230003-3)
- “Which ambidexterity strategies exist to balance exploration and exploitation in digital transformation?” (Hoessler & Carbon, 2022, 2230003-3)

This dissertation aims to conduct a literature review first, as isolated research on digital transformation or ambidexterity, containing exploration and exploitation, exists but has not yet been combined (Hoessler & Carbon, 2024a). The research scope of the literature review is not limited to the characteristics of exploration and exploitation in digital transformation, but also includes ambidexterity strategies in digital transformation. I advance the literature review with empirical findings using semi-structured interviews. This dissertation aims to develop an overview of exploration and exploitation in digital transformation in incumbent companies and associated influencing factors (Hoessler & Carbon, 2024a). Despite being a difficulty for incumbent companies in digital transformation (Bjoerkdahl, 2020; Mirković et al., 2019b), organizational structures are given limited attention in the scientific literature. As organizational separation or integration can be referred to as structural ambidexterity, this dissertation addresses the research gap by providing answers on structural ambidexterity. I, therefore, am researching exploration / exploitation separation, the baseline for decision-making, and separation / integration between the

digital business and the core business (Hoessler & Carbon, 2024a). This is associated with the following research question:

- “How can incumbent companies apply the concept of structural ambidexterity to navigate digital transformation?” (Hoessler & Carbon, 2024b, p. 51)

In addition, this dissertation includes strategic leadership aspects, as leadership is a necessary condition for ambidextrous performance (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008). Consequently, it answers the following research question on strategic leadership:

- “What elements of strategic leadership do leaders in incumbent companies need to implement when navigating digital transformation considering structural ambidexterity?” (Hoessler & Carbon, 2024b, p. 51)

The overall goal of my dissertation is to investigate the mentioned research questions and provide empirically founded insights to support incumbent company leaders in steering their digital transformation. The baseline for my dissertation is the developed theoretical background, followed by the explanation and reasoning of the applied methodology. This dissertation discusses the results gained based on existing research and comes to conclusions about digital transformation and ambidexterity in incumbent companies.

3 Theoretical background

3.1 Digital transformation

In spite of the increasing research on digital transformation (Vesna Bosilj Vukšić et al., 2018), there is no standardized definition of digital transformation (El Sawy et al., 2020). However, there are overlaps between existing definitions (Eberl & Drews; Schallmo et al., 2017b), which serve as the baseline for my dissertation. Figure 1 illustrates the three-phase process of digital transformation (Hoessler & Carbon, 2022, 2024a; Tagscherer & Carbon, 2023; Verhoef et al., 2021).

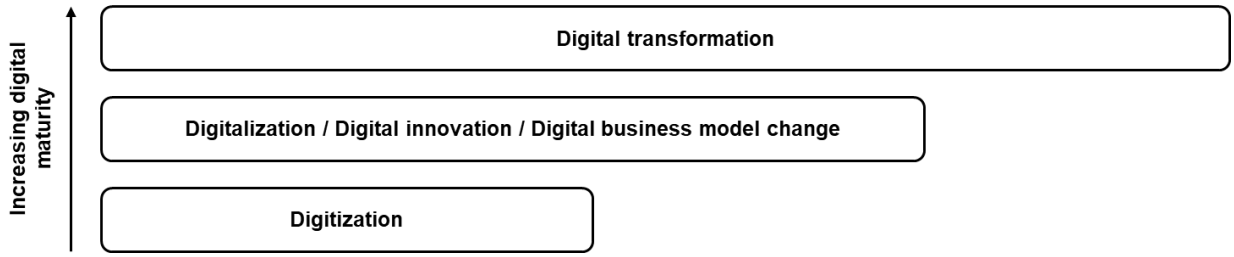

Figure 1 Phases of digital transformation adapted based on Tagscherer and Carbon (2023) and Saarikko et al. (2020)

Digitization is the initial phase of digital transformation (Tekic & Koroteev, 2019). Incumbent companies have, differently from digital start-ups, already existing processes (Hoessler & Carbon, 2024b; Zhang et al., 2023), products, services, and core competencies (Hoessler & Carbon, 2024b; Klos et al., 2021). Digital or digitally enhanced products are enabled in this phase through digital technologies. This phase's focus on the technological aspect is characteristic (Yoo, Henfridsson, & Lyytinen, 2010). The second phase advances this technological view with socio-technical structures (Tilson et al., 2010; Yoo, Lyytinen, et al., 2010). It is often labeled as digitalization, digital innovation, or digital business model change (Hoessler & Carbon, 2024a, 2024b). Existing business processes are automated, extended, or substituted by introducing digital technologies (Cavalcante et al., 2011; Hoessler & Carbon, 2024a, 2024b). Those improved processes are characterized by higher efficiency or higher value added for customers (Cavalcante et al., 2011; Florek-Paszkowska et al., 2021; Hoessler & Carbon, 2024b; Li, 2020). Whereas in phase two, digitalization can be limited to individual functions, digital transformation is about holistic transformation (Porfírio et al., 2021). The relevance of leadership and strategic steering increases with the digital maturity grade. It is necessary to enable the required change in incumbent companies to leverage the potential of digital transformation (Hensellek, 2020). Digital transformation envisions radical changes in how incumbent companies do business (Zhang et al., 2023). Nevertheless, the described three-phase process includes radically new ideas and incremental improvements in that path (Goerzig & Bauernhansl, 2018). Based on this definition, digital transformation consists of incremental and radical innovations, allowing for the connection of digital transformation with ambidexterity and the underlying learning activities, exploration, and exploitation.

3.2 Exploration and exploitation

Ambidexterity describes balancing the paradoxical learning activities exploration and exploitation (Duncan, 1976; Michael. Tushman & O'Reilly III, 1996). This dissertation is built on the understanding that exploration and exploitation are based on different capabilities (Gibson & Birkinshaw, 2004; Hoessler & Carbon, 2022; Lavie et al., 2010) and complement each other (Popadić et al., 2015). This is explained by following March's (1991) definition of exploration and exploitation (Hoessler & Carbon, 2024a). The result of exploration activities is radical or disruptive innovations (Beckman, 2006; Benner & Tushman, 2003) with a revolutionary nature (Hoessler & Carbon, 2024a; Michael. Tushman & O'Reilly III, 1996). Therefore, the outcome is more distant and uncertain and requires higher risk-taking (March, 1991). Exploration involves discovering something fundamentally new and experimenting (March, 1991). It goes beyond applying existing knowledge (Vorhies et al., 2011). Being first (Beckman, 2006), showing a high level of entrepreneurship, and growing new skills are characteristics of exploration (Benner & Tushman, 2003; March, 1991). Exploitation, in contrast to exploration, targets incremental innovations (Beckman, 2006; Benner & Tushman, 2003; Hoessler & Carbon, 2024a) and is more risk-averse (March, 1991). Refining existing processes and products (Gonzalez & Melo, 2017; Grant, 1996), leveraging efficiency (March, 1991), and lowering costs (Beckman, 2006) are associated with exploitation. It is about extending existing knowledge (He & Wong, 2004; March, 1991).

Following the definition of March (1991), the three-phase digital transformation process contains exploration and exploitation activities. Whereas some phases, such as digitization, can be linked to exploitation (Hoessler & Carbon, 2022, 2024a; Jafari-Sadeghi et al., 2021), the second phase includes activities such as providing higher value added to customers or extending processes that cannot be mapped clearly to either exploration or exploitation (Hoessler & Carbon, 2024a; Holotiuk & Beimborn, 2019) and requires further details with the help of empirical research. Especially considering that existing research, which combines digital transformation and exploration and exploitation, is mainly based on existing literature and does not consider empirical research, explains the need for further research (Hoessler & Carbon, 2024a). Another shortcoming of the existing research is that the majority of the research is focused on one area (Hoessler & Carbon, 2024a) such as IT resources

(Hoessler & Carbon, 2024a; Nwankpa & Datta, 2017), smart city innovations (Hoessler & Carbon, 2024a; van den Buuse et al., 2021), new digital technologies (Hoessler & Carbon, 2024a; Jafari-Sadeghi et al., 2021), or the digital technology artificial intelligence (Hoessler & Carbon, 2024a; Princes, 2019). Facing these shortcomings, further research is required to gain deeper insights into learning activities in digital transformation to provide in-depth knowledge for incumbent companies to steer digital transformation activities effectively.

3.3 Ambidexterity

Ambidexterity is achieving a balance of exploration and exploitation activities (Duncan, 1976; Hoessler & Carbon, 2022; Michael. Tushman & O'Reilly III, 1996). Dynamic capabilities are often associated with ambidexterity as they address how to gain competitive advantage, especially in a fast-changing environment (Teece, 2007), such as enabled by digital technologies (Hoessler & Carbon, 2022). Dynamic capabilities are broken down into sensing, seizing, and transforming (Teece, 2007). Linking those activities with exploration, exploitation, and ambidexterity, sensing, and seizing are lower-level concepts (Birkinshaw et al., 2016). Sensing can be associated with exploration, and seizing is about exploitation (Birkinshaw et al., 2016). The higher-level concept is transformation and describes how senior leadership allocates resources and arranges skills to support exploration and exploitation (Birkinshaw et al., 2016; Hoessler & Carbon, 2022; O'Reilly III & Tushman, 2008; O'Reilly III & Tushman, 2013). Companies should strive to balance their activities as too much exploration can lead to high costs without results, but too much focus on exploitation results in stagnation and falling behind the competition (March, 1991). Also, research shows a positive correlation between ambidexterity and company performance (Brix, 2019; Hoessler & Carbon, 2024b; Junni et al., 2013). Nevertheless, companies find this challenging (E. L. Chen & Katila, 2008; Halevi et al., 2015; Keller & Weibler, 2015; Michael Tushman & Euchner, 2015). Three traditional concepts describe ways to achieve ambidexterity. *Structural ambidexterity* suggests setting up an organizational structure containing separate entities for exploration and exploitation to balance the different activities (Birkinshaw & Gibson, 2004a; Duncan, 1976). Incumbent companies have separate sensing and seizing units that are brought together with the help of resource-linking capabilities (Birkinshaw et al., 2016; Hoessler & Carbon, 2024b). *Sequential ambidexterity / punctuated equilibrium* suggests that companies

spend an extended amount of time on either exploration or exploitation and then shift the focus to achieve a balance over time (Gupta et al., 2006; Simsek, 2009). The cycling back and forth between sensing and seizing is achieved through focus-shifting capabilities (Birkinshaw et al., 2016; Hoessler & Carbon, 2024b). Unlike *sequential ambidexterity / punctuated equilibrium*, *contextual ambidexterity* assumes a simultaneous balance (Gibson & Birkinshaw, 2004; Hoessler & Carbon, 2024b). Employees are encouraged to make decisions on when to work on exploration or exploitation tasks (Gibson & Birkinshaw, 2004; Hoessler & Carbon, 2024b). The choice is guided through context-shaping capabilities (Birkinshaw et al., 2016; Hoessler & Carbon, 2024b). In addition to the traditional concepts of ambidexterity, the so-called *temporal ambidexterity* was introduced (Hoessler & Carbon, 2024b; Holotiuk & Beimborn, 2019). It combines structural, sequential, and contextual ambidexterity. Employees are assigned to a separate digital innovation unit focusing on exploration. After completing the assignment, they return to their prior department to work on exploitative tasks (Holotiuk & Beimborn, 2019). Also, the different concepts of ambidexterity can be combined, resulting in *hybrid ambidexterity* (Jöhnk et al., 2020; Ossenbrink et al., 2019). Nevertheless, not one concept of ambidexterity can be preferred over the other. Instead, leaders must define the appropriate way of balancing exploration and exploitation for competitive advantage (Bjoerkdahl, 2020; Jansen et al., 2008; Keller & Weibler, 2015; Mueller et al., 2020). Ambidexterity enabling leadership solves conflicts (Horváth & Szabó, 2019; Smith & Beretta, 2021) and ensures alignment (Kotter, 2017). Embedding ambidexterity enabling leadership in the digital context, also includes managing change (Hoessler & Carbon, 2022; Horváth & Szabó, 2019; Wrede et al., 2020).

3.4 Ambidexterity in digital transformation

Considering digital transformation as a holistic concept, structural ambidexterity is the focus area of existing research (Hoessler & Carbon, 2024b; Holotiuk, 2020; Kaiser & Stummer, 2020; Raabe et al., 2020). Sequential ambidexterity / punctuated equilibrium (Smith & Beretta, 2021) and contextual ambidexterity (Hoessler & Carbon, 2022; Hron et al., 2021) receive minimal attention in digital transformation (Hoessler & Carbon, 2024b). Despite no direct mention, the concepts can be associated through the description, like focusing on different activities over time due to limited resources (Sequential ambidexterity / punctuated equilibrium) (Bjoerkdahl, 2020; Hoessler &

Carbon, 2022). Nevertheless, the central literature combining ambidexterity and digital transformation refers to structural ambidexterity, explaining the separation of digital innovation labs (Hoessler & Carbon, 2024b; Holotiuk, 2020; Kaiser & Stummer, 2020; Lohoff et al., 2025; Raabe et al., 2020). The explained separation is often not named structural ambidexterity but is described as such (Schiffer, 2021). Despite the recommended separation of digital units, the literature is missing the consideration of whether the digital units work on exploration or exploitation (Åkesson et al., 2018; Göbeler et al., 2020; Hoessler & Carbon, 2024b; Holotiuk, 2020; Kaiser & Stummer, 2020; Schiffer, 2021; Smith & Beretta, 2021; Sund et al., 2021). This separation is important as separating all digital activities, regardless of whether they are exploration or exploitation, can be ineffective and misleading (Göbeler et al., 2020). Only some research suggests separating exploration and exploitation in digital transformation (Brauer et al., 2021; Hoessler & Carbon, 2024b; Holotiuk & Beimborn, 2019; Hron et al., 2021). Some authors include elements of distinguishing between exploration and exploitation, but they are missing details. For example, they suggest the separation of new digital products (Hess et al., 2016; Hoessler & Carbon, 2024b) and other offerings (Hoessler & Carbon, 2024b; Sia et al., 2021; van den Buuse et al., 2021) from the core organization and the integration of hybrid products (Hess et al., 2016; Hoessler & Carbon, 2024b). Sia et al. (2021) explain the necessity of integrating the digitalization activity automation into the core organization. Aside from the missing consideration of exploration and exploitation in structural ambidexterity in digital transformation, most research is limited to one specific industry and does not consider the impact of digital transformation on many different sectors (Hess et al., 2016; Hoessler & Carbon, 2024b; Kane et al., 2015). In addition, only very few authors address that the separation of digital hubs needs to be reviewed over time and is subject to change (Åkesson et al., 2018; Göbeler et al., 2020; Hoessler & Carbon, 2024b; Hron et al., 2021; Svahn et al., 2017).

4 Methodology

My overall research on digital transformation and ambidexterity in incumbent companies consists of multiple research questions that are answered by using different research methods. Those are integrated in three published research articles (Hoessler & Carbon, 2022, 2024a, 2024b). Figure 2 illustrates my overall research

design based on Mayring (2001) and creates transparency about the research design elements in each published article.

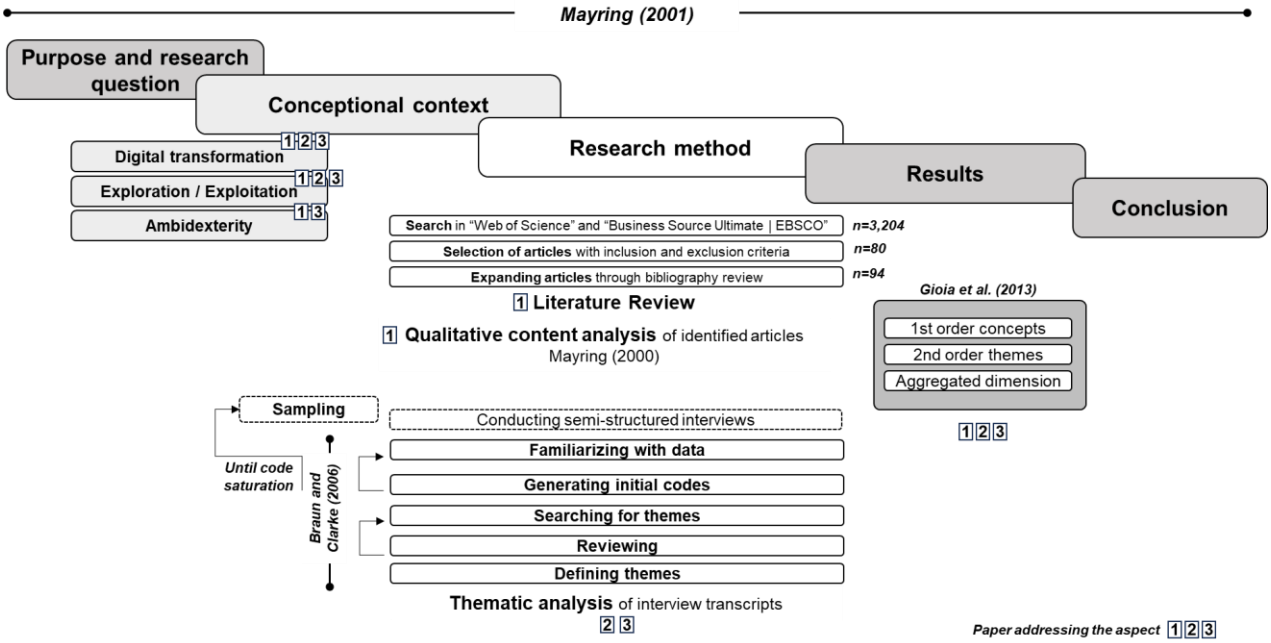

Figure 2 Research design adapted based on Mayring (2001), Mayring (2000), Braun and Clarke (2006), Gioia et al. (2013), Hoessler and Carbon (2024a), and Hoessler and Carbon (2024b)

The literature review in Paper 1 addressed the research gap of a profound comprehension of exploration and exploitation activities in digital transformation. As individual research exists on digital transformation and exploration, exploitation, and ambidexterity, the literature review method allowed for combining the mostly independent existing research streams (Okoli & Schabram, 2010). I followed the methodological steps for a literature review as described by Kitchenham and Charters (2007) and Tranfield et al. (2003) to find journal articles containing research about digital transformation systematically (Hoessler & Carbon, 2022). With the help of trial searches, I determined the search terms (Kitchenham & Charters, 2007; Tranfield et al., 2003) “digitalization,” “digital innovation,” “digital business model change,” “digital transformation”, and “digital transformation strategy” (Hoessler & Carbon, 2022). To ensure social science and other research fields are covered and to allow a broad search, I conducted the search in the scientific databases “Web of Science” and “Business Source Ultimate | EBSCO” (Hoessler & Carbon, 2022). I reviewed articles from 2010-2021 and defined inclusion and exclusion criteria (Hoessler & Carbon,

2022). The qualitative content analysis method, as described by Mayring (2000), combined with a mixed inductive-deductive approach, defined the code generation logic. The developed coding system served as a baseline for the content analysis of the identified journal articles regarding exploration, exploitation, and ambidexterity. The findings are categorized using first-order concepts, second-order themes, and aggregated dimensions (Gioia et al., 2013; Hoessler & Carbon, 2022).

As one finding in Paper 1 was that most of the journal articles on digital transformation do not address exploration and exploitation explicitly, lacking in-depth details (Hoessler & Carbon, 2022) or missing primary empirical work (Hoessler & Carbon, 2022, 2024a), I expanded the research on exploration / exploitation in digital transformation with semi-structured interviews. In addition, based on primary evidence, this allowed a focus on incumbent companies. This distinction was not always possible in the literature review. Purposive sampling was used to select the interview partners for the semi-structured interviews to address the limitation of the literature review (Etikan et al., 2016). Work expertise in digital transformation in an incumbent company was a selection criterion to define the study participants (Hoessler & Carbon, 2024a, 2024b). In addition, different hierarchy levels and sector experiences are represented in the sample group. I conducted the interviews between May 2023 and July 2023, transcribed them using the transcription function of Microsoft Teams, and imported them into MAXQDA (Hoessler & Carbon, 2024a, 2024b; VERBI Software, 2021). Furthermore, using the naturalized / intelligent verbatim approach improved the raw transcripts by transforming them into more readable transcripts (McMullin, 2023) and including timestamps mapped to the audio files. After creating the initial codes (Braun & Clarke, 2006) with MAXQDA (VERBI Software, 2021), I reassessed them and made changes systematically. Code saturation (Hennink et al., 2017) was achieved after 33 interviews (Hoessler & Carbon, 2024b). In addition, all interviews were treated anonymously.

As identified in Paper 1, there is limited consideration of ambidexterity in digital transformation. Despite the relevance of structures in digital transformation (Bjoerkdahl, 2020; Mirković et al., 2019b), there is a lack of structural ambidexterity in researching exploration / exploitation separation or integration in the digital context. The research methods are similar to those used in Paper 2 due to the lack of empirical proof in the existing literature. The explorative research design generated the missing

profound comprehension of structural ambidexterity in digital transformation (Hoessler & Carbon, 2024b). I combined the research design for qualitative studies by Mayring (2001) with the code development for thematic analysis by Braun and Clarke (2006). The open-ended questions focused on separation / integration in digital transformation in incumbent companies. The questions included possible triggers for changes over time and related leadership aspects. Allowing for higher study robustness, one researcher conducted the coding, and the second assessed and confirmed the coding with an inter-coder check (Hoessler & Carbon, 2024b; Mayring, 2014). The results are summarized using first-order concepts, second-order themes, and aggregated dimensions as described by Gioia et al. (2013).

5 Results

5.1 Results of Paper 1

The following section presents the results of the three research papers and derives a synthesis of the results of the individual papers. Using a literature review, Paper 1 investigated exploration and exploitation criteria as well as ambidexterity in digital transformation. Conducting title, abstract, and full-text reviews allowed me to decrease the number of articles from 3,204 to 80 articles (Hoessler & Carbon, 2022). A backward search expanded the number to 94 articles (Hoessler & Carbon, 2022). The conducted literature review in Paper 1 proved that all 94 analyzed articles focused on digital transformation included elements of exploration and exploitation (Hoessler & Carbon, 2022). Looking into the impact, the drivers and targets, and the activities and foci during digital transformation, elements of exploration and exploitation were present (Hoessler & Carbon, 2022). Table 1 summarizes the results clustered by those categories.

Table 1 Exploration and exploitation characteristics in digital transformation adapted based on Hoessler and Carbon (2022)

Learning activity	Category	Paper 1
Exploration	Impact	**Revolutionary impact**
	Drivers and targets	**Growth** - New revenue streams through new products or services - Shift from physical product selling to digital solutions offering - Entering or building new markets
	Activities and foci	**Challenging existing conditions fundamentally** - Moving away from the current core business - Develop new entrepreneurial capabilities - Experimentation - Risk-taking - Failure culture
Exploitation	Impact	**Evolutionary approach**
	Drivers and targets	**Increased efficiency and productivity** **Cost reduction** **Quality improvements** **Advanced customer satisfaction**
	Activities and foci	**Building on existing** - Automation - Embed digital technologies into existing products - Digital channels

The results show that digital transformation's overall effect on incumbent companies and industries is revolutionary (Hoessler & Carbon, 2022; Jones et al., 2021; Rachinger et al., 2019). Evolving new digital technologies enable companies to make significant changes in their business models (Hoessler & Carbon, 2022; Jones et al., 2021), leading to financial improvements (Cichosz et al., 2020; Fitzgerald et al., 2013; Hoessler & Carbon, 2022) if joined with a proper organizational and structural change (Hoessler & Carbon, 2022; Imran et al., 2021; Singh & Hess, 2020; Vial, 2019). This

revolutionary impact of digital transformation is a characteristic of exploration (Michael. Tushman & O'Reilly III, 1996).

The target of growing with the help of digital transformation is associated with exploration. It includes the pursuit of new revenue streams (Gimpel et al., 2018; Hoessler & Carbon, 2022, 2024a; Savytska & Salabai, 2021) through offering new products and services (Hoessler & Carbon, 2022; Loonam et al., 2018; Tagscherer & Carbon, 2024; Verhoef et al., 2021). For manufacturing companies, this means a shift from physical product selling to digital solutions offerings to their customers (Matzner et al., 2018; Schallmo et al., 2017a) or even eventually entering (Calabrese et al., 2020; Hoessler & Carbon, 2022) new emerging markets or building new markets (Hoessler & Carbon, 2022; Naimi-Sadigh et al.; Pihir et al., 2018; Sia et al., 2021).

To achieve revolutionary change, digital transformation exploration activities include fundamentally challenging existing conditions (Fitzgerald et al., 2013; Hoessler & Carbon, 2022; Kane et al., 2018; Neumann et al., 2019). In addition, exploration activities involve conducting radical changes in how business is operated, as well as moving away from the current core business (Hoessler & Carbon, 2022; Jin et al., 2020; Remane et al., 2017) to entirely new addressable markets (Hoessler & Carbon, 2022; Naimi-Sadigh et al.; Pihir et al., 2018; Sia et al., 2021). Companies must develop new entrepreneurial capabilities to transform their business in a targeted, radical way (Garzoni et al., 2020; Hoessler & Carbon, 2022; Niemand et al., 2021; North et al., 2020). Experimentation (Hoessler & Carbon, 2022; Jones et al., 2021; Kane et al., 2018; North et al., 2020), continuous learning (Hoessler & Carbon, 2022; Kane et al., 2019), and admission to failure are required (Andriole, 2020; Hoessler & Carbon, 2022; Sia et al., 2016; Sia et al., 2021). Therefore, exploration in digital transformation is associated with a higher level of risk-taking (Gurbaxani & Dunkle, 2019; Hoessler & Carbon, 2022; Imran et al., 2021; Kane et al., 2015; Sia et al., 2021). Companies either internally develop the required new (digital) capabilities or engage in mergers and acquisitions to acquire the needed skills (Anshin & Bobyleva, 2021; Margiono, 2021).

Despite the explorative target of digital transformation, the journey of incumbent companies is often evolutionary and split into phases (Hoessler & Carbon, 2022; Mazzone, 2014; Schallmo et al., 2017a) due to limited resources (Hoessler & Carbon, 2022; Santos & Martinho, 2020; Schneider & Kokshagina, 2021). Nevertheless, even though digital transformation can be built on evolutionary steps, the journey includes

explorative elements (Hoessler & Carbon, 2022; Riasanow et al., 2019). Alongside the explorative target growth, digital transformation drivers are also exploitative. Companies want to improve efficiency and productivity or achieve cost reductions or quality improvements (Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Hoessler & Carbon, 2022; Horváth & Szabó, 2019; Rachinger et al., 2019).

Exploitation activities, such as automation in different functional areas in the company (Calabrese et al., 2020; Hoessler & Carbon, 2022; Saarikko et al., 2020; Wiesbock & Hess, 2020), support those goals by advancing the existing processes. In addition to the internally oriented exploitation activities in digital transformation, companies pursue the advancement of customer experience (Cichosz et al., 2020; Gurbaxani & Dunkle, 2019; Hoessler & Carbon, 2022) and customer satisfaction (Hoessler & Carbon, 2022; Horváth & Szabó, 2019; Rachinger et al., 2019). Incumbent companies embed digital technologies into existing products to advance their product portfolio (Gimpel et al., 2018; Hess et al., 2016; Hoessler & Carbon, 2022; Vial, 2019). Furthermore, digital channels and platforms help to communicate with customers (Cennamo et al., 2020; Hess et al., 2016; Hoessler & Carbon, 2022; Schallmo et al., 2017a). One characteristic of exploitation activities in digital transformation is the connection to the existing processes, products, or services (Ahmad et al., 2021; Hoessler & Carbon, 2022, 2024a, 2024b; Sanchez, 2017; Verhoef et al., 2021). Using data and digital technologies allows for automating or reducing recurring manual tasks (Hoessler & Carbon, 2022; Schneider & Kokshagina, 2021; Westerman et al., 2014).

Whereas all 94 articles contained elements of exploration and exploitation, only a few articles use the distinct terminologies “exploration” and “exploitation” (Hoessler & Carbon, 2022). Additionally, even though in all articles at least one element of exploration and exploitation was included, this did not apply to each analyzed category (Hoessler & Carbon, 2022). Furthermore, some inconsistencies could be identified as digital transformation is seen as revolutionary, but the listed associated activities were exploitative (Becker & Schmid, 2020; Hoessler & Carbon, 2022). This indicates that further research is required to gain a more in-depth understanding of exploration and exploitation in digital transformation (Hoessler & Carbon, 2022). Table 2 illustrates the identified aspects associated with ambidexterity based on the conducted literature review.

Table 2 Ambidexterity in digital transformation adapted based on Hoessler and Carbon (2022)

Paper 1
Digital transformation includes exploration and exploitation - Inconsistencies in definitions - No in-depth insights on exploration and exploitation
Balancing paradoxical activities - Not following the definition of March (1991) - Digital = exploration / core (old) business = exploitation
Structural ambidexterity - Separate business unit or division for digital - no consideration if digital is really exploration - Risks associated with ignoring learning activities
Leadership - Leaders who enable ambidexterity strive for the needed balance - Senior leadership to provide guidance (vision, strategy, targets) - Consideration of resources and digital maturity grades - Arrange and manage seizing / sensing and continuous renewal (dynamic capabilities)
Challenges - Too focused on short-term profitability - Focus on wrong measurements - Senior leadership attitude influences ambidexterity success
Contextual ambidexterity and sequential ambidexterity / punctuated equilibrium - Receives little attention - Sequential ambidexterity or punctuated equilibrium to countermeasure limited resources

Aside from containing exploration and exploitation, some articles described the necessity of balancing exploration and exploitation activities in digital transformation (Chan et al., 2019; Gastaldi et al., 2018; Hoessler & Carbon, 2022, 2024a; Smith & Beretta, 2021). Nevertheless, the topic was not detailed further and lacked additional insights (Hoessler & Carbon, 2022). In addition, scholars neglected the definition of March (1991) and referred to balancing core and digital business, ignoring the exploration / exploitation differentiation criterion (Åkesson et al., 2018; Bosler et al., 2021; Hoessler & Carbon, 2022; Margiono, 2021; Olsson & Bosch, 2020). One paper indirectly addressed the risks of this definition by showing missing required interactions (Åkesson et al., 2018; Hoessler & Carbon, 2022). Nevertheless, the idea

of separating digital units (Hess et al., 2016; Hoessler & Carbon, 2022; Hron et al., 2021; Kaiser & Stummer, 2020; D. Soto Setzke et al., 2021; Sund et al., 2021) can be associated with structural ambidexterity (Hoessler & Carbon, 2022). Building on the definition of exploration and exploitation (March, 1991) and the fact that the literature review results showed that scholars primarily did not use those learning activities as differentiation, but instead only focused on balancing digital and core business, further in-depth studies are required (Hoessler & Carbon, 2022).

Even though it was not labeled as ambidexterity enabling leadership in the reviewed articles, this ambidexterity enabling leadership is needed to ensure the alignment of conflicting positions and separated units (Hoessler & Carbon, 2022; Horváth & Szabó, 2019; Smith & Beretta, 2021). Leaders who enable ambidexterity strive for the needed balance in digital transformation to improve the existing but also create entirely new offerings in a fundamentally new way (Berghaus & Back, 2016; Hoessler & Carbon, 2022; Wang et al., 2021). Associated with leadership, a clear vision and strategy for digital transformation were seen as important (Anshin & Bobyleva, 2021; Cichosz et al., 2020; Hoessler & Carbon, 2022; Machado et al., 2021). In addition, undefined targets and a path to achieve them were seen as a reason for falling behind expectations in digital transformation (Hess et al., 2016; Hoessler & Carbon, 2022). Nevertheless, the existing literature did not address how to incorporate exploration and exploitation, and how target-setting processes differ (Ahmad et al., 2021; Hoessler & Carbon, 2022; Krasonikolakis et al., 2020). Furthermore, leadership is responsible for defining the path of the digital transformation journey, considering digital maturity grades (Berghaus & Back, 2016; Y. Chen et al., 2021; Garzoni et al., 2020; Hoessler & Carbon, 2022; Saarikko et al., 2020) and organization specifics (Hoessler & Carbon, 2022; Horváth & Szabó, 2019; Jones et al., 2021). Similar to other categories, existing literature touched on dynamic capabilities in digital transformation, but did not explicitly name the concept (Hoessler & Carbon, 2022). Working in ecosystems and fostering collaboration were described as a way to orchestrate and foster sensing and seizing (Bosler et al., 2021; Cichosz et al., 2020; Hoessler & Carbon, 2022; Rachinger et al., 2019; Soluk & Kammerlander, 2021; Vial, 2019).

Overall, balancing paradoxical activities was seen as important but also challenging. Especially for incumbent companies, exploration is challenging

(Bjoerkdahl, 2020; Hoessler & Carbon, 2022). This can be explained as incumbent companies are too focused on daily activities and lack exploration, leading to reduced competitiveness in the future (Hoessler & Carbon, 2022; Jones et al., 2021; Sund et al., 2021). Also, particularly in family-owned companies that are risk-averse, there is a risk of focusing on exploitation and never achieving the targeted revolutionary impact (Ceipek et al., 2021; Hoessler & Carbon, 2022; Soluk & Kammerlander, 2021). In addition, companies face challenges in pursuing ambidexterity when short-term profitability is prioritized (Cichosz et al., 2020; Hoessler & Carbon, 2022; Krasonikolakis et al., 2020). The other ambidexterity concepts, aside from structural ambidexterity, were only brought up very sporadically in the analyzed articles (Hoessler & Carbon, 2022; Hron et al., 2021; Jackson & Dunn-Jensen, 2021) and with insufficient details (Hoessler & Carbon, 2022). Some authors mentioned that companies shift between exploration and exploitation due to a lack of resources. Primarily, combined with growing digital maturity grade incorporating exploration elements, this approach can be associated with sequential ambidexterity or punctuated equilibrium (Bjoerkdahl, 2020; Bosch & Olsson, 2021; Gastaldi & Corso, 2012; Ghobakhloo & Iranmanesh, 2021; Hoessler & Carbon, 2022; Smith & Beretta, 2021).

5.2 Results of Paper 2

A literature review has the limitation of only referring to existing literature and not generating empirical findings, which are required for my overall research on digital transformation and ambidexterity in incumbent companies. Therefore, a further investigation on the exploration and exploitation characteristics in digital transformation with the help of empirical research was performed (Hoessler & Carbon, 2024a). Semi-structured interviews were the baseline for deriving the study results. Our data synthesis was performed following Mayring (2000). We used the identified impact, target, and activities from our first research (Hoessler & Carbon, 2022) to set the inductive categories (Hoessler & Carbon, 2024a; Mayring, 2000). Table 3 presents the findings of Paper 1 and compares them to the results from the second research article, including the gained empirical evidence.

Table 3 Characteristics of exploration and exploitation in digital transformation, enhanced by empirical research, adapted based on Hoessler and Carbon (2022) and Hoessler and Carbon (2024a)

Learning activity	Category	Paper 1	Paper 2
Exploration	Impact	**Revolutionary impact**	**Radical or disruptive change** - Digital business model innovation
	Drivers and targets	**Growth** - New revenue streams through new products or services - Shift from physical product selling to digital solutions offering - Entering or building new markets	**Market orientation** - Digital servitization - Surviving in disrupted markets
	Activities and foci	**Challenging existing conditions fundamentally** - Moving away from the current core business - Develop new entrepreneurial capabilities - Experimentation - Risk-taking - Failure culture	**Using digital technologies to rethink existing business models** - Starting from blank - Develop new capabilities - Safe space for experimentation - Willingness to take risks - Failure culture - Usage of data - Applying new (disruptive) technologies
	Steering		**Challenging target-setting process** - High complexity and uncertainty - Alternative targets and measurements

Exploration (continued)	Steering (continued)		- Unclear outcome requires assumptions - Long-term profit orientation
Exploitation	Impact	**Evolutionary approach**	**Conservative approach**
	Drivers and targets	**Increased efficiency and productivity** **Cost reduction** **Quality improvements** **Advanced customer satisfaction**	**Increased efficiency and productivity** **Cost reduction** **Quality improvements** **Enhance customer value** **Improved digital penetration** **Legal reporting requirements**
	Activities and foci	**Building on existing** - Automation - Embed digital technologies into existing products - Digital channels	**Optimize existing** - Internal process automation - Embed digital technologies into existing products - Digital channels - Applying available technologies - Creating transparency **Maintain and improve IT infrastructure** - Aligning and harmonizing the existing IT infrastructure - Connecting systems - Improving systems - Scaling-up and roll-outs

Exploitation (continued)	Steering	**Clear target-setting process** - Quantitative targets - Similar targets to non-digital activities

The results of the semi-structured interviews confirmed the revolutionary impact of digital transformation, describing it as a radical or disruptive change to incumbent companies (Hoessler & Carbon, 2024a). In addition, digital business model innovation was brought up as a concrete exploration outcome (Hoessler & Carbon, 2024a). Growth as a driver and target of exploration in digital transformation was less present in the interview results (Hoessler & Carbon, 2024a). Whereas the market orientation of exploration in digital transformation was gained as a new insight, growth could only be indirectly associated with it. Instead, the more long-term orientation of surviving in disrupted markets was seen as one of the main drivers (Hoessler & Carbon, 2024a). Nevertheless, when detailing the growth ambitions, the empirical research validated that the target of incumbent companies is to shift from product to digital solution selling. In addition, the empirical research added digital servitization as an approach for companies to grow new revenue streams and disrupt their selling proposition (Hoessler & Carbon, 2024a).

The activities and foci that the interview partners saw in exploration in digital transformation matched the literature review's findings. An additional insight was that moving away from the core business can be achieved by starting from blank (Hoessler & Carbon, 2024a). To enable the required experimentation, companies need to establish a failure culture and ensure that employees have enough space to experiment (Hoessler & Carbon, 2024a). Applying disruptive technologies from the outside and using data to change business processes fundamentally or create new selling propositions are the main exploration activities in digital transformation (Hoessler & Carbon, 2024a).

Aside from impact, drivers and targets, and activities and foci, requirements of steering exploration in digital transformation were identified in this research (Hoessler & Carbon, 2024a). Alternative targets and measurements are needed due to the higher level of uncertainty and complexity of exploration (Hoessler & Carbon, 2024a). Working with assumptions allows using common financial key performance indicators,

but adapting to the exploration characteristics (Hoessler & Carbon, 2024a). Despite the challenges of monitoring and steering exploration, it is required to ensure a long-term profit orientation of those activities (Hoessler & Carbon, 2024a).

The interview results underpinned that digital transformation could have an exploitative impact. Exploitation activities in digital transformation are used in the early stages of the journey by companies that are more risk-averse (Hoessler & Carbon, 2022, 2024a). Furthermore, the empirical research revealed the same drivers and targets of exploitation in digital transformation as identified in the literature review (Hoessler & Carbon, 2024a). Nevertheless, increasing digital penetration can also be an exploitation target (Hoessler & Carbon, 2024a). Furthermore, companies are motivated by the increasing amount of legally required reporting to improve data availability and, therefore, pursue exploitation activities in the digital context (Hoessler & Carbon, 2024a).

Additionally, the interview results reinforced that exploitation activities in digital transformation focus on optimizing the existing (Hoessler & Carbon, 2024a). In addition, applying available digital technologies, such as robotic process automation, reduces manual work (Hoessler & Carbon, 2024a). With the help of digital technologies, data can be collected, made accessible, and analyzed to identify improvement projects (Hoessler & Carbon, 2024a). Based on the interview results, exploitation activities in digital transformation referred to maintaining and improving the IT infrastructure (Hoessler & Carbon, 2024a). Efforts to align and harmonize the existing IT infrastructure and connect systems internally and with customer systems are associated with these activities (Hoessler & Carbon, 2024a). Constant improvement of systems by adding new functionalities and ensuring system performance is necessary to leverage additional benefits (Hoessler & Carbon, 2024a). Furthermore, introducing new systems for automation or increased transparency is characteristic of exploitation activities in digital transformation (Hoessler & Carbon, 2024a). Additionally, scaling up and rolling out a previously developed digital technology is associated with exploitation in digital transformation (Hoessler & Carbon, 2024a).

Explained by the shorter time-horizon of exploitation, outcomes are more foreseeable, and therefore, quantitative targets are required for exploitation (Hoessler & Carbon, 2024a). It can be monetary targets or other quantitative measurements,

such as output goals (Hoessler & Carbon, 2024a). Because exploitation in digital transformation is closely associated with the existing core business, targets and measurements are similar to those of non-digital activities (Hoessler & Carbon, 2024a).

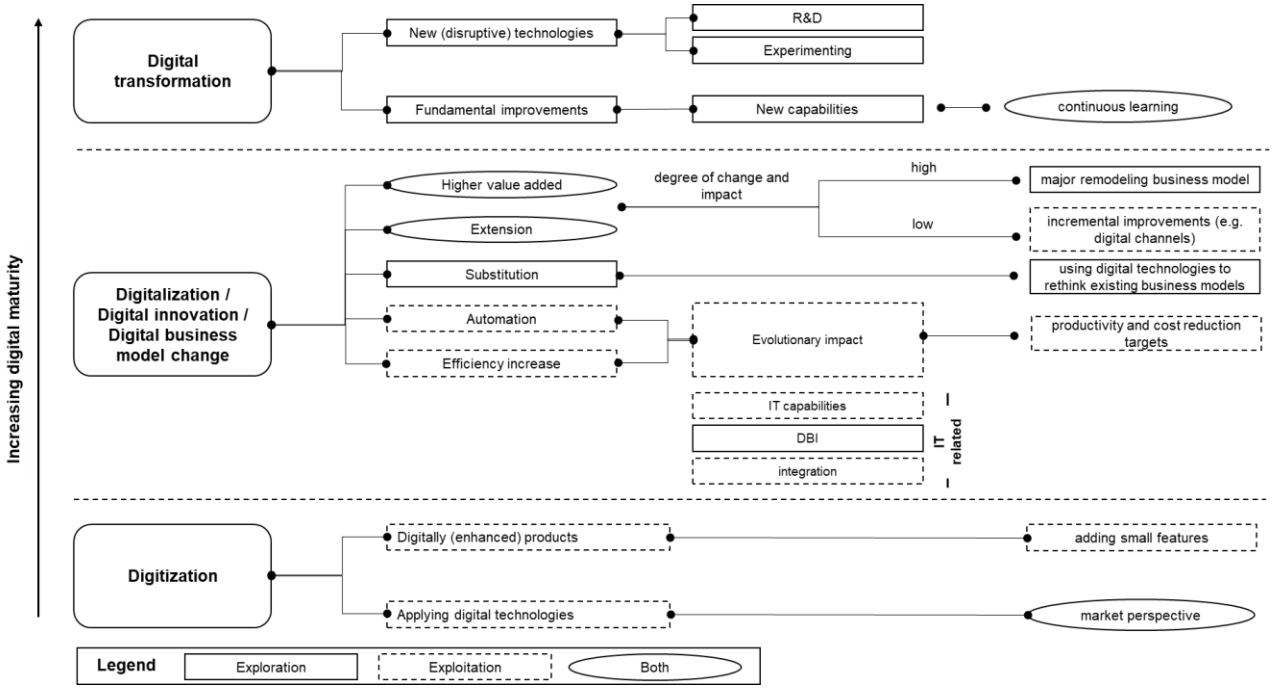

Figure 3 Phases of digital transformation mapped to exploration and exploitation, adapted based on Hoessler and Carbon (2024a)

Figure 3 illustrates that the results of the literature review can be confirmed. Additionally, the framework is advanced with empirical findings. Mapping the insights from the literature review and the semi-structured interviews to the phases of digital transformation provides a distinct differentiation of the terms digitization, digitalization / digital innovation / digital business model change, and digital transformation (Hoessler & Carbon, 2022, 2024a). Combining those terms with exploration and exploitation allows a more specific differentiation and appropriate steering (Hoessler & Carbon, 2024a). Figure 3 shows that the initial phase digitization mainly consists of exploitation (Hoessler & Carbon, 2024a). Only the application of new digital technologies can contain explorative elements if the technology disrupts the market (Hoessler & Carbon, 2024a). Digitalization, digital innovation, and digital business model change are built on digitization and are characterized by a higher digital maturity grade, as it is more than pure technology (Hoessler & Carbon, 2022, 2024a; Tilson et al., 2010; Yoo, Lyytinen, et al., 2010). This phase contains exploration and exploitation.

Nevertheless, the categorization depends on the degree of change and impact for an increased value added to the customer. Activities are associated with exploration in case of fundamental changes, such as a major remodeling of the business model. Incremental changes, like introducing digital channels, are seen as exploitation (Hoessler & Carbon, 2024a). Digital transformation is a multifaceted and holistic business transformation (Chanias et al., 2019; Henriette et al., 2016; Hoessler & Carbon, 2022; Singh & Hess, 2020) and consists of elements of digitization and digitalization combined with leadership and change management (Gregory et al., 2019; Hoessler & Carbon, 2022; Leipzig et al., 2017). Therefore, seen as the phase with the highest digital maturity grade, it mainly includes explorative activities showing the overall revolutionary character of digital transformation. Nevertheless, it also consists of exploitative elements as a basis (Hoessler & Carbon, 2024a).

Aside from the impact, drivers and targets, activities and foci, and steering of exploration and exploitation, there are some fundamental principles leaders in digital transformation should apply (Hoessler & Carbon, 2024a). Digital literacy is essential for leaders in digital transformation, according to our interview results. This involves a basic understanding of digital technologies and following new market developments (Hoessler & Carbon, 2024a). Furthermore, the interview partners acknowledged the need to drive exploration and exploitation to succeed in digital transformation (Hoessler & Carbon, 2024a). Therefore, it is beneficial if leaders know the differences between exploration and exploitation and integrate this into the strategic framework (Hoessler & Carbon, 2024a). Referring to the literature review, which suggested the need to have a clear vision and strategy for digital transformation, the empirical study provided more in-depth insights into this (Anshin & Bobyleva, 2021; Cichosz et al., 2020; Hoessler & Carbon, 2022; Machado et al., 2021). Executive leaders should incorporate exploration and exploitation in their digital transformation strategy and enable operationalization by providing resources (Hoessler & Carbon, 2024a). Following the steering recommendations for exploration and exploitation derived from the interview results helps to provide a distinct target setting for the activities (Hoessler & Carbon, 2024a). With this knowledge, this empirical research added insights to the missing guidance on target setting, which was seen as one reason for falling behind expectations in digital transformation (Hess et al., 2016; Hoessler & Carbon, 2022). Despite this, there are sometimes tendencies toward one of the activities (Hoessler &

Carbon, 2024a). Therefore, it is recommended that leaders acknowledge those industry-driven or organization-driven tendencies (Hoessler & Carbon, 2024a). An example of an industry-driven tendency toward exploitation is a strong intensity of regulation in the healthcare industry (Hoessler & Carbon, 2024a). Furthermore, companies in industries with a higher degree of disruption might tend more to exploration (Hoessler & Carbon, 2024a). Another factor that can influence whether companies show tendencies is economic cycles. Especially in economic downturns, companies tend to lean towards cost savings and short-term oriented exploitation activities in digital transformation (Hoessler & Carbon, 2024a). The literature review identified differences associated with company size (Hoessler & Carbon, 2022). The performed empirical study could not validate size as a driving factor (Hoessler & Carbon, 2024a). Instead, how decisions are made in companies can influence exploration or exploitation tendencies (Hoessler & Carbon, 2024a). In addition, organizational structures, attitudes toward risk, legacies, available resources, and degree of diversification can impact companies' tendencies in exploring or exploiting in digital transformation.

5.3 Results of Paper 3

The results of the conducted literature review showed that the focus when combining the research streams ambidexterity and digital transformation is on structural ambidexterity (Hoessler & Carbon, 2022, 2024a; Holotiuk, 2020; Kaiser & Stummer, 2020; Raabe et al., 2020). Nevertheless, these research articles often neglected the differentiation between exploration and exploitation (Åkesson et al., 2018; Hoessler & Carbon, 2022, 2024a, 2024b; Margiono, 2021). This can lead to ineffectiveness, therefore, Paper 3 investigated how incumbent companies can utilize the concept of structural ambidexterity to steer digital transformation (Hoessler & Carbon, 2024b). It also addressed the gap that most authors consider separation in digital transformation, but did not directly refer to structural ambidexterity (Hoessler & Carbon, 2024b). Our results from the conducted semi-structured interviews were derived following the code development of Braun and Clarke (2006). We followed Gioia et al. (2013) to cluster our coding results into three aggregated dimensions, eight 2nd order themes, and 27 1st order concepts (Gioia et al., 2013; Hoessler & Carbon, 2024b). Figure 4 displays the summary of the results illustrating the driving factors for incumbent companies to

separate regarding exploration / exploitation or to apply the differentiation between digital / core business (Hoessler & Carbon, 2024b).

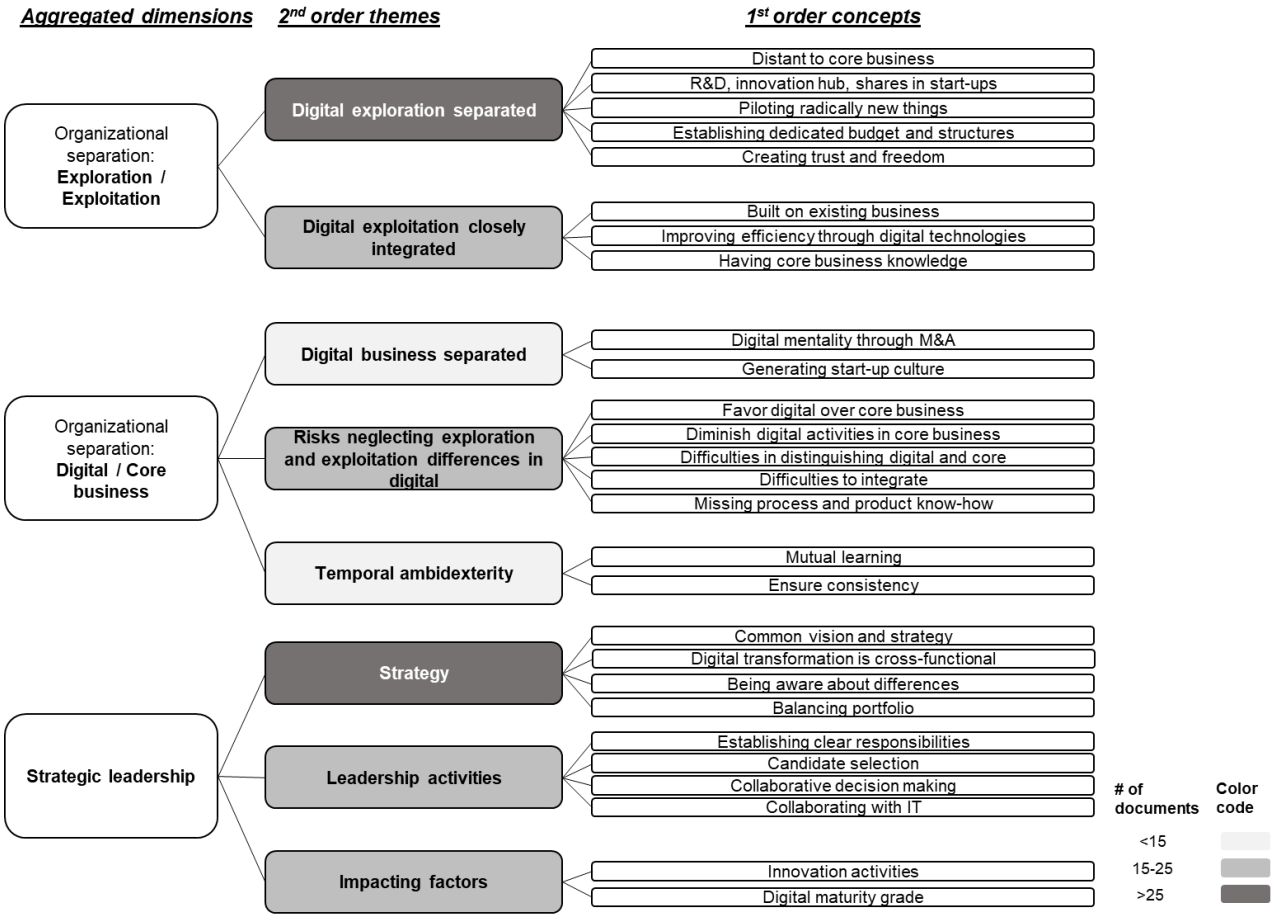

Figure 4 Structural ambidexterity in digital transformation (Hoessler & Carbon, 2024b)

Following the definition of March (1991) and separating exploration and exploitation, the study results showed that closeness to the existing core business is a decision-making factor (Hoessler & Carbon, 2024b). If digital exploration activities are distant from the core business, separating them with an exploration (digital) innovation hub or a research and development organization is recommended (Hoessler & Carbon, 2024b). The separation allows outside-the-box thinking and enables experimentation (Hoessler & Carbon, 2024b). Aside from internal separation, buying startup shares can allow digital exploration detached from the core business (Hoessler & Carbon, 2024b). Due to the differences in target setting, as described in the results of Paper 2, separated digital exploration units should have dedicated budgets and measurements (Hoessler & Carbon, 2024b). Flat hierarchies support flexibility and a trusted

atmosphere for employees to explore (Hoessler & Carbon, 2024b). Adhering to the same logic as when recommending separation, the study results advised integration if exploitation is closely connected to the core business (Hoessler & Carbon, 2024b). For example, when automating existing processes or digitizing existing products, the expertise of the existing is required, and integration is advised (Hoessler & Carbon, 2024b). The integration can be implemented through centralized departments, support functions, or direct integration into the business functions (Hoessler & Carbon, 2024b).

If incumbent companies want to create a digital mentality through mergers and acquisitions or to build a startup culture, internally separating all digital activities is a possible solution (Hoessler & Carbon, 2024b). Separation allows focusing on digital specifics undisturbed from daily activities (Hoessler & Carbon, 2024b). Nevertheless, there are risks if differences in exploration and exploitation in the digital context are neglected (Hoessler & Carbon, 2024b). The separated digital unit can be preferred over the existing core business due to being newer and more progressive (Hoessler & Carbon, 2024b). This can lead to tensions between the entities (Hoessler & Carbon, 2024b). Furthermore, if there are conflicts, the knowledge exchange required for exploitation in digital transformation is at risk. Therefore, if all digital activities are separated, there is a lack of core business advancement with the help of digital technologies (Hoessler & Carbon, 2024b). A low digital maturity grade is characteristic when companies begin the digital transformation journey. At that stage, they can clearly distinguish between digital and core business. Nevertheless, over time, this gets increasingly interwound and challenging to separate (Hoessler & Carbon, 2024b). Another risk of separating digital / core business is that new digital products must be integrated with the associated sales organization to leverage the potential, and expectations are not aligned (Hoessler & Carbon, 2024b). This results in the risk that the requirements for the core business are not met due to isolated workstreams (Hoessler & Carbon, 2024b). The described risk is strongly linked to the need for core business knowledge in digital exploitation (Hoessler & Carbon, 2024b).

Even if temporal ambidexterity is less mentioned, the study results indicated that shifting between a digital exploration unit and the core business could support mutual learning and effective integration of innovations (Hoessler & Carbon, 2024b). In case of a separation based on digital / core business, temporal ambidexterity could help to build a digital skill-set and reduce the risk of undermining digital activities in the

core business (Hoessler & Carbon, 2024b). Despite the positive aspects, it is important to have a consistent core team to assure efficiency in learning (Hoessler & Carbon, 2024b)

As it is a leadership responsibility to achieve ambidexterity (Alghamdi, 2018; Hoessler & Carbon, 2024b; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011), this dissertation also investigated strategic leadership aspects related to structural ambidexterity. One central theme is related to strategy. Senior leadership is responsible for integrating the digital transformation strategy into the company strategy. A clear vision, strategy, and continuous communication are important (Hoessler & Carbon, 2024b). As shown in the literature review, there is a highly influential role of senior leadership (Andriole, 2020; Bjoerkdahl, 2020; Cichosz et al., 2020; Hoessler & Carbon, 2022; Imran et al., 2021; Wrede et al., 2020). Therefore, top management should be acquainted with the knowledge of differences in exploration and exploitation in digital transformation. Furthermore, achieving an ambidexterity awareness of needing both activities and targeting a long-term balance is essential (Hoessler & Carbon, 2024b). Portfolio management is a suitable tool to balance the activities and ensure that the company has a balanced innovation portfolio within its digital transformation (Hoessler & Carbon, 2024b). Aside from setting the strategic framework, leaders are responsible for setting clear responsibilities and defining expectations for exploration and exploitation activities in digital transformation (Hoessler & Carbon, 2024b). Also, different required skill sets for exploration and exploitation must be considered when hiring (Hoessler & Carbon, 2024b). Collaborative decision-making strengthens ambidexterity and limits favoring one activity due to individual preferences. In addition, close collaboration with IT was also seen as important to advance digital literacy (Hoessler & Carbon, 2024b).

As only a few studies focused on changes over time regarding structural ambidexterity (Åkesson et al., 2018; Göbeler et al., 2020; Hoessler & Carbon, 2024b; Hron et al., 2021; Svahn et al., 2017), the study provided additional guidance for incumbent companies in digital transformation. Innovation can be split into innovation phases. An innovation starts with exploration and develops into exploitation, and therefore justifies a basic amount of collaboration between exploration and exploitation, especially when linked to the core business (Hoessler & Carbon, 2024b). Furthermore, the change from exploration to exploitation can be seen as a prompt to

integrate into the core business in case of prior separation (Hoessler & Carbon, 2024b). Aside from the innovation phase, companies' digital maturity grade can trigger organizational set-up changes (Hoessler & Carbon, 2024b). In the early stages, the need to build up a digital mindset is higher and justifies a digital unit. With a growing maturity grade, there is an increasing interest from the core organization in using exploitation in the digital context to improve, and integration becomes more suitable (Hoessler & Carbon, 2024b). Overall, there are reasons for separating digital / core business and exploration / exploitation. Combining this with the identified risks and the impacting factors, such as digital maturity grade, helps to guide leaders to monitor those and decide on separation / integration (Hoessler & Carbon, 2024b).

Figure 5 integrates the recommendations of our study results on structural and temporal ambidexterity in digital transformation into a decision tree. This allows practitioners to have a guiding framework for navigating digital transformation, considering organizational structures to support their goals (Hoessler & Carbon, 2024b). Leaders are advised to consider the digital maturity grade as a first decision-making criterion for organizational structures. Secondly, the focus and characteristics of the digital transformation activities need to be reviewed to select the fitting organizational structure. Furthermore, the decision tree provides suggestions on how organizational structures can be supplemented with forms of temporal ambidexterity (Hoessler & Carbon, 2024b).

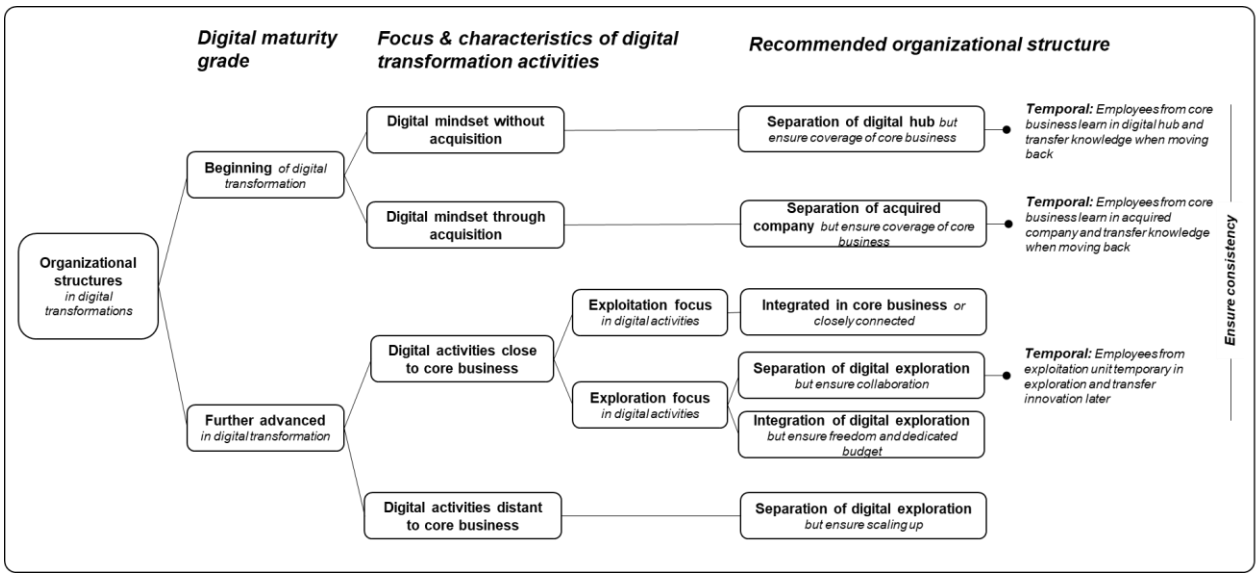

Figure 5 Decision tree on structural and temporal ambidexterity adapted based on Hoessler and Carbon (2024b)

5.4 Synthesis of research results

Despite the individual character of the three research articles, I addressed with all of them my overarching research topic on digital transformation of incumbent companies and ambidexterity. Reviewing the results, four overarching areas can be identified. Firstly, the study results showed that digital transformation includes elements of exploration and exploitation. Secondly, it requires leadership for digital transformation (Faix, 2020) and ambidexterity in digital transformation. Thirdly, structural ambidexterity was the most commonly mentioned concept associated with ambidexterity in the digital context. Finally, the dissertation identified decision-making factors helping to guide leaders in incumbent companies to apply structural ambidexterity to drive digital transformation journeys. Figure 6 combines the four focus areas into a cohesive whole.

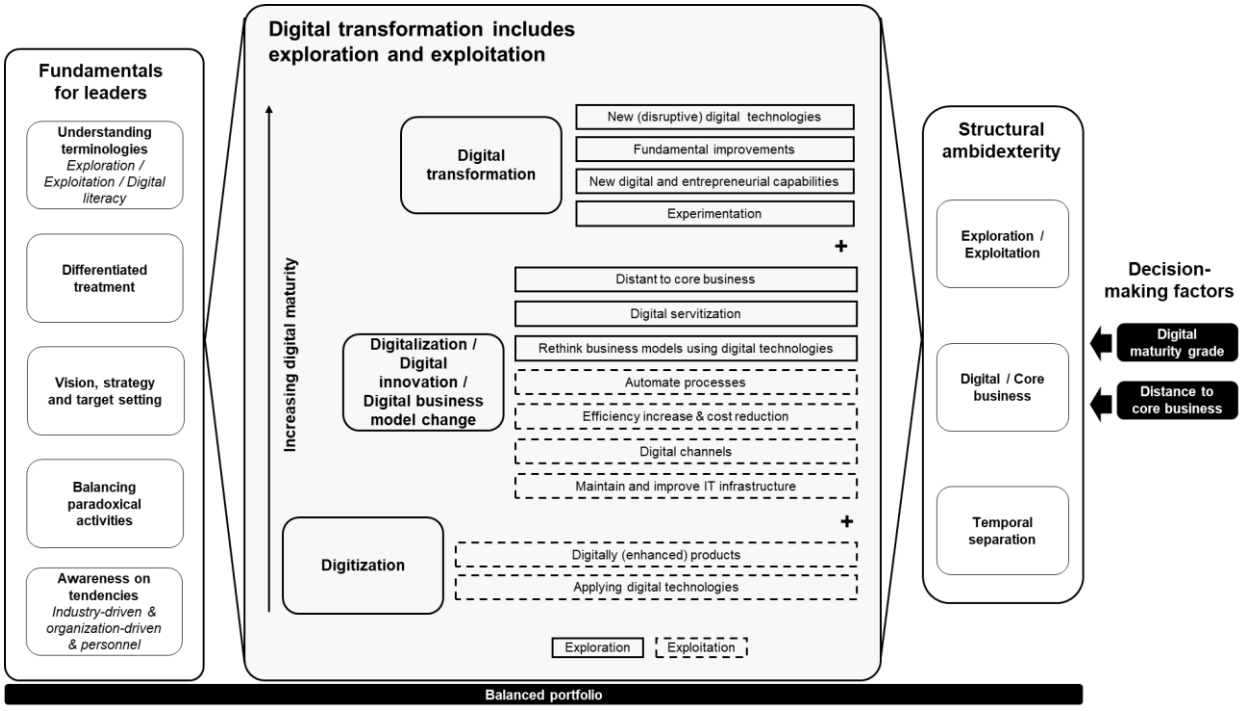

Figure 6 Digital transformation and ambidexterity in incumbent companies adapted based on Hoessler and Carbon (2024b)

As Paper 1 targeted to identify exploration and exploitation elements in digital transformation, the results were also clustered from an exploration / exploitation perspective (Hoessler & Carbon, 2022). Therefore, I used semi-structured interviews to map exploration and exploitation elements to the terminologies used in the digital

context (Hoessler & Carbon, 2024a). With this, the limitations of a literature review could be overcome, and exploration and exploitation activities could be put into the context of how leaders in incumbent companies are confronted with it. I adapted the illustration of the digital transformation phases of Hoessler and Carbon (2022) by integrating the learnings from the literature review and the empirical study results (Hoessler & Carbon, 2022, 2024a). The middle part of Figure 6 illustrates the exploration and exploitation elements of the digital transformation phases, considering an increasing digital maturity.

Ambidexterity is managing those paradoxical exploration and exploitation activities (Duncan, 1976; Hoessler & Carbon, 2022, 2024b; Michael. Tushman & O'Reilly III, 1996). It is leadership responsibility to drive necessary change (Heilemann & Faix, 2023) for digital transformation (Hensellek, 2020; Hoessler & Carbon, 2024b) and apply ambidexterity enabling leadership (Alghamdi, 2018; Hoessler & Carbon, 2024b; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011; Probst et al., 2011). All three published papers showed the need for leaders to have an active role and guide digital transformation and ambidexterity (Hoessler & Carbon, 2022, 2024a). Leaders steering digital transformations in incumbent firms must understand the related terminologies (Hoessler & Carbon, 2024a, 2024b). One aspect is basic knowledge of digital technologies and staying connected regarding new developments (Hoessler & Carbon, 2024a). Paper 3 detailed this by recommending a close collaboration with the IT department to stay informed (Hoessler & Carbon, 2024b). Another aspect is that leaders need to be acquainted with differences in exploration and exploitation (Hoessler & Carbon, 2022, 2024a, 2024b). Paper 2 emphasized the need for executive leadership to understand differences and communicate them to lower leadership levels (Hoessler & Carbon, 2024a). Also, the findings in Paper 1 supported the described requirement by stating the influence of senior leadership (Ceipek et al., 2021; Hoessler & Carbon, 2022; Soluk & Kammerlander, 2021). Nevertheless, knowing the differences is not sufficient. Leaders need to derive distinct operationalizations for both activities (Hoessler & Carbon, 2024a). This includes, for example, considering the required skills when hiring (Hoessler & Carbon, 2024b) and ensuring positioning people with the appropriate skills into the fitting position (Becker & Schmid, 2020; Hoessler & Carbon, 2022). From a strategic leadership perspective, all three papers called for the development of a digital transformation strategy

(Hoessler & Carbon, 2022, 2024a, 2024b) and to integrate it into the corporate strategy (Anshin & Bobyleva, 2021; Hoessler & Carbon, 2022; Martincevic & Kozina, 2021). Determining clear goals for digital transformation (Ahmad et al., 2021; Cichosz et al., 2020; Hoessler & Carbon, 2022; Machado et al., 2021) and a vision is important (Hoessler & Carbon, 2022, 2024b). Despite emphasizing the importance of a vision and strategy, Papers 1 and 2 lacked the idea that the targeted exploration and exploitation elements should be part of the strategy (Hoessler & Carbon, 2024b). Aside from the differentiated treatment, leaders need to balance exploration and exploitation to ensure the long-term orientation of digital transformation (Hoessler & Carbon, 2022, 2024b). Paper 3 detailed the balancing with portfolio management, assuring the targeted activities are included in the strategy (Hoessler & Carbon, 2024b). Due to limited resources or economic difficulties, the portfolio can change over time and does not consist of the same amount of exploration and exploitation activities (Hoessler & Carbon, 2024b). Nevertheless, leaders need to be aware of industry-driven and organization-driven tendencies influencing their views (Hoessler & Carbon, 2024a).

The central concept of achieving ambidexterity, whether looking into digital vs. core business or exploration vs. exploitation, discussed in the digital context is structural ambidexterity. The study results of Paper 3 showed that leaders need to take the digital maturity grade, the closeness to the core business, and whether the activities are exploration or exploitation into consideration when deciding on separation or integration (Hoessler & Carbon, 2024b). A flexible team structure, but ensuring a consistent core team, allows for mutual learning and better exchange in case of separation. This can apply to separating exploration / exploitation and digital / core business (Hoessler & Carbon, 2024b) and is associated with temporal ambidexterity (Holotiuk & Beimborn, 2019).

Overall, Figure 6 illustrates the cohesive outcome of the three individual papers contributing to the overarching research on digital transformation and ambidexterity of incumbent companies. It emphasizes the exploration and exploitation elements in digital transformation, the role of the leaders, and ways to achieve structural ambidexterity and a long-term balanced portfolio (Hoessler & Carbon, 2022, 2024a, 2024b).

6 Discussion

The rise of digital technologies is not only a disruption threat to incumbent companies (Klos et al., 2021; Zhang et al., 2023) but also provides major opportunities for them (Klos et al., 2021; Llopis-Albert et al., 2021). Despite incumbent companies' growing digital transformation initiatives (Gurumurthy et al., 2020), many lack success and fall behind expectations (Gebauer et al., 2020; Meier et al., 2025). Therefore, the target of the dissertation was to provide insights for incumbent companies to overcome those challenges. One major challenge is linked to limiting digital transformation to the technology aspect or having a too broad view, missing to consider the complex character of digital transformation (Kahveci, 2025; Kreiterling, 2023; Shahi & Sinha, 2021) and the associated activities (Hoessler & Carbon, 2024a, 2024b; Tolboom, 2016). This research on digital transformation and ambidexterity of incumbent companies addresses this research gap by providing distinct knowledge on exploration and exploitation in digital transformation (Hoessler & Carbon, 2022, 2024a). Whereas Paper 1 provided already clear differentiation between exploration and exploitation regarding impact, targets and drivers and activities and foci, it lacks empirical evidence (Hoessler & Carbon, 2022) like the majority of existing studies (Hoessler & Carbon, 2024a; Holotiuk & Beimborn, 2019; Jafari-Sadeghi et al., 2021; Nwankpa & Datta, 2017; Princes, 2019; van den Buuse et al., 2021). Paper 2 eliminated this gap using empirical contributions. Furthermore, this research guides practitioners as the perspective is shifted to provide more insights about the different digital transformation phases. This dissertation reveals that the overarching digital transformation journey includes elements of exploration and exploitation (Hoessler & Carbon, 2024a). Whereas activities related to a lower digital maturity grade are associated with exploitation, exploration activities such as fundamentally reassessing existing business models using digital technologies are integrated with a rising digital maturity grade (Hoessler & Carbon, 2024a). Based on existing research, activities related to higher value-added and extension activities in digital transformation are not distinguishable from an exploration and exploitation perspective (Hoessler & Carbon, 2024a; Holotiuk & Beimborn, 2019). This dissertation shows that the degree of change and impact allows for differentiation (Hoessler & Carbon, 2024a). Furthermore, this dissertation helps to gain additional insights into various steering mechanisms (Hoessler & Carbon, 2024a). Using quantitative targets to measure and steer

exploitation in digital transformation and applying alternative measurements for exploration ensures continuous tracking (Hoessler & Carbon, 2024a). Those insights help to overcome the barrier to successful digital transformation related to missing clear objectives (Hess et al., 2016; Mirković et al., 2019b). Also, the relevance of those insights can be seen in the recommendation of Shahi and Sinha (2021) to have clear goals to overcome challenges in the digital transformation of manufacturing companies. Another major challenge for incumbent companies is the lack of a vision and strategy (Shahi & Sinha, 2021), which provides guidance and shows leadership commitment (Favoretto et al., 2022). All three papers addressed the importance of strategic leadership (Hoessler & Carbon, 2022, 2024a, 2024b). Whereas the existing literature focused on the general need to provide a vision and strategy (Berghaus & Back, 2016; Brown & Brown, 2019; Hoessler & Carbon, 2022; Niemand et al., 2021), this dissertation adds more specifics by recommending having exploration and exploitation elements included (Hoessler & Carbon, 2024a) and use portfolio management to ensure a long-term orientation of the digital transformation strategy (Hoessler & Carbon, 2024b). Another challenge incumbents face regarding digital transformation is associated with organizational structures (Bjoerkdahl, 2020; Hoessler & Carbon, 2024b; Mirković et al., 2019a). This explains why structural ambidexterity in literature combining digital transformation and ambidexterity receives the highest attention (Hoessler & Carbon, 2024b; Holotiuk, 2020; Raabe et al., 2020). Nevertheless, reviewing the existing literature body, the present research identified a gap in the clear distinguishment of exploration / exploitation in structural ambidexterity (Hoessler & Carbon, 2024b). Also, it is linked mainly to one specific industry, neglecting an overarching view (Hoessler & Carbon, 2024b). Therefore, the scientific contribution of this dissertation is that it provides details on separation in digital transformation using exploration / exploitation or digital / core business as separation criterion (Hoessler & Carbon, 2024b). The study results revealed that exploration / exploitation and digital / core business are not the only relevant decision-making criteria. However, the distance to the core business and digital maturity grades are relevant (Hoessler & Carbon, 2024b). Whereas Sia et al. (2021) suggest integrating automation, this dissertation confirms this but expands it to all exploitation activities and provides reasoning (Hoessler & Carbon, 2024b). Aside from an organizational separation using exploration / exploitation as a criterion, existing literature often considers digital / core business as the separation criterion (Åkesson et al., 2018;

Göbeler et al., 2020; Holotiuk, 2020; Smith & Beretta, 2021). While existing literature only stated the separation of a digital unit or digital innovation lab (Kaiser & Stummer, 2020; Sund et al., 2021), the study results reveal that establishing a digital mindset or a start-up culture can be achieved by separating all digital activities (Hoessler & Carbon, 2024b). Despite the reasons for separating everything related to digital, there are risks associated with it, and leaders should be aware of them (Hoessler & Carbon, 2024b). As stated earlier, the connection to the core business is essential for digital exploitation. This aligns with the study of Lohoff et al. (2025), emphasizing the need for collaboration. Separating all digital activities could lead to neglecting digital activities in the core business (Hoessler & Carbon, 2024b). Especially with an increasing digital maturity grade, the separation between digital / core business becomes more difficult as the areas will be increasingly intertwined (Hoessler & Carbon, 2024b). Therefore, with an increasing digital maturity grade, activities closely linked to the core business should be integrated, and the ones distant from it should be separated (Hoessler & Carbon, 2024b). There are two options for digital exploration activities directly connected with the core business. Either separate digital exploration activities and ensure collaboration with the core business, or integrate but provide enough freedom and dedicated budgets (Hoessler & Carbon, 2024b). This suggests that there is no one solution fits all concept, and impact factors such as digital maturity grade and closeness to the business need to be considered for deciding regarding separation / integration (Hoessler & Carbon, 2024b). Therefore, the results are aligned with the existing literature stating that separation can be a temporary solution (Åkesson et al., 2018; Göbeler et al., 2020; Hoessler & Carbon, 2024b; Hron et al., 2021; Svahn et al., 2017) but provide more insights into what influences the changes.

The developed decision tree guides practitioners. It allows them to navigate the challenges of structure and addresses the ambidexterity in digital transformation. Building on the literature of ambidexterity in the digital context, this dissertation confirms that temporal ambidexterity, described by Holotiuk and Beimborn (2019), can support mutual learning. In addition, consistency in the team setup is required to ensure efficiency. Temporal ambidexterity can be used when exploration / exploitation is the separation criterion as well as digital / core business (Hoessler & Carbon, 2024b).

7 Limitations and future research implications

Whereas this dissertation followed scientific rigor, it still has some methodological limitations. The results of Paper 1 are based on a search that included the term digital transformation and terms such as digitalization (Hoessler & Carbon, 2022). Without the distinction, it was not possible to specify which exploration and exploitation activities are associated with which phase in digital transformation. This dissertation overcomes this shortfall by expanding it with the research in Paper 2, focusing on digital transformation overall and mapping the results to the model developed by Hoessler and Carbon (2022). Nevertheless, individual studies focusing on specific digital maturity grades and individual stages of digital transformation could provide more granularity. Especially, a longitudinal study could provide insights into changes over time. Another shortcoming of the literature review, which forms the foundation of the overall research, is that only one researcher performed the review process and the coding. Having a clearly defined review process, including exclusion criteria and transparency about additionally added articles and the sources where they were cited, limited the implications (Hoessler & Carbon, 2022). Furthermore, the findings of a literature review are always based on existing knowledge, which is suitable for combining individual research streams but lacks empirical evidence (Hoessler & Carbon, 2022). Therefore, I expanded and enhanced the research on the digital transformation of incumbent companies and ambidexterity by integrating qualitative research (Hoessler & Carbon, 2024a, 2024b). The purposive sampling of 33 interview partners ensured that the study participants had experience in the research topic. Also, different hierarchy levels and industries were included to address the limitations of existing research on focused industries (Hoessler & Carbon, 2024a, 2024b). Even though this addresses a research gap, there is a potential that industry-specific insights are missed due to the broad focus. Despite describing how code saturation was achieved, this dissertation did not consider hierarchy levels or industries but focused on the complete sample size. This could have influenced the results as code saturation could have been achieved early (Hoessler & Carbon, 2024b). Based on the risk of missing industry specifics and how code saturation was achieved, I recommend further studies considering hierarchy level, industry, and incorporating the digital maturity grade for achieving code saturation to identify differences within the digital transformation journey on an in-depth level (Hoessler & Carbon, 2024b). Whereas this

dissertation provided transparency on the coding process, including building 1st order concepts, 2nd order themes, and aggregated dimensions (Gioia et al., 2013; Hoessler & Carbon, 2024a, 2024b), only one researcher conducted the coding process. To address this potential analysis bias, a second researcher in a supervisory role was included in the research process for an intercoder check (Hoessler & Carbon, 2024a, 2024b). Despite an anonymity guarantee for the interview partners, there remains a small risk of interviewee bias impacting the study results (Hoessler & Carbon, 2024b). Also, interpersonal dynamics between the researcher conducting the interview and the interviewee can influence the study's outcome (Hoessler & Carbon, 2024b). Using semi-structured interviews with an interview guide mitigated this limitation of the applied research design (Hoessler & Carbon, 2024b).

Aside from methodological limitations, I see the need for follow-up research based on my dissertation. Several studies provide evidence that ambidexterity is positively affecting a company’s performance (Birkinshaw & Gibson, 2004b; O'Reilly III & Tushman, 2013) by, for example, supporting the development of new products (Del Giudice et al., 2021; Katila & Ahuja, 2002) or achieving growth targets (Del Giudice et al., 2021; He & Wong, 2004). Nevertheless, only limited research provides evidence of this in the context of digital transformation (Del Giudice et al., 2021). Only individual research, such as the work of Del Giudice et al. (2021), shows ambidexterity’s positive effect on digital innovation (Hoessler & Carbon, 2024b). This study also has limitations, such as focusing on the Italian context and small and medium-sized companies (Del Giudice et al., 2021), so further empirical studies are desirable. Based on this research on the digital transformation of incumbent companies and ambidexterity, future research should test the hypothesis of a positive relationship between organizational ambidexterity and digital transformation. I suggest having a sub-hypothesis considering digital maturity grades. This could provide empirical evidence for the underlying assumption of this study. Furthermore, Del Giudice et al. (2021) investigate organizational ambidexterity, not structural in particular, which could be a potential for further research. In addition, according to this research, exploration and exploitation are relevant in the digital transformation of incumbent companies. This can be linked to the understanding that exploration and exploitation are complementary (Bierly III & Daly, 2007; Coreynen et al., 2020; Hoessler & Carbon, 2024a). Therefore, I suggest building on this research and

combining it with the research stream on innovation phases to get more distinct knowledge on separation / integration of digital exploration activities close to the core business (Hoessler & Carbon, 2024b). In addition, the study results of Coreynen et al. (2020) show an exponential effect of exploration on digital servitization when achieving a medium level of exploitation. Therefore, I suggest further quantitative studies investigating the effect of exploration and exploitation depending on the intensity, the associated maturity grade, and the overall impact on digital transformation and associated company performance. As this research is focused on organizational ambidexterity as well as the specific concept of structural ambidexterity combined with temporal ambidexterity, I see the need to expand the research investigating contextual ambidexterity and combine it with hybrid ambidexterity (Hoessler & Carbon, 2024b).

Whereas this research guides leaders in digital transformations in incumbent companies about steering exploration and exploitation, additional research on leadership skills could be built on those results. This can be brought into context with developing required skills and hiring for open leadership positions. Additional insights into this subject could be additional managerial contributions. Further scientific insights could result from researching the impact of elements of leadership styles, like transactional or transformational leadership (Bass, 1990; Tagscherer & Carbon, 2025) on exploration and exploitation in digital transformation. Furthermore, this dissertation focused more on the strategic leadership aspect, as digital transformation is seen as a holistic concept. Nevertheless, further research on more individual-oriented leadership at the employee level could gain more insights into the steering. An example is understanding employees' motivation for the respective activities better. In addition, as this dissertation illustrates the importance of leadership in digital transformation and ambidexterity, I see further potential to better understand how leadership promotes ambidextrous capabilities (Hoessler & Carbon, 2024b). This can be of interest, especially in the context of contextual ambidexterity. Even though agility is often associated with digital innovation (Chan et al., 2019; Cichosz et al., 2020; Hoessler & Carbon, 2022; Imran et al., 2021; Mustafa et al., 2022; Smith & Beretta, 2021), there is a lack of differentiation between exploration and exploitation (Hoessler & Carbon, 2022). Also, this research supports organizational agility but is lacking in terms of the required conditions and activities.

As this dissertation is limited to incumbent companies, similar studies focusing on public organizations like schools or hospitals could provide overlaps or differences and address the impact of digital transformation in multiple areas. Furthermore, as this dissertation identified the need to be aware of organizational-driven tendencies (Hoessler & Carbon, 2024a), I suggest adding clustering of the study participants for a future study. Including organizational forms or decision-making models in companies could provide valuable distinguishing factors.

8 Conclusion

This dissertation on digital transformation of incumbent companies and ambidexterity aims to provide insights for incumbent companies to overcome challenges in their digital transformation journey. Consisting of a literature review of 94 articles and semi-structured interviews, this dissertation addresses the research gap on the missing differentiation of exploration and exploitation in digital transformation, as well as guidance on separation or integration regarding structural ambidexterity in digital transformation. This research reveals that digital transformation is a holistic concept that includes exploration and exploitation elements. The differentiation criteria of exploration and exploitation are different impacts, targets and drivers, activities, and foci. Based on this, awareness of the differences and differentiated treatment and steering are essential for leaders in digital transformation of incumbent companies. With the decision tree for leaders of incumbent companies, the managerial contribution is to provide guidance on separation / integration. The digital maturity grade, the closeness to the existing business, and whether the activities are associated with exploration or exploitation drive the decision on separation / integration. Overall, this dissertation's scientific contributions are insights into combining two research streams that have been looked at vaguely together but not in a focused manner. Focusing on the main challenges of incumbent companies in digital transformation, such as the complex character of it, missing targets and strategies, and organizational structures, this dissertation combines scientific contributions and managerial ones within this research, which synthesizes digital transformation and ambidexterity.

CRediT author statements

My dissertation on digital transformation and ambidexterity is based on three peer-reviewed research papers. The CrediT author statements per research article are shown in Table 4. Individual contributions of the first author Hoessler, S. (now Tagscherer, S. after name change because of marriage) and Carbon, C.C. are outlined in the table.

Table 4 CRediT author statements

Paper	**Contribution Hoessler, S.**	**Contribution Carbon, C.C.**
Paper 1: Hoessler, S., & Carbon, C.-C. (2022). Digital transformation and ambidexterity: A literature review on exploration and exploitation activities in companies' digital transformation. International Journal of Innovation Management, 26(08), 2230003-1 - 2230003-54. https://doi.org/10.1142/S1363919622300033 *Preprint of an article published in [International Journal of Innovation Management, Vol. 26, No. 08, 2022, 54 Pages] [DOI: 10.1142/S1363919622300033] © [copyright World Scientific Publishing Company] [https://www.worldscientific.com/worldscinet/ijim]*	Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration	Conceptualization, Methodology, Validation, Formal analysis, Writing - Review & Editing, Visualization, Supervision, Project administration
Paper 2: Hoessler, S., & Carbon, C.-C. (2024a). Digital transformation in incumbent companies: a qualitative study on exploration and exploitation activities in innovation. Journal of Innovation and Entrepreneurship, 13(1), 1–31. https://doi.org/10.1186/s13731-024-00404-5	Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration	Conceptualization, Methodology, Validation, Formal analysis, Writing - Review & Editing, Visualization, Supervision, Project administration
Paper 3: Hoessler, S., & Carbon, C.-C. (2024b). Guiding incumbent companies in navigating digital transformations: A qualitative study on structural ambidexterity and strategic leadership. Journal of Entrepreneurship, 20(4), 49–72. https://doi.org/10.7341/20242043	Conceptualization, Methodology, Formal analysis, Investigation, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration	Conceptualization, Methodology, Validation, Formal analysis, Writing - Review & Editing, Visualization, Supervision, Project administration

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Appendix

Paper 1

International Journal of Innovation Management

Digital transformation and ambidexterity: A literature review on exploration and exploitation activities in companies' digital transformation

--Manuscript Draft--

Manuscript Number:	
Full Title:	Digital transformation and ambidexterity: A literature review on exploration and exploitation activities in companies' digital transformation
Article Type:	Review
Keywords:	digital transformation; digitalization; ambidexterity; exploration; exploitation
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Abstract:	One major challenge in the industries is digital transformation. Ambidexterity, the ability to optimize the existing and innovate new business concepts, is widely accepted as a critical concept of sustainable success. We conducted a literature review (period from 2010 to 2021) on what differential aspects of exploration and exploitation are needed to lead a digital transformation. With the help of a structured selection process, we identified 94 relevant papers. Our findings show that all reviewed articles on digital transformation contain aspects of exploration and exploitation, often without deep specifications. We reveal that structural ambidexterity, leadership, and collaboration are the focus areas related to ambidexterity in digital transformation. Digital transformations fail by not achieving the intended innovation income resulting from inadequate key performance indicators and focusing on short-term profitability. Our findings provide first insights but need additional empirical research for validation and more detailed knowledge on ambidexterity in digital transformation.

Digital transformation and ambidexterity: A literature review on exploration and exploitation activities in companies' digital transformation

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Digital transformation and ambidexterity

Abstract

One major challenge in the industries is digital transformation. Ambidexterity, the ability to optimize the existing and innovate new business concepts, is widely accepted as a critical concept of sustainable success. We conducted a literature review (period from 2010 to 2021) on what differential aspects of exploration and exploitation are needed to lead a digital transformation. With the help of a structured selection process, we identified 94 relevant papers. Our findings show that all reviewed articles on digital transformation contain aspects of exploration and exploitation, often without deep specifications. We reveal that structural ambidexterity, leadership, and collaboration are the focus areas related to ambidexterity in digital transformation. Digital transformations fail by not achieving the intended innovation income resulting from inadequate key performance indicators and focusing on short-term profitability. Our findings provide first insights but need additional empirical research for validation and more detailed knowledge on ambidexterity in digital transformation.

Keywords: digital transformation, digitalization, ambidexterity, exploration, exploitation

1 Introduction

The recent developments in digital technology drive current innovation activities. Companies face a change driven by those new technological opportunities (Verhoef et al., 2021; Wirtz et al., 2010). They are now operating in an environment highly impacted by fast-changing digital technology and must strive for innovation (Bughin et al., 2016; Fitzgerald et al., 2013; Yoo et al., 2012). Most companies who can call themselves digital are young and small companies acting in already digitally infused industries. However, well-established, larger corporations serving traditional markets also need to find a way to digitally transform (Westerman & Bonnet, 2015). The COVID-19 pandemic is one of the most recent developments showing the high uncertainty and change businesses face. An Executive survey on digital transformation conducted by Deloitte 2021 proves that companies that successfully master digital transformation show higher levels of success in times of rapid change. The survey results show that nearly two-thirds of commercial respondents believe digital transformation will determine companies' future success and survival in the next five years. The main rationales for companies to engage in digital transformation are, therefore to become more resilient and be able to innovate faster (Gurumurthy et al., 2021). Another recent study supports the focus of companies on digital transformation. 52% of the questioned companies intend to reduce investments due to the COVID-19 pandemic, but only 9% plan to cut budgets for digital transformation projects (Appio et al., 2021; Puthiyamadam et al., 2020). This can be linked to the increasing need to be resilient and to be able to succeed in rapid change. The question is not whether companies attempt to digitize but how they embrace the transformation (Hess et al., 2016).

As the digital transformation within companies can contain radical and incremental aspects (Ismail et al., 2017; Matt et al., 2015), digital transformation can be connected to the concept of exploration and exploitation and the combination of both, referred to as ambidexterity. Innovations driven by exploration are of a more radical nature and address new customers or markets (Abernathy & Clark, 1985; Benner & Tushman, 2002). In contrast, innovations resulting from exploitative activities are incremental, extend current knowledge, and seek greater efficiency and improvements (Abernathy & Clark, 1985;

Andriopoulos & Lewis, 2009). Based on Duncan (1976), who introduced the technical term ambidexterity, ambidexterity means handling today's business demands but also accommodating to new developments in the environment (Birkinshaw & Gibson, 2004a; Duncan, 1976; Gibson & Birkinshaw, 2004; Tushman & O'Reilly III, 1996). Empirical research provides evidence that ambidexterity is positively associated with growth, innovation success, financial performance, and long-time existence (O'Reilly III & Tushman, 2013). Therefore, it can be justified to look at digital transformation in the context of ambidexterity. Existing scientific research provides insights into definitions, elements, processes, and challenges of digital transformation. However, no known research is available on a structured review on exploration and exploitation in digital transformation. This would benefit scientific and business audiences as March (1991) proposes that exploration and exploitation are two different learning activities that require different capabilities and resources (Del Giudice et al., 2021; R. W. Gregory et al., 2015; Smith & Beretta, 2021; Soule et al., 2016). It has not been analyzed in a literature review whether aspects of being ambidextrous are considered within digital transformation research.

With the present study, we, therefore, aimed to address the following research questions:

How does scientific research on digital transformation consider characteristics of exploration and exploitation?

What aspects of ambidexterity are present in scientific research on digital transformation?

We decided to focus on these two research questions as the themes of exploration and exploitation and ambidexterity are closely interconnected and should be looked at together but are still two different concepts. A systematic literature review is used to answer the outlined research questions. This method is applied as there is already research on digital transformation, exploration, exploitation, and ambidexterity, but those research topics have never been combined (Okoli & Schabram, 2010).

2 Theoretical background

2.1 Digital Transformation

Digital technologies and digitization

The creation of digital technologies characterizes the beginning of the digital era (Tekic & Koroteev, 2019). Since then, the performance of digital technologies has continually improved (Tekic & Koroteev, 2019). Even if there is no unique definition for digitization, most authors refer to the technical process of "encoding of analog information into a digital" (Yoo, Henfridsson, & Lyytinen, 2010, p. 725) format with the help of digital technologies. Physical assets become digitally enhanced or fully digital artifacts by embedding digital technologies (Bican & Brem, 2020; Schallmo & Williams, 2018). Digital technologies generate new opportunities for companies to create value (Briel et al., 2018; F. Li, 2020). Therefore, digital technologies are both the outcome and the baseline for developing digital innovations (Ciriello et al., 2018; Yoo, Henfridsson, & Lyytinen, 2010).

Digitalization, Digital Innovation, and digital business model change

The terms digitization and digitalization are often used to describe the same (Schallmo et al., 2017). In the present paper, we will distinguish between digitization and digitalization mainly because digitization refers to the pure technical process of "encoding of analog information" (Yoo, Henfridsson, & Lyytinen, 2010, p. 725). Digitalization, in contrast, goes beyond pure technology (Tilson et al., 2010; Yoo, Lyytinen, et al., 2010). According to Gartner's IT glossary, digitalization "provide[s] new revenue and value-producing opportunities" (Gartner, 2021). Digitalization enables, improves, and transforms business operations, processes, and activities by leveraging digital technologies (Sousa & Rocha, 2019). The outcome can be automated, extended, or substituted operations, processes, and activities (F. Li, 2020).

Digital innovation is similarly defined as digitalization. Yoo, Henfridsson, and Lyytinen (2010, p. 725) adhere to Schumpeter's definition of digital innovation as "the carrying out new combinations of digital and physical components to produce novel products." More recent definitions do not limit digital innovation to products. Instead, they define it as the creation of market offerings and business processes (Brown & Brown; Hinings et al., 2018). In contrast to digitalization, digital innovation can also describe the outcome of innovation (Nambisan et al., 2017).

Bringing digitalization and digital innovation in context with digital technologies, digitization is necessary but insufficient (Yoo, Henfridsson, & Lyytinen, 2010).

Another term in the existing literature is digital business model change (Veit et al., 2014). The necessary change can be split into three broad categories automation, extension, and transformation (Cavalcante et al., 2011; F. Li, 2020). Based on these definitions, digital business model change can be interchangeably used with digitalization.

Digital transformation

Various definitions of digital transformation are present in the scientific literature (Schallmo et al., 2017; Ziyadin et al.). Our paper focuses on the main similarities and combines them into one definition. Digital transformation is a holistic form of business transformation made possible by digital technologies (Chanias et al., 2019; Henriette et al., 2016; Singh & Hess, 2020). It affects all company areas and is not limited to one function (Porfírio et al., 2021). Digital transformation enables companies to gain a competitive advantage (Fitzgerald et al., 2013; Liu et al., 2011; Moreira et al., 2018). Pihir et al. (2018) grouped the changes driven by digital transformation into three stages: Substitution, extension, and transformation.

Whereas the result of the process of digital transformation has a radical and disruptive change character (Berghaus & Back, 2016; Nambisan et al., 2019), the journey can include both innovations of explorative or exploitative nature (Berghaus & Back, 2016; Henriette et al., 2016; Pihir et al., 2018). Leaders must balance explorative and exploitative digital innovations (Hess et al., 2016). Digitization, digitalization, and digital transformation are often described as the three stages of digital transformation (Verhoef et al., 2021). Digital transformation of a company can be seen as a journey (Porfírio et al., 2021) that can be evolutionary or revolutionary (Goerzig & Bauernhansl, 2018).

However, digital transformation cannot be limited to technology. Instead, and importantly, it also impacts the organization itself (Hinings et al., 2018). Strategic and cultural changes are associated (R. Gregory et al., 2019; Leipzig et al., 2017) as it affects multiple business dimensions (Azhari et al., 2014; Ismail et al., 2017; Sainger, 2018; Vukšić et al., 2018).

Digital Business Strategy and Digital Transformation Strategy

Based on the growing attention to digital technologies, companies combine information technology and business strategies resulting in the so-called digital business strategies

(Bharadwaj et al., 2013; Brown & Brown). While a digital business strategy describes the company's digital future state, it does not guide achieving this target status (Brown & Brown; Hess et al., 2016). Digital transformation strategy describes exploring and exploiting digital technologies (Ismail et al., 2017; Matt et al., 2015).

Figure 1 summarizes the different stages of digital transformation, i.e. digitization, digitalization, digital innovation, digital business model change, digital business strategy, digital transformation, and digital transformation strategy. Digitization is the first stage of digital transformation, starting with encoding analog information with digital technologies. The results of Stage I go into digitalization, where business operations, processes, or activities are enabled, improved, or transformed using digital technologies, leading to digital innovation. When digital innovation is connected with management, leadership, and people and affects the whole company, this can be defined as Stage III digital transformation.

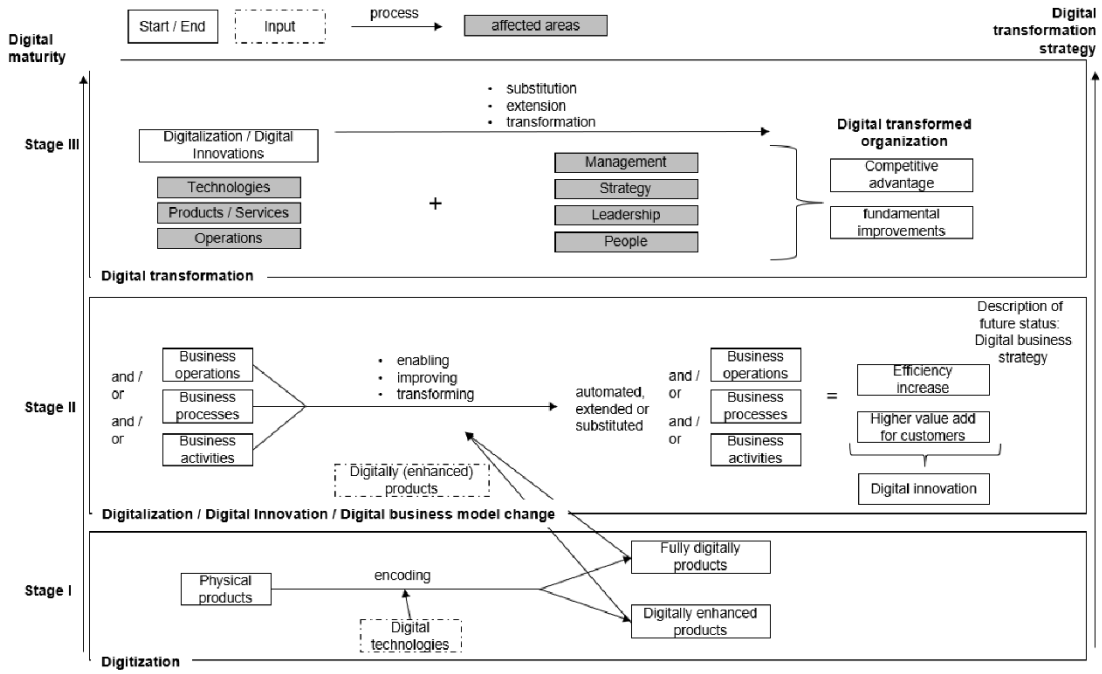

Figure 1 Stages of digital transformation based on the summary of the present literature review

2.2 Exploration and exploitation

Due to the high speed of change and increasing competition, companies cannot just focus on current or future customers' needs. They must address both aspects (Boer & Gertsen, 2003; Corso et al., 2009). Especially in changing environments, many agree that learning is an essential source of sustainable competitive advantage (Levinthal & March, 1993; McGrath, 2001), and innovation is the outcome of learning activities (Atuahene-Gima, 2005; Lennerts et al., 2020; Sidhu et al., 2007). Several studies on organizations' innovation capability describe innovation as a knowledge management process (Grant, 1996; Madhavan & Grover, 1998; Soosay & Hyland, 2008; Spanos & Prastacos, 2004; Subramaniam & Youndt, 2005). Organizational learning literature recommends that companies participate in two different learning activities called exploration and exploitation (Beckman, 2006; March, 1991). Since March's pioneering article, both expressions have found an increasing presence in innovation literature (Gupta et al., 2006). Following existing literature, exploratory innovation and exploitative innovation are two types of innovative learning outcomes (C.-R. Li et al., 2014; McGrath, 2001; Sidhu et al., 2007) and are used to analyze innovation processes (Rosenkopf & Nerkar, 2001).
Our research understands that both activities rely on different knowledge and capabilities (Gibson and Birkinshaw 2004; Lavie et al. 2010) and are complementary (Popadić et al., 2015). We follow the understanding that the difference is about the type or amount of learning (Gupta et al., 2006). The main reason for this definition is that we follow March's original definition, as otherwise, some activities classified as exploitation would be categorized in the exploration segment (Gupta et al., 2006). The concept of exploration and exploitation has been researched in various dimensions (Lavie et al., 2010) such as technology development and product innovation (Danneels, 2002; He & Wong, 2004; Lavie et al., 2010; Rosenkopf & Nerkar, 2001), strategic alliances (Gupta et al., 2006; Koza & Lewin, 1999; Lavie et al., 2010; Lavie & Rosenkopf, 2006), and management teams (Beckman, 2006; Lavie et al., 2010; McGrath, 2001).

The terms „search, variation, risk-taking, experimentation, play, flexibility, and discovery" (March, 1991, p. 71) describe exploration. It is characterized as being more distant from known activities (Benner & Tushman, 2002). Exploratory search is needed to provide completely new solutions (Katila & Ahuja, 2002; Schumpeter, 1934).

Exploration goes further than existing knowledge (Vorhies et al., 2011). To identify exploration activities, Beckman (2006, p. 747) used words like „pioneer“ and „first mover“. Results of exploratory activities are uncertain, and no quick wins (March, 1991). Exploratory activities are about non-known demands (Gonzalez & Melo, 2017; Grant, 1996). Tushman and O'Reilly III (1996) described exploration as being revolutionary.

In contrast to exploration, exploitation includes „refinement, choice, production, efficiency, selection, implementation, and execution“ (March, 1991, p. 71). Exploitation combines existing solutions (Katila & Ahuja, 2002; Schumpeter, 1934). Activities that extend existing knowledge are exploitative (He & Wong, 2004; March, 1991). Phrases such as „low cost“, „clone“ and „better design“ are used to identify exploitation activities (Beckman, 2006, p. 747). Exploitative learning activities target the needs of customers and markets, expanding existing products and services, and improving existing processes (Gonzalez & Melo, 2017; Grant, 1996). Outcomes of exploitative activities are predictable and close in time (March, 1991).

The conceptual framework of digital transformation in Figure 1 includes exploitative and explorative learning activities. For example, the automation or extension of business processes can be classified as exploitation. The substitution or transformation of entire business models would be categorized as exploration. Both activities can be complementary, and companies must learn how to carry out both forms (Lewin & Volberda, 1999). Nevertheless, there is very little research combining the research on digital transformation with exploration, exploitation, and ambidexterity.

2.3 Ambidexterity

As mentioned above, there is consensus regarding the positive impact of ambidexterity on performance (Brix, 2019). The ability to manage the paradoxical exploration and exploitation activities is called ambidexterity (Duncan, 1976; Tushman & O'Reilly III, 1996). Tushman and O'Reilly III (1996) were among the first to readdress the term ambidexterity from Duncan's initial paper on exploration and exploitation (Almahendra & Ambos, 2015).

On the one hand, focusing on exploration and ignoring exploitation can lead to high costs without benefits. On the other hand, focusing on exploitation can put a company at

a stable status but let it fall behind the competition in the long run. As a result, maintaining a balance between exploration and exploitation is a primary factor for companies to succeed (March, 1991). Following March (1991), we view ambidexterity as an organization-level construct (Simsek, 2009). In the understanding of March (1991) exploration and exploitation are conflicting. He based this understanding on mainly the following arguments: Exploration and exploitation face limited resources, and the mindset needed for each kind of activity is radically different (Gupta et al., 2006). Consequently, exploration and exploitation are viewed as two ends of a continuum (March, 1991). This line of argument is logical, but some key assumptions can be questioned (Gupta et al., 2006). A company might have scarce resources, but companies can access external resources, which weakens the argument. This illustrates that there is no unique correct understanding if exploration and exploitation are two ends of a continuum or orthogonal (Gupta et al., 2006). Based on those two different understandings, the definition of ambidexterity, meaning achieving a balance of exploration and exploitation, can be understood in two ways (Brix, 2019). Cao et al. (2009, p. 783) summarized those various understandings with the terms “balanced” and “combined”.

Balanced ambidexterity

Balanced ambidexterity follows the understanding of March (1991) that exploration and exploitation are at the end of one continuum. It is achieved when exploration and exploitation are balanced (Cao et al., 2009). The closer the balance between the two activities is, the lower the risks are for companies (Cao et al., 2009).

Combined ambidexterity

Combined ambidexterity follows the understanding that exploratory and exploitative processes are not in direct competition. Therefore, they can be seen as orthogonal (Cao et al., 2009). By exchanging knowledge between the two activities of exploration and exploitation can support each other (Cao et al., 2009). Aside from the discussion of what balance means, the existing literature consists of mainly three concepts on how to realize this balance: Structural ambidexterity, sequential ambidexterity / punctuated equilibrium, and contextual ambidexterity (Birkinshaw & Gibson, 2004a; Gupta et al., 2006).

Structural ambidexterity

Structural ambidexterity suggests creating dual structures for different activities (Birkinshaw & Gibson, 2004a; Duncan, 1976). Exploration units have a loose culture and high flexibility, whereas exploitation units focus on efficiency and consistency (Benner & Tushman, 2002, 2003; Jansen et al., 2009). Those units have different cultures, structures, and rewards systems (O'Reilly III & Tushman, 2004). At the same time, these separate units are aligned by common values and strategy (O'Reilly III & Tushman, 2013). O'Reilly III and Tushman (2004) suggested separation on lower levels of the organization and integration on the top management level. Following the balanced view of ambidexterity and the understanding of March (1991) that exploration and exploitation are two ends of a continuum, structural ambidexterity is the only option to become ambidextrous on an organizational level.

Sequential ambidexterity or punctuated equilibrium

Carrying out both activities in a non-simultaneous way can be done by adopting a cycling approach. This means alternating between time dedicated to exploration or exploitation. In scientific research, that process is called sequential ambidexterity or punctuated equilibrium (Gupta et al., 2006; Simsek, 2009). Sequential ambidexterity / punctuated equilibrium does not require dual structures and therefore follows the understanding of combined ambidexterity. The main difference is the timing. Structural ambidexterity targets separation to have an apparent dedication to exploration or exploitation and achieve a simultaneous balance (Boumgarden et al., 2012).

Contextual ambidexterity

Gibson and Birkinshaw (2004) introduced another way of simultaneously balancing exploration and exploitation, called contextual ambidexterity. With the help of systems, individual employees can choose between exploration and exploitation depending on priorities (Filippini et al., 2012).

We understand that all are valid concepts to achieve long-term success. Gibson and Birkinshaw (2004) followed the understanding that there might be temporal imbalances, but in a long-term perspective, companies need to achieve a balance of exploration and exploitation. Figure 2 summarizes our understanding of ambidexterity.

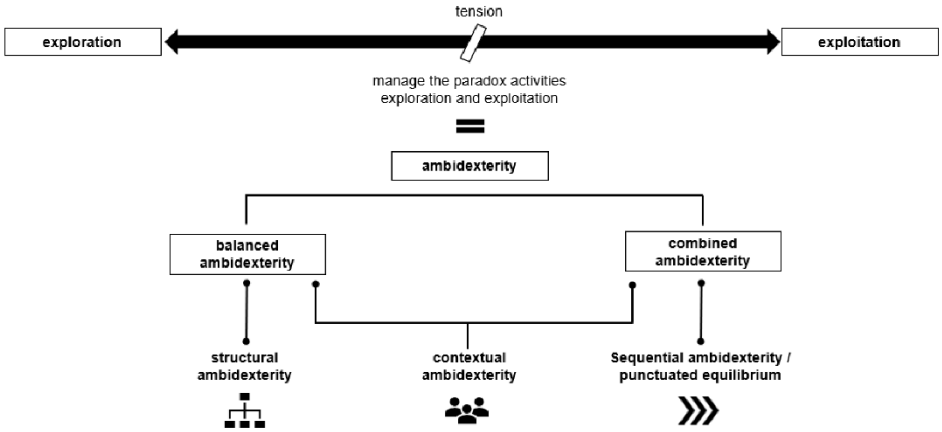

Figure 2 Different concepts of ambidexterity

In addition to the research streams on structural ambidexterity, sequential ambidexterity / punctuated equilibrium, and contextual ambidexterity, scientific research provides insights on alliance formation. Lavie and Rosenkopf (2006) focused on balancing exploration and exploitation alliances. Exploration alliances are described as partnering with companies with no prior interaction, whereas exploitation alliances are characterized by collaboration with existing partners (Lavie & Rosenkopf, 2006). Therefore, the company's intentions to engage in alliances differ depending on exploration or exploitation alliances. Decisions are based on the needs of the company and the availability of resources and capabilities (Kauppila, 2010; Rothaermel & Deeds, 2004).

3 Method

The process for the literature review is based on the three-stage procedure described by Tranfield et al. (2003) and Kitchenham and Charters (2007). Figure 3 shows the individual steps we followed.

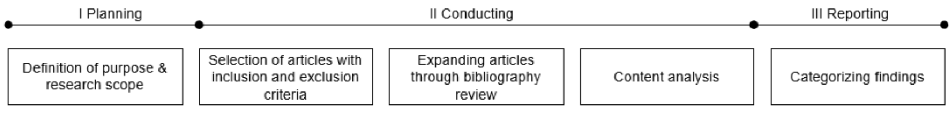

Figure 3 Methodological steps for literature review: Process based on Kitchenham and Charters (2007) and Tranfield et al. (2003), Chart based on Tijan et al. (2021)

We covered three main areas of research within the literature review:

- Digital transformation / Digitalization / Digital innovation / Digital business model change / Digital transformation strategy
- Exploration , Exploitation in digital transformation
- Ambidexterity

The literature review aims to identify journal articles about digital transformation in a systematic and reproducible way. We then analyzed them regarding defined criteria for exploration, exploitation, and ambidexterity. To identify search terms, we used trial searches and reviewed the found articles (Kitchenham & Charters, 2007; Tranfield et al., 2003). The relevant studies were selected with the definition of search terms, databases, and exclusion criteria (Tranfield et al., 2003). Even if we defined the difference between digitalization / digital innovation / digital business model change and digital transformation in the present paper, there are no consistent definitions in the existing literature. We included all in our search terms to ensure a complete picture of the current research. In addition, we excluded the societal level of digital transformation (Parviainen et al., 2017) by integrating synonyms for companies in the search terms. We selected "Web of Science" and "Business Source Ultimate | EBSCO" as the used scientific databases because they cover scholarly journals in social science and other relevant research fields. For the research area of digital transformation, we set the period from 2010 to 2021 as explained by a study showing that the research on digital transformation started growing in 2010 (Pihir et al., 2018). Only articles in English or German were reviewed. Figure 4 illustrates how the employed search terms were combined:

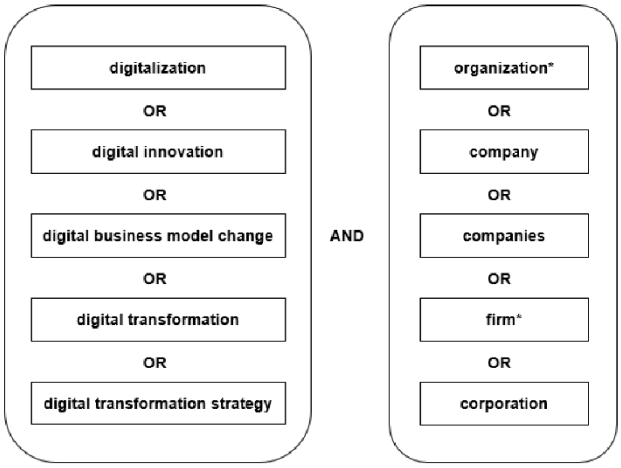

Figure 4 Search terms used for the literature review

We used the search field topic on the "Web of Science" platform. This covers titles, abstracts, author keywords, as well as keywords plus. For "Business Source Ultimate | EBSCO", we selected abstract or author-supplied abstract. Figure 5 illustrates the search process. The search conducted in the two databases resulted in 3,204 articles. After removing duplicates, non-journal articles, and articles with no access, 2,491 articles remained. We identified clustered exclusion criteria based on the research questions. After reviewing titles regarding those criteria, 925 articles remained. Abstract reviews eliminate 602 articles of those. 323 articles were then reviewed in depth, considering the exclusion criteria. This lead to 80 articles remaining. Based on the review of the literature references in those articles, we added 14 further articles. We decided to keep articles related to hospitals in the selection as ambidexterity is a frequently addressed and relevant topic in the medical sector, and so those findings could contribute to our insights.

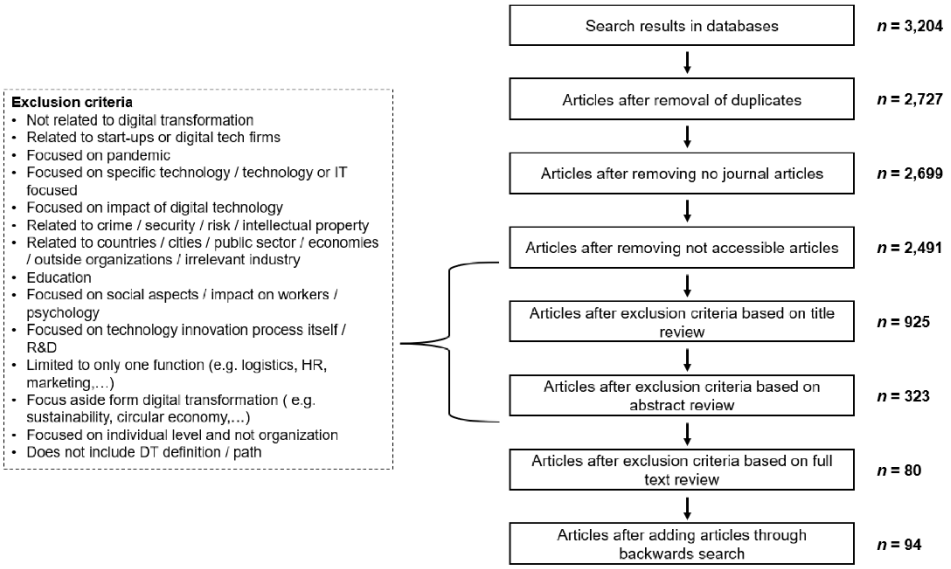

Figure 5 Review process of literature review

The 94 remaining articles covering digital transformation processes in companies were the baseline for the data synthesis.

4 Results and discussion

In this section, we provide answers to our two research questions by answering how digital transformation is characterized regarding exploration and exploitation in the selected articles. In addition, we show what aspects of ambidexterity have already been researched. For the data synthesis, we followed the qualitative content analysis method proposed by Mayring (2000), and employed a mixed inductive-deductive approach. We defined categories for exploration and exploitation with an inductive approach. This means we developed categories as close as possible to the material (Mayring, 2000, 2004). We established a coding system to analyze the selected articles on digital transformation in a structured way. Figure 6 summarizes those categories and the coding system on the top. To improve the study results, we combined the inductive approach with deductive elements. We used the categories developed with the inductive approach

to examine the literature on digital transformation (Mayring, 2000, 2004). A deductive approach works with previously formulated analysis aspects (Mayring, 2000). After ~30% of the articles had been coded, the categories Risk (F) and Time Horizon (G) were eliminated as well as subcategories „Uncertain results (AORA2“ and „Predictable Results (AOIT2)“. The reason for the exclusion is that those aspects were very sporadically mentioned within the digital transformation literature. In addition, categories were further consolidated to avoid duplicate findings. Figure 6 summarizes the main clusters‘ impact of digital transformation, drivers and targets, and activities and foci we used to analyze digital transformation literature on exploration and exploitation.

Cluster	Exploration (ORA)	Exploitation (OIT)
Impact (A)	Revolutionary (AORA1)	Evolutionary (AOIT1)
	Uncertain results (AORA2)	Predictable results (AOIT2)
Focus (B)	Growth (BORA1)	Margins, productivity(BOIT1)
Activities (C)	Searching for new solutions(CORA1)	Combining existing solutions (COIT1)
	Experimentation (CORA2)	
Competencies (D)	Entrepreneurial (DORA1)	Operational (DOIT1)
Target (E)	New technologies to market (EORA1)	Cost savings (EOIT1)
		Efficiency increase (EOIT2)
	Addressing new customer needs (EORA3)	Addressing existing needs (EOIT3)
Risk (F)	High risk-taking (FORA1)	Low risk-taking (FOIT1)
Time horizon (G)	Longer period (GORA1)	Shorter period (GOIT1)

Cluster	Exploration (ORA)	Exploitation (OIT)
Impact of digital transformation	Revolutionary (AORA1)	Evolutionary (AOIT1)
Drivers and targets of digital transformation	Growth (BORA1)	Margins, productivity (BOIT1)
	New technologies to market (EORA1)	Cost savings (EOIT1)
		Efficiency increase (EOIT2)
	Addressing new customer needs (EORA3)	Addressing existing needs (EOIT3)
Activities and foci during digital transformation	Searching for new solutions (CORA1)	Combining existing solutions (COIT1)
	Experimentation (CORA2)	
	Entrepreneurial (DORA1)	Operational (DOIT1)

Figure 6 Exploration, exploitation characteristics. Own illustration based on O'Reilly III and Tushman (2004)

Based on the literature of ambidexterity formulated aspects, we used the following criteria to analyze digital transformation literature on ambidexterity:

Balance exploration and exploitation (Duncan, 1976; March, 1991; Tushman & O'Reilly III, 1996) / *Organizational structure* (Birkinshaw & Gibson, 2004b; Duncan, 1976) /

Temporal separation (Gupta et al., 2006; Simsek, 2009) / *Context creation* (Filippini et al., 2012; Gibson & Birkinshaw, 2004) / *Leadership* (O'Reilly III & Tushman, 2004, 2013) / *Alliances and networks* (Lavie & Rosenkopf, 2006) / *Challenges*

To capture the findings, we followed the widely accepted procedure of Gioia et al. (2013) by identifying first-order concepts and second-order themes and creating aggregated dimensions. The aggregated dimensions cover the main research areas with which we want to connect digital transformation: Exploration / Exploitation / Ambidexterity We derive the second-order themes in the aggregated dimension exploration and exploitation with our prior derived coding structure and based on the main research streams in ambidexterity literature. This is illustrated in an overview in Table 1.

Table 1 Aggregated dimensions, second-order themes and first-order concepts of ambidexterity in digital transformation

Aggregated Dimension	Second-order Themes	First-order concepts	Content summary	Sources
Exploration	Revolutionary impact	• Radical or disruptive change to companies and industries • Radical changes to organizational structure and strategy • Revolutionary nature of digital technologies as enabler for major improvements	• Disruptive change to society, political and industry level • Transformation of existing value creation • Radical changes to organizational structure and strategy possible • Possible re-organization Disruptive character of digital technologies • New digital business opportunities • Significant performance increases only possible with suitable organizational set-up	(Ahmad et al., 2021; Åkesson et al., 2018; Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Bosler et al., 2021; Brown & Brown; Calabrese et al., 2021; Ceipek et al., 2021; Cichosz et al., 2020; Correani et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Garzoni et al., 2020; Gastaldi et al., 2018; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Johansson et al., 2021; Jones et al., 2021; Kane, 2019; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Machado et al., 2021; Matt et al., 2015; Matzner et al., 2018; Naimi-Sadigh et al.; North et al., 2020; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Riasanow et al., 2019; Saarikko et al., 2020; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Tijan et al., 2021; Tronvoll et al., 2020; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020; Wrede et al., 2020; Wu et al., 2021)
	Strategic targets and drivers	• Increase revenue / grow through digital transformation • Digital growth through partnerships or ventures • Addressing new customer needs or innovating new technologies to markets as drivers for digital transformation	• Growth as one major driving force of digital transformation • Growth outside traditional industries • Growth enabled by developing new products, new markets, or both • Quick acquisition of needed capabilities and resources through mergers • Acquiring companies outside core-business • Acquiring companies with targeted technologies (start-ups) • Co-creation in digital ecosystem • Create new market requirements • Address needs, customers don't know yet • Shift from analog offerings to digital ones • Access to new markets	(Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Brown & Brown; Calabrese et al., 2020; Camarinha-Matos et al., 2019; Fitzgerald et al., 2013; Franco et al., 2021; Gastaldi et al., 2018; Gimpel et al., 2018; Gruia et al., 2020; Heberle et al., 2017; Horváth & Szabó, 2019; Iansiti & Lakhani, 2014; Imran et al., 2021; Ismail et al., 2017; Jin et al., 2020; Jones et al., 2021; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Margiono, 2021; Martincevic & Kozina, 2021; Matt et al., 2015; Matzner et al., 2018; Naimi-Sadigh et al.; Niemand et al., 2021; North et al., 2020; Olsson & Bosch, 2020; Parida et al., 2019; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Saarikko et al., 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Svahn & Henfridsson, 2012; Tekic & Koroteev, 2019; Tomičić Furjan et al., 2020; Tronvoll et al., 2020; Verhoef et al., 2021; Vial, 2019; Wiesbock & Hess, 2020)

	Entrepreneurial activities	• Searching for new solutions • Rethinking and transformation of current business • Development of new capabilities	• Research & Development • New technologies, products, services and business models • Co-creation in digital ecosystem enables searching for new solutions • Rethink existing procedures, value propositions, products, services, and internal structures • Challenge status quo constantly • Creation of new core-business • Termination of old activities • Start-up mind-set • Experimentation • Failure • Risk taking • Flexibility • Dynamic capabilities	(Ahmad et al., 2021; Andriole, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Calabrese et al., 2021; Camarinha-Matos et al., 2019; Cennamo et al., 2020; Chen et al., 2021; Correani et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Franco et al., 2021; Garzoni et al., 2020; Ghobakhloo & Iranmanesh, 2021; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Jin et al., 2020; Jones et al., 2021; Kaiser & Stummer, 2020; Kane et al., 2015, 2018; Kane, 2019; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Martincevic & Kozina, 2021; Matt et al., 2015; Matzner et al., 2018; Neumann et al., 2019; Niemand et al., 2021; North et al., 2020; Nwaiwu, 2018; Olsson & Bosch, 2020; Rachinger et al., 2019; Remane et al., 2017; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Sia et al., 2016; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Tijan et al., 2021; Tomičić Furjan et al., 2020; Verhoef et al., 2021; Westerman et al., 2014)
Exploitation	Evolutionary impact	• Achieve digital transformation through evolutionary stages	• Limited resources allow only digital evolution of a company • Stages / maturity levels of digital transformation	(Jones et al., 2021; Matt et al., 2015; Naimi-Sadigh et al.; Parviainen et al., 2017; Santos & Martinho, 2020; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Smith & Beretta, 2021; Verhoef et al., 2021)
	Operational targets and drivers	• Increase efficiency and productivity and reduce costs • Enhance customer value	• Increase efficiency, productivity and reduce cost • Increase the efficiency of the operational backbone • Enhance customer experience • Improve customer satisfaction • Higher quality products • Increased customer interaction through digital technologies	(Balakrishnan & Das, 2020; Becker & Schmid, 2020; Bosch & Olsson, 2021; Calabrese et al., 2021; Cennamo et al., 2020; Cichosz et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Garzoni et al., 2020; Gastaldi et al., 2018; Ghobakhloo & Iranmanesh, 2021; Gimpel et al., 2018; Gopal et al., 2019; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Ismail et al., 2017; Jones et al., 2021; Kane et al., 2015, 2018; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Machado et al., 2021; Martincevic & Kozina, 2021; Matzner et al., 2018; Naimi-Sadigh et al.; Neumann et al., 2019; Niemand et al., 2021; North et al., 2020; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Remane et al., 2017; Saarikko et al., 2020; Sanchez, 2017; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Sia et al., 2021; Smith & Beretta, 2021; Svahn & Henfridsson, 2012; Tijan et al., 2021; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Vial, 2019; Wiesbock & Hess, 2020)
	Improving the existing	• Optimization and automation of existing processes • Combining existing solutions	• Optimizing established processes and procedures • Automation of processes (internal and external) • Elimination of tasks through automation • Optimize existing processes but not reimagine the old procedures • Adding digital features	(Ahmad et al., 2021; Andriole, 2020; Anshin & Bobyleva, 2021; Becker & Schmid, 2020; Bosch & Olsson, 2021; Bosler et al., 2021; Celpek et al., 2021; Cennamo et al., 2020; Correani et al., 2020; Fitzgerald et al., 2013; Gastaldi et al., 2018; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Jones et al., 2021; Karekla et al., 2021; Margiono, 2021; Matzner et al., 2018; Naimi-Sadigh et al.; Neumann et al., 2019; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pumaleque et al., 2021; Rachinger et al., 2019; Remane et al., 2017; Sanchez, 2017; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Smith & Beretta, 2021; Sund et al., 2021; Tekic & Koroteev, 2019; Tijan et al., 2021; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020)

Ambidexterity	Digital Transformation contains evolutionary and evolutionary aspects	• Digital transformation can be revolutionary and evolutionary • Inconsistencies in digital transformation characteristics	• Incremental and disruptive changes • All articles include exploration and exploitation aspects but not always in all cluster categories • One cluster might include aspects of exploration but not exploitation but other clusters in the same article include exploitation criteria • Scholars pay limited attention to the details, therefore, do not further differentiate those distinct activities	(Andriole, 2020; Calabrese et al., 2020; Calabrese et al., 2021; Cichosz et al., 2020; Franco et al., 2021; Garzoni et al., 2020; Krasonikolakis et al., 2020; Libert et al., 2016; Naimi-Sadigh et al.; Saarikko et al., 2020; Schallmo et al., 2017)
	Balancing exploration and exploitation	• General agreement to paradoxical activities • Different understandings of exploration and exploitation • Digital Technologies as enabler for ambidexterity	• Importance of balancing two paradoxical activities • Often no details are provided • Different foci • Digital = exploration / traditional (old) = exploitation • No consideration if digital is really exploration • New capabilities for digital but no differentiation into exploration / exploitation • Social media enables more exchange and therefore insights for radical / incremental innovation • Digital technologies increasingly enable ambidexterity though connectivity	(Ahmad et al., 2021; Åkesson et al., 2018; Bjoerkdahl, 2020; Bosler et al., 2021; Cennamo et al., 2020; Chan et al., 2019; Gastaldi et al., 2018; Gastaldi & Corso, 2012; R. W. Gregory et al., 2015; Hess et al., 2016; Kaiser & Stummer, 2020; Kane et al., 2018; Kane, 2019; Margiono, 2021; Olsson & Bosch, 2020; Riasanow et al., 2019; Scuotto et al., 2019; Sia et al., 2021; Smith & Beretta, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020; Wu et al., 2021)
	Structural ambidexterity	• Rethinking structure and separation • Alignment	• Digital transformation can significantly impact organizational structures • Often no details on separation • The closer to core business – integration, more distant to core business – separation • Understanding old vs. digital – digital separate business unit or division - no consideration if digital is really exploration • Digital innovation labs or digital hubs • Alignment needed • Lack of interaction • Data sharing	(Ahmad et al., 2021; Åkesson et al., 2018; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Bosler et al., 2021; Camarinha-Matos et al., 2019; Chen et al., 2021; Correani et al., 2020; Fischer et al., 2020; Hess et al., 2016; Hron et al., 2021; Ismail et al., 2017; Kaiser & Stummer, 2020; Krasonikolakis et al., 2020; Margiono, 2021; Matt et al., 2015; Naimi-Sadigh et al.; Rachinger et al., 2019; Riasanow et al., 2019; Setzke et al., 2021; Sia et al., 2016; Smith & Beretta, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Wiesbock & Hess, 2020)

	Alliances, collaborations and networks	• Open innovation • Acquisitions, mergers and ventures	• Fast changing environment • Digital ecosystem innovation • Open innovation systems • Collaborations and partnerships in and outside the industry • No hierarchical structures • Access to resources and capabilities • Not clear if used for exploration or exploitation • Complement the current portfolio of companies	(Åkesson et al., 2018; Balakrishnan & Das, 2020; Berghaus & Back, 2016; Bosler et al., 2021; Camarinha-Matos et al., 2019; Cennamo et al., 2020; Chan et al., 2019; Chen et al., 2021; Cichosz et al., 2020; Fischer et al., 2020; Franco et al., 2021; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Hanelt et al.; Hess et al., 2016; Horváth & Szabó, 2019; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Johansson et al., 2021; Jones et al., 2021; Kaiser & Stummer, 2020; Kane et al., 2018; Kane, 2019; Krasonikolakis et al., 2020; Margiono, 2021; Matzner et al., 2018; Nwaiwu, 2018; Olsson & Bosch, 2020; Rachinger et al., 2019; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Scuotto et al., 2019; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Svahn & Henfridsson, 2012; Tijan et al., 2021; Tomičić Furjan et al., 2020; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Wiesbock & Hess, 2020)
	Senior leadership support is necessary	• Senior leadership attitude influences ambidexterity success • Senior leadership to provide guidance • Ambidextrous leadership • No differentiation between leadership and management • Agility	• Senior leadership has a significant impact on transformation projects • Family-owned businesses focus on exploitation • Importance of ambidextrous leadership • Strategy • Vision • Seldomly directly mentioned in digital transformation literature • Balance between leveraging digital technologies to enhance the existing but also to create new digital business offerings • Alignment IT + business • Resource allocation • Have the right people in the right position • Centralized decision-making in case of separation • Support change • Often focus on new capabilities for digital, not distinguishing between exploration and exploitation • No differentiation between leadership and management in digital transformation literature • Exploration and exploitation of different needs (leadership vs. management) • Fast-changing environment • Agility allows quick responses to context changes • Flat hierarchies • Not clear if needed for exploration or exploitation or both (all digital)	(Ahmad et al., 2021; Åkesson et al., 2018; Algahtani, 2014; Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosler et al., 2021; Brown & Brown; Chan et al., 2019; Cichosz et al., 2020; Correani et al., 2020; Fischer et al., 2020; Franco et al., 2021; Ghobakhloo & Iranmanesh, 2021; Gimpel et al., 2018; Gruia et al., 2020; Heberle et al., 2017; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Jackson & Dunn-Jensen, 2021; Johansson et al., 2021; Jones et al., 2021; Kane et al., 2018; Kane, 2019; Karekla et al., 2021; Kotter, 2008; Krasonikolakis et al., 2020; Machado et al., 2021; Margiono, 2021; Martincevic & Kozina, 2021; Matzner et al., 2018; Niemand et al., 2021; Nwaiwu, 2018; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pumaleque et al., 2021; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Schneider & Kokshagina, 2021; Sebastian et al., 2020; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Tekic & Koroteev, 2019; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Wrede et al., 2020)

	No one size fits all	• Company size • Companies' digital maturity levels impact exploration /exploitation focus	• Company size influences how companies approach digital transformation but an ambiguous picture if productivity and efficiency increase have different priorities to companies depending on size • Companies strive for different things during their path to evolve in a digital company • Lower maturity level: exploitation • Higher maturity level: Exploitation + exploration	(Ahmad et al., 2021; Balakrishnan & Das, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Calabrese et al., 2020; Ceipek et al., 2021; Cennamo et al., 2020; Chan et al., 2019; Garzoni et al., 2020; Gastaldi et al., 2018; Gastaldi & Corso, 2012; Ghobakhloo & Iranmanesh, 2021; Heberle et al., 2017; Herceg et al., 2020; Horváth & Szabó, 2019; Jones et al., 2021; Kaiser & Stummer, 2020; Kane, 2019; Karekla et al., 2021; Libert et al., 2016; Margiono, 2021; Nwaiwu, 2018; Pihir et al., 2018; Saarikko et al., 2020; Santos & Martinho, 2020; Scuotto et al., 2019; Setzke et al., 2021; Soluk & Kammerlander, 2021; Verhoef et al., 2021)
	Challenge to achieve ambidexterity	• Understanding DT is both, but current focus on exploitation • Radical intention incremental outcome • Focus on wrong KPIs and methods	• Companies often understand the duality of digital transformation but fail do execute • Focusing on existing customers to leverage short-term high returns • Radical intention incremental outcome • Characteristics of digital artifacts can lead to an innovation shift • Missing ambidextrous leadership • Building on existing products includes risk for a shift in innovation • Pressure to exploitation due to short-term orientation • Customer centricity • Measurement systems focusing on exploitation • No KPIs for transformation itself • Same processes for exploration and exploitation	(Ahmad et al., 2021; Bjoerkdahl, 2020; Calabrese et al., 2020; Cichosz et al., 2020; Gruia et al., 2020; Hron et al., 2021; Imran et al., 2021; Jones et al., 2021; Krasonikolakis et al., 2020; Neumann et al., 2019; Remane et al., 2017; Setzke et al., 2021; Smith & Beretta, 2021; Sund et al., 2021)
	Complementary aspects	• Contextual ambidexterity • Sequential ambidexterity or punctuated equilibrium	• Little focus on contextual ambidexterity • If integration – contextual ambidexterity needed • Ambidextrous mindset needs to be lived throughout the whole organization • Little focus on sequential ambidexterity or punctuated equilibrium • Limited resources can lead to periods of exploration and exploitation • Evolutionary path can be seen as sequential ambidexterity or punctuated equilibrium • Shifting between exploration and exploitation can lead to long-term ambidexterity	(Hron et al., 2021; Jackson & Dunn-Jensen, 2021) (Bjoerkdahl, 2020; Bosch & Olsson, 2021; Gastaldi et al., 2018; Gastaldi & Corso, 2012; Hron et al., 2021; Jackson & Dunn-Jensen, 2021; Smith & Beretta, 2021)

4.1 Exploration

4.1.1 Revolutionary impact of digital transformation

Digital transformation can significantly influence the economic, social, and political environment due to its *revolutionary character* (Ahmad et al., 2021; Fischer et al., 2020; Hess et al., 2016). The disruptive force completely changes existing industries (Rachinger et al., 2019). For example, new entrants reshape industries and create new competition (Rachinger et al., 2019). When incumbents transform into digital companies driven by adopting new digital technologies (Sund et al., 2021), this radically impacts the whole business model (Jones et al., 2021), including products, services (Balakrishnan & Das, 2020), operations (Andriole, 2020) and organizational activities (Jones et al., 2021). As digital transformation affects the whole organization, a *fundamental change in strategy* is associated (Anshin & Bobyleva, 2021). Multiple studies show the need for a digital strategy due to the radical character of digital transformation (Becker & Schmid, 2020; Hess et al., 2016). However, only having a strategy is not sufficient. Some companies radically reorganize during their digital transformation process (Sia et al., 2016). Digital technologies themselves are often described as radical or disruptive (Benbya et al., 2020; Bosch & Olsson, 2021; Nwaiwu et al., 2020). They *enable large-scale improvements* for companies (Cichosz et al., 2020; Fitzgerald et al., 2013). Nevertheless, it is crucial to note that digital technologies' game-changing character only enables radical business improvement combined with the correct organizational set-up (Imran et al., 2021; Singh & Hess, 2020; Vial, 2019).

4.1.2 Strategic targets and drivers of digital transformation

Academic literature describes *growth as one major driving force and target* for companies to engage in digital transformation activities (Becker & Schmid, 2020; Gartner, 2021; Verhoef et al., 2021; Vial, 2019). Digital transformation enabled by digital technologies provides *new growth paths and new revenue streams* for companies (Gimpel et al., 2018; Loonam et al., 2018; Pumaleque et al., 2021; Savytska & Salabai, 2021). Growth can result from developing new products, new markets, or both (Loonam et al., 2018; Verhoef et al., 2021). However, digital transformation is not a pure internal topic but connects industries (Balakrishnan & Das, 2020; Iansiti & Lakhani, 2014). One goal for

manufacturing companies linked to digital transformation is becoming competitive outside the traditional manufacturing sector (Calabrese et al., 2020; Gimpel et al., 2018). A path to growth is through *merger and acquisition activities* (Anshin & Bobyleva, 2021; Margiono, 2021). Margiono (2021) separated two intentions of acquiring other companies. The first objective is to gain the needed digital capabilities to grow rapidly. The second is to buy start-ups that already provide the targeted new digital offerings and differentiating technologies (Olsson & Bosch, 2020). Both purposes aim to offer markets new value (Margiono, 2021). However, the primary purpose is not always the takeover. Instead, partnerships and network activities help build collaborations (Olsson & Bosch, 2020). Balakrishnan and Das (2020) pointed out that co-creation is vital to creating new digital offerings for growth efforts.

Digital transformation changes customers' expectations and creates new market requirements (Andriole, 2020; Tomičić Furjan et al., 2020). The target is *to create and address new customer needs* by innovating something radical new (Fitzgerald et al., 2013; Pihir et al., 2018; Rachinger et al., 2019; Saarikko et al., 2020). The result of digital innovation might be something customers are unaware of that would be beneficial to them and can lead to new levels of customer satisfaction (Imran et al., 2021; Sia et al., 2016; Tomičić Furjan et al., 2020). In manufacturing, product companies transform into digital solution-selling companies by providing preventive solutions and recommendations to improve customers‘ equipment (Matzner et al., 2018; Schallmo et al., 2017). The requirement is to shift from analog offerings to digital ones (Bjoerkdahl, 2020). In addition, companies target to gain access to new markets and customers (Calabrese et al., 2020; Fitzgerald et al., 2013; Ismail et al., 2017) or even create entirely new markets (Naimi-Sadigh et al.; Pihir et al., 2018; Sia et al., 2021).

4.1.3 Entrepreneurial activities

Exploration activities include *searching for new solutions*. During digital transformations, companies focus on creating new solutions by development activities resulting in radical innovation (Hron et al., 2021; Rachinger et al., 2019). The invention of new technology is one path companies pursue (Becker & Schmid, 2020). Those technologies can refer to internal processes or external-oriented products or services (North et al., 2020; Santos &

Martinho, 2020; Savytska & Salabai, 2021; Tomičić Furjan et al., 2020). In addition, digital business model is one major research stream in digital transformation literature (Chen et al., 2021; Nwaiwu, 2018; Rachinger et al., 2019; Sund et al., 2021). To successfully transform companies in an explorative way, companies need to *rethink existing* procedures (Schallmo et al., 2017), value propositions (Loonam et al., 2018; Saarikko et al., 2020), products, services (Correani et al., 2020), and internal structures (Sia et al., 2016). It is about questioning the status quo to innovate something radically new (Fitzgerald et al., 2013; Kane et al., 2018; Neumann et al., 2019). For incumbents, that means moving away from their core business and towards radical new ways of doing business inspired by digital technologies (Ghobakhloo & Iranmanesh, 2021; Jin et al., 2020; Neumann et al., 2019; Nwaiwu, 2018; Remane et al., 2017). Some existing activities, processes (Jones et al., 2021), and products are terminated and replaced by new ones (Imran et al., 2021; Nwaiwu, 2018; Rachinger et al., 2019). To rethink and transform the current business, companies need to develop *new entrepreneurial capabilities* (Garzoni et al., 2020; Niemand et al., 2021; North et al., 2020). In order to make a radical transformation possible, a start-up mindset is needed (Sia et al., 2016). Working with trials and experimentation is a required capability (Imran et al., 2021). Radical innovations are fostered by experimentation (Berghaus & Back, 2016; Jones et al., 2021; Kane et al., 2018; North et al., 2020) and continuous learning (Kane, 2019). Flexibility and acceptance of failure are needed for experimentation (Andriole, 2020; Sia et al., 2016; Sia et al., 2021). Therefore experimentation is connected to a higher level of risk-taking (Gurbaxani & Dunkle, 2019; Imran et al., 2021; Kane et al., 2015; Sanchez, 2017; Sia et al., 2021).

Another perspective is related to dynamic capabilities in digital transformation. If companies have dynamic capabilities, they are capable of identifying and employing new opportunities and transforming the existing way of doing business to leverage those new opportunities (Riasanow et al., 2019; Soluk & Kammerlander, 2021; D. J. Teece, 2007; D. Teece et al., 2016; Tijan et al., 2021). The analyzed required capabilities are not explicitly tied to exploration in the digital transformation literature. Nevertheless, connecting those results with the exploration and exploitation literature, the capabilities fit exploration. We find that some scholars are not consistent with our understanding. For

example, (digital) entrepreneurship refers to exploration and exploitation (Franco et al., 2021; Veile et al., 2020), and not only to exploration.

4.2 Exploitation

4.2.1 Evolutionary impact

Digital transformation is an ongoing *digital evolution* of a company, especially for incumbent companies (Mazzone, 2014; Schallmo et al., 2017; Smith & Beretta, 2021). Incumbents tend to transform their business in an evolutionary process where at least for a certain period, traditional products and services coexist with new digital offerings (Smith & Beretta, 2021). In addition, companies often cannot afford a big radical bang due to limited resources or high complexity (Davenport & Ronanki, 2018; Santos & Martinho, 2020; Schneider & Kokshagina, 2021). Digital transformation is, therefore, often broken down into stages (Jones et al., 2021), phases (Ahmad et al., 2021; Verhoef et al., 2021), or maturity levels (Cichosz et al., 2020). The first stages are more incremental phases (Ahmad et al., 2021; Verhoef et al., 2021). Even if the digital transformation literature contains evolutionary aspects, Riasanow et al. (2019) confirmed that there is no article connecting digital transformation with a purely evolutionary change.

4.2.2 Operational targets and drivers

Aside from growth, companies pursue digital transformation to increase *efficiency and productivity and reduce costs* (Balakrishnan & Das, 2020; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Horváth & Szabó, 2019; Rachinger et al., 2019). Digital technologies generate opportunities to increase the efficiency of the operational backbone of organizations (Ross et al., 2017; Sanchez, 2017). More accessible communication and data availability provide better control mechanisms and drive efficiency (Sanchez, 2017). Further specifications of productivity improvements are automized business processes in operations (Saarikko et al., 2020), administrative functions (Wiesbock & Hess, 2020), improved inventory and warehouse management (Calabrese et al., 2020), time reduction, reduction in lead times, error, and scrap (Horváth & Szabó, 2019). Digital technologies enable data analytics and machine learning to increase companies' efficiency and productivity (Sia et al., 2021). In addition, different channels like online services provide

further options to reduce costs (Niemand et al., 2021). Especially articles about Industry 4.0 focus on productivity and efficiency improvements as goals (Calabrese et al., 2020; Ghobakhloo & Iranmanesh, 2021; Nwaiwu et al., 2020; Veile et al., 2020). In addition to productivity and efficiency increases, companies ultimately want to achieve higher levels of profitability through digital transformation. (Calabrese et al., 2021; Schallmo et al., 2017).

Another evolutionary-oriented reason companies pursue digital transformation is to *enhance customer experience* (Cichosz et al., 2020; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Olsson & Bosch, 2020) and improve customer satisfaction (Horváth & Szabó, 2019; Rachinger et al., 2019). One approach to achieve this is to enhance existing products or services (Fischer et al., 2020; Naimi-Sadigh et al.; Sanchez, 2017; Tronvoll et al., 2020; Wiesbock & Hess, 2020). Companies use digital technologies to enhance traditional products with digital add-ons like sensors (Gimpel et al., 2018; Hess et al., 2016; Karekla et al., 2021; Vial, 2019). Another way to improve customer experience is to improve customer interaction by introducing digital channels (Cennamo et al., 2020; Gruia et al., 2020; Hess et al., 2016). In addition, companies use digital platforms as marketing and communication platforms (Krasonikolakis et al., 2020; Naimi-Sadigh et al.; Schallmo et al., 2017).

4.2.3 Improving the existing

One characteristic of exploitation is working with the existing. Within digital transformation literature, focusing on *optimizing the existing* with the help of digital technologies is one focus of companies (Ahmad et al., 2021; Sanchez, 2017; Savytska & Salabai, 2021; Sund et al., 2021; Verhoef et al., 2021). This can be related to operational (Correani et al., 2020; Gruia et al., 2020; Wiesbock & Hess, 2020), administrative (Wiesbock & Hess, 2020) and innovation processes (Cennamo et al., 2020). Higher transparency for quicker decision-making is one benefit of optimized processes (Anshin & Bobyleva, 2021; Gastaldi et al., 2018). The processes can be internal, but also processes shared with external partners are optimized (Becker & Schmid, 2020; Ceipek et al., 2021). Increased usage of data and automation are essential activities to improve performance (Fitzgerald et al., 2013; Naimi-Sadigh et al.; Nwaiwu et al., 2020; Tijan et al., 2021). Activities performed by humans can

be replaced by automated solutions (Heberle et al., 2017). With artificial intelligence, repetitive tasks can be eliminated, and the resources of employees can be used for value-adding work (Schneider & Kokshagina, 2021; Westerman et al., 2014). One exploitative activity companies do when applying digital technologies is *combining existing solutions* (Bosler et al., 2021; Remane et al., 2017). Individual, already existing technologies are added together, or products are integrated into other products (Ceipek et al., 2021; Olsson & Bosch, 2020).

4.3 Ambidexterity

In the previous two sections, we have shown how digital transformation literature includes exploration and exploitation. In the following, we refer to both and how ambidexterity is considered.

4.3.1 Explorative and exploitative aspects in digital transformation

Following our understanding of digital transformation, digital transformation is often described as *incremental and revolutionary* (Calabrese et al., 2020; Calabrese et al., 2021; Cichosz et al., 2020; Schallmo et al., 2017). Digital transformation is iterative and can include incremental and disruptive changes (Franco et al., 2021; Garzoni et al., 2020; Krasonikolakis et al., 2020; Naimi-Sadigh et al.). All reviewed articles include aspects of exploration and exploitation. Few articles directly refer to exploration and exploitation but using our coding structure, we can identify some *inconsistencies*. Articles stating a revolutionary impact do not always include aspects of evolutionary impacts. Nevertheless, they all include either targets and drivers or activities related to exploitation. In addition, some articles describe digital transformation as a revolutionary impact on a high level but then focus on exploitative activities on a detailed level (Becker & Schmid, 2020). This leads to the assumption that overall digital transformation is described by exploration and exploitation characteristics. However, scholars pay limited attention to the details and do not differentiate those specific activities further.

4.3.2 Balancing exploration and exploitation

Some scholars directly mention the importance of *balancing two paradoxical activities*. Those can be exploration and exploitation or based on their interpretation of ambidexterity

(Åkesson et al., 2018; Chan et al., 2019; Gastaldi et al., 2018; R. W. Gregory et al., 2015; Smith & Beretta, 2021; Sund et al., 2021; Wu et al., 2021). In addition, no further details are often mentioned, and the need to balance exploration and exploitation is just mentioned without providing further insights. Some scholars mentioning ambidexterity often focus on something else, not directly answering our research question. One example is a study focusing on correlations between ambidextrous learning and company performance (Wu et al., 2021). Nevertheless, other authors follow our definition of exploration and exploitation even if they are not directly mentioned. Those activities require different capabilities and foci (Bjoerkdahl, 2020). It is acknowledged that efficiency gains are limited and that the potential benefits for companies by achieving explorative results are higher (Cennamo et al., 2020). Companies should achieve a balance between exploration and exploitation (Chan et al., 2019; Hess et al., 2016). Hess et al. (2016) referred to a simultaneous balance. Overall the digital transformation literature supports the understanding that paradoxical activities need to be balanced, not constantly referencing the same understanding as we do.

There exist *different understandings of the paradoxical activities*. Some scholars understand all activities related to digital technologies as exploration and everything affecting the traditional business as exploitation (Åkesson et al., 2018; Bosler et al., 2021; Margiono, 2021; Olsson & Bosch, 2020; Verhoef et al., 2021). For example, Åkesson et al. (2018) defined the balance between the old paper-based newspaper business and the new digital business as ambidexterity. The separate division for digital features at Miele is called the innovation engine, and the rest of the organization is called the performance engine (Kaiser & Stummer, 2020). There is no consideration if the new digital business is explorative. Following that understanding of old vs. new, often new capabilities required for the digital age, like a digital mindset, are mentioned (Ahmad et al., 2021; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Naimi-Sadigh et al.; Riasanow et al., 2019). We agree that different capabilities are necessary due to the novelty of digital and the different artifacts compared to physical products. Nevertheless, this does not automatically mean that all activities related to something digital require explorative capabilities. Two articles related to ambidexterity in hospitals directly refer to ambidexterity in digital transformation. Both do not follow the understanding of March (1991) and us regarding exploration and

exploitation (Gastaldi et al., 2018; Gastaldi & Corso, 2012). Smith and Beretta (2021) followed our understanding but still show conflicting ideas. Separation is used to create digital features for existing products and not something radically new. Another view is *digital technologies as enabler for ambidexterity*. Scuotto et al. (2019) described how luxury fashion brands use digital technologies such as social media as an enabler for ambidexterity. Platforms and other digital technologies enable companies to exchange with partners more effectively and lead to ideas for incremental or radical innovations (Sia et al., 2021; Vial, 2019).

4.3.3 Structural ambidexterity

Referencing the revolutionary impact of digital transformation, we already brought up that digital transformation can significantly impact organizational structures. To digitally transform a company, *organizational structures need to be rethought*. Many scholars just mention this on a general level without providing detailed recommendations (Ahmad et al., 2021; Balakrishnan & Das, 2020; Bosler et al., 2021; Riasanow et al., 2019; Smith & Beretta, 2021; Verhoef et al., 2021). Regarding the understanding of balancing old vs. new (digital) business, companies need to decide if integrating the new digital functions into the existing functions or if *separation* is suitable (Balakrishnan & Das, 2020; Setzke et al., 2021). The first option provides less coordination and alignment efforts. The second enables higher flexibility and speed (Åkesson et al., 2018; Balakrishnan & Das, 2020; Duncan, 1976). Existing studies advise companies to integrate the closer the new activities are to their core competencies. Separation seems more suitable for more considerable changes (Balakrishnan & Das, 2020; Becker & Schmid, 2020; Hess et al., 2016; Matt et al., 2015). Establishing different cultural mindsets needed for exploration activities with separation is more manageable. One option for separation is to implement so-called digital innovation labs (Setzke et al., 2021; Sund et al., 2021) or digital hubs (Hron et al., 2021). Separate business units (Hess et al., 2016) or sub-companies (Kaiser & Stummer, 2020) are used to organize all digital activities. This indicates that if companies separate all digital activities, no matter how far away from the core business (Chen et al., 2021; Correani et al., 2020), activities not requiring the same competencies are combined. Not all digital activities are substantial new things like automation and

optimization. Often, companies lack the *alignment* between separate units, creating conflicts (Åkesson et al., 2018). Especially for the case where the understanding is followed to balance old vs. new (digital), this can cause a deficiency of interaction (Åkesson et al., 2018). As we mentioned earlier, digital does not automatically mean exploration, so those set-ups can hurt companies in their exploitation (Åkesson et al., 2018; Bosler et al., 2021). Another aspect of alignment refers to information technologies and data. Companies often do not access shared data, making digital efforts difficult (Bjoerkdahl, 2020).

4.3.4 Alliances, collaborations, and networks

The fast-changing digital environment explains the need for more *collaborations*. Therefore literature on digital transformation often refers to *digital ecosystem innovations* and highlights the importance of partnerships (Bosler et al., 2021; Sanchez, 2017). Co-design, co-creation, or co-productions with partners are relevant practices (Scuotto et al., 2019; Setzke et al., 2021; Sia et al., 2016). Ecosystem collaborations enable companies to collaborate quickly without setting up hierarchical structures like in the case of joint ventures or alliances (Balakrishnan & Das, 2020; Cennamo et al., 2020; Chen et al., 2021; Jones et al., 2021). Network and ecosystem innovation enable access to missing resources and capabilities (Chan et al., 2019; Cichosz et al., 2020; Soluk & Kammerlander, 2021). Ecosystem collaborations have the advantage of high speed and shared innovation costs (Olsson & Bosch, 2020). Collaboration partners include customers, suppliers, universities, or independent companies (Gruia et al., 2020; Horváth & Szabó, 2019). Collaborations within digital transformation projects are often outside industry boundaries (Krasonikolakis et al., 2020; Olsson & Bosch, 2020). Another aspect is the change in the innovation process itself. Especially digital radical innovations require different methods than traditional stage-gate processes. Design thinking and other agile methods are used to foster open collaborations (Kaiser & Stummer, 2020).

Acquisitions of other companies, especially start-ups, are often used by companies to enable exploration due to limited resources or missing capabilities (Åkesson et al., 2018; Bosler et al., 2021; Hron et al., 2021; Setzke et al., 2021). Acquisitions are options to complement the current portfolio of companies. Large companies focusing on digital

transformation, particularly, invest corporate budgets in acquiring new digital companies (Hess et al., 2016). Those acquisitions are usually outside the core competencies if used for exploration (Sia et al., 2021). If speed is essential for companies, acquisitions are the choice for companies pursuing an offensive digital transformation strategy (Margiono, 2021). Most scholars do not provide insights into whether collaborations and acquisitions in digital transformation are used for exploration or exploitation.

4.3.5 Senior leadership support is necessary

The support of *senior leadership has a significant impact on transformation projects* in general. This also applies to digital transformation (Andriole, 2020; Bjoerkdahl, 2020; Cichosz et al., 2020; Imran et al., 2021; Wrede et al., 2020). Therefore digital transformation has become a priority for many leadership teams (Hess et al., 2016). If the senior leadership team focuses on exploration or exploitation and not the long-term balance of both, companies cannot achieve ambidexterity. Family-owned companies tend to focus on exploitation due to being risk-averse leadership teams. Reasoned by the high impact of the attitude of top leadership teams, those companies often fail digital revolutions (Ceipek et al., 2021; Soluk & Kammerlander, 2021). Those results emphasize the importance of ambidextrous leadership.

It is the responsibility of the senior leadership team to develop a *digital strategy* as well as a *digital transformation strategy*. These include status quo (Berghaus & Back, 2016; Kane et al., 2018), vision (Balakrishnan & Das, 2020; Berghaus & Back, 2016; Brown & Brown; Johansson et al., 2021; Kane et al., 2018; Niemand et al., 2021; Sia et al., 2016), objectives (Ahmad et al., 2021; Cichosz et al., 2020; Machado et al., 2021), and a defined path (Bharadwaj et al., 2013; Fischer et al., 2020; Hess et al., 2016; Tekic & Koroteev, 2019). Having a clear understanding of the meaning of digital transformation is crucial for the success of digital transformation. The digital business strategy and digital transformation strategy should be integrated into the company strategy (Anshin & Bobyleva, 2021; Martincevic & Kozina, 2021). Scholars indicate that missing clarity about elements and targets of the digital transformation leads to companies' failure (Hess et al., 2016). Regarding agility in digital transformation, strategies should be revisited and changed if needed (Horváth & Szabó, 2019). Even if the importance of a strategy and

vision is emphasized, no details on how to integrate exploration and exploitation targets are provided.

Sia et al. (2016) are one of the few authors in digital transformation literature who call out specifically the requirement of *ambidextrous leadership*. Ambidextrous leadership refers to the balance between leveraging digital technologies to enhance the existing and creating new digital business offerings (Berghaus & Back, 2016; Sia et al., 2021). Sia et al. (2021) added another level to ambidexterity. The balance of exploration and exploitation and the alignment of information technology and business are called future-ready enterprises. The leadership teams own the decision how to achieve ambidexterity by deciding on separation, contextual or sequential ambidexterity and necessary actions (Bjoerkdahl, 2020; Ghobakhloo & Iranmanesh, 2021; Hess et al., 2016).

Enhancing the core business with digital developments and exploring new digital business opportunities is the responsibility of ambidextrous leaders. Leaders are responsible for having the right people in the right positions (Becker & Schmid, 2020). In addition, digital transformation can lead to contradictory interests (exploration and exploitation) in business units, and ambidextrous leaders manage to solve those conflicts (Horváth & Szabó, 2019; Smith & Beretta, 2021). The aforementioned aspects are not directly called ambidextrous leadership in the digital transformation literature but describe the attitudes (Schneider & Kokshagina, 2021; Wrede et al., 2020). The study of Setzke et al. (2021) showed that centralized decision-making is present in all companies successfully managing digital transformation. This can be connected to a clear vision and leadership support towards resource allocation. In addition, if companies decide to have separate units, centralized decision-making is needed for guidance and alignment (Berghaus & Back, 2016; Setzke et al., 2021). Åkesson et al. (2018) showed that the pure separation of exploration and exploitation is not enough to achieve ambidexterity. To successfully digitally transform a company, the mindset of people needs to change as the purpose of the company changes. Leadership is responsible for organizational acceptance of change (Horváth & Szabó, 2019; Wrede et al., 2020), whereas change can be of explorative or exploitative character. Literature does not further differentiate if this is related to exploration or, in general, to the digital environment.

In addition, unique to digital transformation, switching to digital products or processes might require new capabilities even for exploitative tasks (Chan et al., 2019; Sanchez, 2017). Companies, therefore, establish training initiatives to get employees ready for digital technologies (Balakrishnan & Das, 2020). Nevertheless, not to the extent as those are required to explore new digital businesses. Literature often focuses on new capabilities and mindset shifts required for the digital world, not differentiating into exploration or exploitation (Franco et al., 2021; Sanchez, 2017).

Many scholars in digital transformation literature tend to refer to management and not leadership. Based on *management vs. leadership* research, some main differences can be identified. Management refers to more day-to-day management and organizing. It is about following concrete procedures and ensuring efficiency and solid planning and budgeting (Algahtani, 2014; Kotter, 2008). Leadership includes motivation, developing a vision, and supporting change (Kotter, 2008). As we elaborated earlier, there is often no clear distinction between exploration and exploitation or what leadership or management's responsibility is exactly about in this respect. According to our definition of exploration and exploitation, those activities need different treatment. Combining this with leadership vs. management can lead to critical insights into companies' success or non-success of digital transformation. Nevertheless, this is not looked at in the reviewed articles on digital transformation.

Organizational *agility* is often described as an essential capability of companies in the digital age. Driven by fast-changing environments, companies need to fasten up processes and provide more flexibility to employees (Ahmad et al., 2021; Gruia et al., 2020). Agility allows quick responses to context changes (Chan et al., 2019; Cichosz et al., 2020; Imran et al., 2021; Smith & Beretta, 2021). Flat hierarchies, fewer approval processes, and more entrepreneurial freedom are needed, especially for explorative activities. Nevertheless, literature on digital transformation does not differentiate here and refers to agility to digital innovation in general (Imran et al., 2021). In addition, a high level of transparency and an open mindset is crucial in digital transformation (Ghobakhloo & Iranmanesh, 2021). Sia et al. (2021) connected ambidexterity with agility. The more ambidextrous organizations are, the more agile they can react to changing environments. This can be explained by the ability to do both exploration and exploitation. Similar to

other categories, it is unclear if agility is needed for explorative and exploitative activities. The literature only refers to it in general.

4.3.6 No one-size fits all

There is *no one-size fits all solution* related to multiple areas within digital transformation (Bjoerkdahl, 2020; Kaiser & Stummer, 2020; Margiono, 2021; Nwaiwu, 2018; Setzke et al., 2021). It is the responsibility of leadership to determine the most suitable path. Sometimes literature differentiates between smaller and bigger companies. Nevertheless, there is no unified understanding of how company size impacts companies focusing on exploration or exploitation (Balakrishnan & Das, 2020; Ceipek et al., 2021; Horváth & Szabó, 2019; Jones et al., 2021). Digital transformation is often described as a process with multiple stages, phases, or maturity levels (Ahmad et al., 2021; Berghaus & Back, 2016; Chen et al., 2021; Garzoni et al., 2020; Saarikko et al., 2020; Soluk & Kammerlander, 2021). This understanding correlates with our definition in Figure 1. *Depending on the stage, focus on exploration or exploitation vary* (Karekla et al., 2021). At lower maturity levels and early stages, the focus is on smaller, mostly internal, improvements in lower maturity levels (Ahmad et al., 2021; Chen et al., 2021; Ghobakhloo & Iranmanesh, 2021; Karekla et al., 2021; Libert et al., 2016). More digitally mature companies expand their activities to a broader scope, addressing the ecosystem (Chen et al., 2021) and focusing on growth-related targets. There are multiple ways how to combine exploration and exploitation to achieve ambidexterity and that it depends on the company what to use (Gastaldi et al., 2018; Gastaldi & Corso, 2012).Even if the stages and maturity levels of digital transformation are described frequently in the literature, there is no direct connection between exploration and exploitation. Some scholars indirectly refer to it by mentioning the attributes of the activities.

4.3.7 Challenge to achieve ambidexterity

Companies often understand the duality of digital transformation, containing explorative and exploitative activities. Nevertheless, most companies *struggle with exploration*, such as achieving growth (Bjoerkdahl, 2020) and focusing on exploitation (Calabrese et al., 2020; Neumann et al., 2019). In digital transformation, IT departments are often part of

enabling the transformation. The IT department often focuses on providing solutions to existing problems and not exploring new business opportunities due to their focus on the day-to-day business (Bjoerkdahl, 2020). Companies might be trapped in the innovation dilemma by knowing that digital transformation is about exploration and exploitation but focusing on existing customers and products to leverage short-term high returns. This can lead to a lack of long-term competitiveness (Jones et al., 2021; Sund et al., 2021). Hron et al. (2021) et al. show how *targeted radical digital transformation can drift towards incremental ones*. As digital artifacts are edible and distributable, sharing and leveraging them in multiple areas is easy. This can lead to the fact that the intent of the innovation gets lost (Hron et al., 2021). Also, Smith and Beretta (2021) highlighted that problem. The decision was made to reintegrate the former separated unit, and the company ended up with an integrated extension instead of the targeted separated development of something new (Hron et al., 2021). This case study shows that separation alone does not lead to exploration (Hron et al., 2021). Without ambidextrous leadership, an innovation shift from radical to incremental is possible and likely. In addition, building on existing products can also easily lead to exploitation instead of exploration (Hron et al., 2021). If the threat of digital disruption is too big, companies favor focusing on quick wins and neglect exploration (Setzke et al., 2021).

Innovation labs are sometimes used to centralize all digital transformation activities. There is a risk that the focus will shift towards exploitation in these labs. This is reasoned by the fact that they must convince the remaining company to accept their innovations. It is easier to convince about incremental improvement with specific positive results than radical uncertain experimentations. The core business focuses on short-term wins and therefore prefers exploitation (Sund et al., 2021). In addition, there might be no clear distinction between explorative and exploitative digital activities. If companies decide not to separate exploration activities, the business units carry the cost of explorative digital transformation. Due to the short-term focus on profitability, what they often get measured against, investments in unsure digital experimentation are not made. Short-term priorities get focus (Cichosz et al., 2020; Krasonikolakis et al., 2020).

We find that in digital transformation literature customer centricity is often brought up as a success factor. Companies are encouraged to include customers in the

development (Gruia et al., 2020; Imran et al., 2021; Remane et al., 2017; Setzke et al., 2021). The constant exchange enabled through digital technologies can help to enhance products and services constantly. Companies gain increased insights into customer needs and wishes (Gruia et al., 2020). Overall, we agree that customer centricity can be important for explorative and exploitative activities, but needs to be treated differently. Especially when involving customers in developments, there might be a risk of looking too close to existing and focusing on exploitation. The digital transformation literature does not differentiate into exploration and exploitation activities when referring to close customer interaction.

Often *wrong measurement systems* are in place, focusing on exploitative targets and hindering exploration initiatives (Ahmad et al., 2021; Krasonikolakis et al., 2020). Also, metrics to steer the transformation are not thought of, and instead, companies stay with current key performance indicators. Ahmad et al. (2021) provided a proposal for measuring the transformation itself. Johansson et al. (2021) gave insights on managerial controls for digital transformation and emphasized the difference to traditional innovations. Nevertheless, there is no distinction between measurements for exploration and exploitation phases of digital transformation. Another observation is that companies fail to explore because they use the same processes for exploration and exploitation (Bjoerkdahl, 2020). DBS bank introduced a new balanced scorecard including traditional KPIs and focused on the transformation process and covering topics like digitalization and engagement (Sia et al., 2021).

4.3.8 Complementary aspects

The only one paper that addresses *contextual ambidexterity* in digital transformation is Hron et al. (2021). Examples are if existing business units manage digital exploration without separation and leaders can focus on the suitable activities or even the individual team members do. Another indirect way of promoting contextual ambidexterity is how Jackson and Dunn-Jensen (2021) emphasized that the ambidextrous mindset needs to be lived throughout the whole organization. Nevertheless, this article does not directly refer to digital transformation but more to the digital age. Overall even if some articles

mention ambidexterity on the surface or indirectly mention its importance, there is very little focus on the details.

Similiar to contextual ambidexterity, there is very little focus on *sequential ambidexterity or punctuated equilibrium* in the reviewed articles (Ghobakhloo & Iranmanesh, 2021; Smith & Beretta, 2021). Nevertheless, some scholars tend to say that due to limited resources, companies could focus on exploration or exploitation at different times (Bjoerkdahl, 2020). Another indirect way of referencing sequential ambidexterity or punctuated equilibrium is the evolutionary path containing, at some point, revolutionary elements (Bosch & Olsson, 2021). The work of Gastaldi and Corso (2012) showed that shifting between exploration and exploitation can lead to long-term ambidexterity. Even if there is no direct mention of sequential ambidexterity or punctuated equilibrium, it still supports that this is a way to be ambidextrous when transforming the company.

5 Conclusion

Currently, many companies struggle with digital transformation, which is related to innovation. Companies do not consistently achieve targeted maturity levels and fail in their digital transformation journey. Ambidexterity is widely accepted as being positively correlated with growth and also innovation success. This is the reason our paper connects ambidexterity with digital transformation. Our literature review combines the three different research areas: exploration / exploitation, ambidexterity, and digital transformation. Our article provides insights on what aspects of exploration and exploitation digital transformation literature contains. The conducted literature review on 94 articles illustrate that all 94 articles on digital transformation contain elements of exploration and exploitation. A reshaped competition landscape or a redefinition of the core business in companies shows the revolutionary impact of digital transformation on individual organizations and industries. The introduction and development of radical new digital technologies enable companies to achieve significant performance improvements. Companies create new customer demands and markets through internal capability development or acquisitions. This ultimately leads to growth. To achieve this, entrepreneurial activities and cultural change are required. However, digital transformation does not only account for exploration activities. The sometimes

evolutionary path due to resource restrictions can lead to exploitative aspects in the journey. Companies use digital technologies to advance and automate already existing processes by combining available solutions. Efficiency and productivity gains are targets of companies pursuing those activities. Adding digital functions to enhance customer value is another exploitative aspect of digital transformation. Even though all articles contain aspects of both activities, scholars are not very specific about them.

As ambidexterity means balancing those paradoxical activities, it is essential to see that a minority directly connects digital transformation with ambidexterity. Even if they do, our and the original understanding of March (1991) of exploration and exploitation is often not followed. Instead, there is a common understanding to balance all digital activities with the traditional core business activities. This shows that there is limited focus on differentiating exploration and exploitation, leading to undifferentiated treatment and innovation failure. One major contribution of digital transformation to the ambidexterity literature we found is that digital technologies can enable ambidexterity through increased connectivity. Focusing on aspects not directly being called ambidexterity but being connected reveals further valuable insights. A frequently brought-up topic is the separation of digital activities, which can be connected with structural ambidexterity. Also, digital transformation literature does not differentiate between explorative and exploitative digital activities here. Open ecosystem innovation is vital in the fast-changing digital environment. This can be connected to the network and alliance research stream in ambidexterity research. We find that digital transformation literature calls for strong leadership support through vision and strategy guidance. Not directly mentioned, but we can find the need for attributes of ambidextrous leadership. We identify that digital transformation literature does not distinguish between leaders and managers and which capabilities are needed. Another focus area of articles is the challenges and reasons for the failure of digital transformation. The identified aspects can be tied to missing ambidexterity, even though scholars do not address it directly. Overall we find some valuable insights on aspects of exploration, exploitation, and ambidexterity in the reviewed articles. Nevertheless, the main conclusions are based on themes related to the other research areas without a direct connection in the literature.

6 Research limitations & Outlook

We faced a couple of challenges which we would like to share with the interested reader. Due to the existing literature's unharmonized definition of digital transformation, we used multiple search terms and not only digital transformation. As our research focuses on exploration, exploitation and all reviewed articles contain aspects of both, a broad alignment with our definition of digital transformation is still ensured. One researcher only conducted our selection and coding process of the articles. This could lead to the fact that another researcher would make a different selection. The risk is mitigated by defining clear exclusion criteria and applying them so other researchers can reproduce the selection process. By applying those exclusion criteria, relevant papers could have been overlooked. Adding papers through a bibliography review of the selected papers reduced this risk but did not eliminate it. Even if we applied structured coding to identify aspects of exploration and exploitation in the digital transformation literature, there is always a residuary part of subjectivity.

Our findings show how exploration / exploitation and ambidexterity are reflected in the literature, but we do not provide own empirical evidence within our present study. Therefore we would be happy to inspire further research in this respect via our literature review. Such research shoud ideally focus on how companies lead their digital transformation journey and how they treat exploration and exploitation as well has how ambidextrous their digital transformation strategy is.

We also want to make clear that our finding that literature does not clearly differentiate between means of „managing“ and „leading“ makes further theoretical as well as empirical research necessary to fully understand how to manage and lead a digital transformation to maximize the related success.

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Table 1

Aggregated Dimension	Second-order Themes	First-order concepts	Content summary	Sources
Exploration	Revolutionary impact	• Radical or disruptive change to companies and industries • Radical changes to organizational structure and strategy • Revolutionary nature of digital technologies as enabler for major improvements	• Disruptive change to society, political and industry level • Transformation of existing value creation • Radical changes to organizational structure and strategy possible • Possible re-organization Disruptive character of digital technologies • New digital business opportunities • Significant performance increases only possible with suitable organizational set-up	(Ahmad et al., 2021; Åkesson et al., 2018; Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Bosler et al., 2021; Brown & Brown; Calabrese et al., 2021; Ceipek et al., 2021; Cichosz et al., 2020; Correani et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Garzoni et al., 2020; Gastaldi et al., 2018; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Johansson et al., 2021; Jones et al., 2021; Kane, 2019; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Machado et al., 2021; Matt et al., 2015; Matzner et al., 2018; Naimi-Sadigh et al.; North et al., 2020; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Riasanow et al., 2019; Saarikko et al., 2020; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Tijan et al., 2021; Tronvoll et al., 2020; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020; Wrede et al., 2020; Wu et al., 2021)
	Strategic targets and drivers	• Increase revenue / grow through digital transformation • Digital growth through partnerships or ventures • Addressing new customer needs or innovating new technologies to markets as drivers for digital transformation	• Growth as one major driving force of digital transformation • Growth outside traditional industries • Growth enabled by developing new products, new markets, or both • Quick acquisition of needed capabilities and resources through mergers • Acquiring companies outside core-business • Acquiring companies with targeted technologies (start-ups) • Co-creation in digital ecosystem • Create new market requirements • Address needs, customers don't know yet • Shift from analog offerings to digital ones • Access to new markets	(Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Brown & Brown; Calabrese et al., 2020; Camarinha-Matos et al., 2019; Fitzgerald et al., 2013; Franco et al., 2021; Gastaldi et al., 2018; Gimpel et al., 2018; Gruia et al., 2020; Heberle et al., 2017; Horváth & Szabó, 2019; Iansiti & Lakhani, 2014; Imran et al., 2021; Ismail et al., 2017; Jin et al., 2020; Jones et al., 2021; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Margiono, 2021; Martincevic & Kozina, 2021; Matt et al., 2015; Matzner et al., 2018; Naimi-Sadigh et al.; Niemand et al., 2021; North et al., 2020; Olsson & Bosch, 2020; Parida et al., 2019; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Saarikko et al., 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Svahn & Henfridsson, 2012; Tekic & Koroteev, 2019; Tomičić Furjan et al., 2020; Tronvoll et al., 2020; Verhoef et al., 2021; Vial, 2019; Wiesbock & Hess, 2020)

	Entrepreneurial activities	• Searching for new solutions • Rethinking and transformation of current business • Development of new capabilities	• Research & Development • New technologies, products, services and business models • Co-creation in digital ecosystem enables searching for new solutions • Rethink existing procedures, value propositions, products, services, and internal structures • Challenge status quo constantly • Creation of new core-business • Termination of old activities • Start-up mind-set • Experimentation • Failure • Risk taking • Flexibility • Dynamic capabilities	(Ahmad et al., 2021; Andriole, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Bosch & Olsson, 2021; Calabrese et al., 2021; Camarinha-Matos et al., 2019; Cennamo et al., 2020; Chen et al., 2021; Correani et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Franco et al., 2021; Garzoni et al., 2020; Ghobakhloo & Iranmanesh, 2021; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Jin et al., 2020; Jones et al., 2021; Kaiser & Stummer, 2020; Kane et al., 2015, 2018; Kane, 2019; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Martincevic & Kozina, 2021; Matt et al., 2015; Matzner et al., 2018; Neumann et al., 2019; Niemand et al., 2021; North et al., 2020; Nwaiwu, 2018; Olsson & Bosch, 2020; Rachinger et al., 2019; Remane et al., 2017; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Sia et al., 2016; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Tijan et al., 2021; Tomičić Furjan et al., 2020; Verhoef et al., 2021; Westerman et al., 2014)
Exploitation	Evolutionary impact	• Achieve digital transformation through evolutionary stages	• Limited resources allow only digital evolution of a company • Stages / maturity levels of digital transformation	(Jones et al., 2021; Matt et al., 2015; Naimi-Sadigh et al.; Parviainen et al., 2017; Santos & Martinho, 2020; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Smith & Beretta, 2021; Verhoef et al., 2021)
	Operational targets and drivers	• Increase efficiency and productivity and reduce costs • Enhance customer value	• Increase efficiency, productivity and reduce cost • Increase the efficiency of the operational backbone • Enhance customer experience • Improve customer satisfaction • Higher quality products • Increased customer interaction through digital technologies	(Balakrishnan & Das, 2020; Becker & Schmid, 2020; Bosch & Olsson, 2021; Calabrese et al., 2021; Cennamo et al., 2020; Cichosz et al., 2020; Fischer et al., 2020; Fitzgerald et al., 2013; Garzoni et al., 2020; Gastaldi et al., 2018; Ghobakhloo & Iranmanesh, 2021; Gimpel et al., 2018; Gopal et al., 2019; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Ismail et al., 2017; Jones et al., 2021; Kane et al., 2015, 2018; Karekla et al., 2021; Krasonikolakis et al., 2020; Loonam et al., 2018; Machado et al., 2021; Martincevic & Kozina, 2021; Matzner et al., 2018; Naimi-Sadigh et al.; Neumann et al., 2019; Niemand et al., 2021; North et al., 2020; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pihir et al., 2018; Pumaleque et al., 2021; Rachinger et al., 2019; Remane et al., 2017; Saarikko et al., 2020; Sanchez, 2017; Santos & Martinho, 2020; Savytska & Salabai, 2021; Schallmo et al., 2017; Sia et al., 2021; Smith & Beretta, 2021; Svahn & Henfridsson, 2012; Tijan et al., 2021; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Vial, 2019; Wiesbock & Hess, 2020)
	Improving the existing	• Optimization and automation of existing processes • Combining existing solutions	• Optimizing established processes and procedures • Automation of processes (internal and external) • Elimination of tasks through automation • Optimize existing processes but not reimagine the old procedures • Adding digital features	(Ahmad et al., 2021; Andriole, 2020; Anshin & Bobyleva, 2021; Becker & Schmid, 2020; Bosch & Olsson, 2021; Bosler et al., 2021; Ceipek et al., 2021; Cennamo et al., 2020; Correani et al., 2020; Fitzgerald et al., 2013; Gastaldi et al., 2018; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Heberle et al., 2017; Herceg et al., 2020; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Jones et al., 2021; Karekla et al., 2021; Margiono, 2021; Matzner et al., 2018; Naimi-Sadigh et al.; Neumann et al., 2019; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pumaleque et al., 2021; Rachinger et al., 2019; Remane et al., 2017; Sanchez, 2017; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Smith & Beretta,

				2021; Sund et al., 2021; Tekic & Koroteev, 2019; Tijan et al., 2021; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020)
Ambidexterity	Digital Transformation contains evolutionary and evolutionary aspects	• Digital transformation can be revolutionary and evolutionary • Inconsistencies in digital transformation characteristics	• Incremental and disruptive changes • All articles include exploration and exploitation aspects but not always in all cluster categories • One cluster might include aspects of exploration but not exploitation but other clusters in the same article include exploitation criteria • Scholars pay limited attention to the details, therefore, do not further differentiate those distinct activities	(Andriole, 2020; Calabrese et al., 2020; Calabrese et al., 2021; Cichosz et al., 2020; Franco et al., 2021; Garzoni et al., 2020; Krasonikolakis et al., 2020; Libert et al., 2016; Naimi-Sadigh et al.; Saarikko et al., 2020; Schallmo et al., 2017)
	Balancing exploration and exploitation	• General agreement to paradoxical activities • Different understandings of exploration and exploitation • Digital Technologies as enabler for ambidexterity	• Importance of balancing two paradoxical activities • Often no details are provided • Different foci • Digital = exploration / traditional (old) = exploitation • No consideration if digital is really exploration • New capabilities for digital but no differentiation into exploration / exploitation • Social media enables more exchange and therefore insights for radical / incremental innovation • Digital technologies increasingly enable ambidexterity though connectivity	(Ahmad et al., 2021; Åkesson et al., 2018; Bjoerkdahl, 2020; Bosler et al., 2021; Cennamo et al,. 2020; Chan et al., 2019; Gastaldi et al., 2018; Gastaldi & Corso, 2012; R. W. Gregory et al., 2015; Hess et al., 2016; Kaiser & Stummer, 2020; Kane et al., 2018; Kane, 2019; Margiono, 2021; Olsson & Bosch, 2020; Riasanow et al., 2019; Scuotto et al., 2019; Sia et al., 2021; Smith & Beretta, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Verhoef et al., 2021; Vial, 2019; Westerman et al., 2014; Wiesbock & Hess, 2020; Wu et al., 2021)
	Structural ambidexterity	• Rethinking structure and separation • Alignment	• Digital transformation can significantly impact organizational structures • Often no details on separation • The closer to core business – integration, more distant to core business – separation • Understanding old vs. digital – digital separate business unit or division - no consideration if digital is really exploration • Digital innovation labs or digital hubs • Alignment needed • Lack of interaction	(Ahmad et al., 2021; Åkesson et al., 2018; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Bosler et al., 2021; Camarinha-Matos et al., 2019; Chen et al., 2021; Correani et al., 2020; Fischer et al., 2020; Hess et al., 2016; Hron et al., 2021; Ismail et al., 2017; Kaiser & Stummer, 2020; Krasonikolakis et al., 2020; Margiono, 2021; Matt et al., 2015; Naimi-Sadigh et al.; Rachinger et al., 2019; Riasanow et al., 2019; Setzke et al., 2021; Sia et al., 2016; Smith & Beretta, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Wiesbock & Hess, 2020)

			• Data sharing	
	Alliances, collaborations and networks	• Open innovation • Acquisitions, mergers and ventures	• Fast changing environment • Digital ecosystem innovation • Open innovation systems • Collaborations and partnerships in and outside the industry • No hierarchical structures • Access to resources and capabilities • Not clear if used for exploration or exploitation • Complement the current portfolio of companies	(Åkesson et al., 2018; Balakrishnan & Das, 2020; Berghaus & Back, 2016; Bosler et al., 2021; Camarinha-Matos et al., 2019; Cennamo et al., 2020; Chan et al., 2019; Chen et al., 2021; Cichosz et al., 2020; Fischer et al., 2020; Franco et al., 2021; Gruia et al., 2020; Gurbaxani & Dunkle, 2019; Hanelt et al., Hess et al., 2016; Horváth & Szabó, 2019; Hron et al., 2021; Imran et al., 2021; Ismail et al., 2017; Johansson et al., 2021; Jones et al., 2021; Kaiser & Stummer, 2020; Kane et al., 2018; Kane, 2019; Krasonikolakis et al., 2020; Margiono, 2021; Matzner et al., 2018; Nwaiwu, 2018; Olsson & Bosch, 2020; Rachinger et al., 2019; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Savytska & Salabai, 2021; Schallmo et al., 2017; Schneider & Kokshagina, 2021; Scuotto et al., 2019; Setzke et al., 2021; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Svahn & Henfridsson, 2012; Tijan et al., 2021; Tomičić Furjan et al., 2020; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Wiesbock & Hess, 2020)
	Senior leadership support is necessary	• Senior leadership attitude influences ambidexterity success • Senior leadership to provide guidance • Ambidextrous leadership • No differentiation between leadership and management • Agility	• Senior leadership has a significant impact on transformation projects • Family-owned businesses focus on exploitation • Importance of ambidextrous leadership • Strategy • Vision • Seldomly directly mentioned in digital transformation literature • Balance between leveraging digital technologies to enhance the existing but also to create new digital business offerings • Alignment IT + business • Resource allocation • Have the right people in the right position • Centralized decision-making in case of separation • Support change • Often focus on new capabilities for digital, not distinguishing between exploration and exploitation	(Ahmad et al., 2021; Åkesson et al., 2018; Alqahtani, 2014; Andriole, 2020; Anshin & Bobyleva, 2021; Balakrishnan & Das, 2020; Becker & Schmid, 2020; Berghaus & Back, 2016; Bharadwaj et al., 2013; Bjoerkdahl, 2020; Bosler et al., 2021; Brown & Brown; Chan et al., 2019; Cichosz et al., 2020; Correani et al., 2020; Fischer et al., 2020; Franco et al., 2021; Ghobakhloo & Iranmanesh, 2021; Gimpel et al., 2018; Gruia et al., 2020; Heberle et al., 2017; Hess et al., 2016; Horváth & Szabó, 2019; Imran et al., 2021; Jackson & Dunn-Jensen, 2021; Johansson et al., 2021; Jones et al., 2021; Kane et al., 2018; Kane, 2019; Karekla et al., 2021; Kotter, 2008; Krasonikolakis et al., 2020; Machado et al., 2021; Margiono, 2021; Martincevic & Kozina, 2021; Matzner et al., 2018; Niemand et al., 2021; Nwaiwu, 2018; Nwaiwu et al., 2020; Olsson & Bosch, 2020; Pumaleque et al., 2021; Riasanow et al., 2019; Saarikko et al., 2020; Sanchez, 2017; Schneider & Kokshagina, 2021; Sebastian et al., 2020; Sia et al., 2016; Sia et al., 2021; Smith & Beretta, 2021; Soluk & Kammerlander, 2021; Sund et al., 2021; Svahn & Henfridsson, 2012; Tekic & Koroteev, 2019; Tronvoll et al., 2020; Veile et al., 2020; Verhoef et al., 2021; Wrede et al., 2020)

			• No differentiation between leadership and management in digital transformation literature • Exploration and exploitation of different needs (leadership vs. management) • Fast-changing environment • Agility allows quick responses to context changes • Flat hierarchies • Not clear if needed for exploration or exploitation or both (all digital)	
	No one size fits all	• Company size • Companies' digital maturity levels impact exploration /exploitation focus	• Company size influences how companies approach digital transformation but an ambiguous picture if productivity and efficiency increase have different priorities to companies depending on size • Companies strive for different things during their path to evolve in a digital company • Lower maturity level: exploitation • Higher maturity level: Exploitation + exploration	(Ahmad et al., 2021; Balakrishnan & Das, 2020; Berghaus & Back, 2016; Bjoerkdahl, 2020; Calabrese et al., 2020; Ceipek et al., 2021; Cennamo et al., 2020; Chan et al., 2019; Garzoni et al., 2020; Gastaldi et al., 2018; Gastaldi & Corso, 2012; Ghobakhloo & Iranmanesh, 2021; Heberle et al., 2017; Herceg et al., 2020; Horváth & Szabó, 2019; Jones et al., 2021; Kaiser & Stummer, 2020; Kane, 2019; Karekla et al., 2021; Libert et al., 2016; Margiono, 2021; Nwaiwu, 2018; Pihir et al., 2018; Saarikko et al., 2020; Santos & Martinho, 2020; Scuotto et al., 2019; Setzke et al., 2021; Soluk & Kammerlander, 2021; Verhoef et al., 2021)
	Challenge to achieve ambidexterity	• Understanding DT is both, but current focus on exploitation • Radical intention incremental outcome • Focus on wrong KPIs and methods	• Companies often understand the duality of digital transformation but fail do execute • Focusing on existing customers to leverage short-term high returns • Radical intention incremental outcome • Characteristics of digital artifacts can lead to an innovation shift • Missing ambidextrous leadership • Building on existing products includes risk for a shift in innovation • Pressure to exploitation due to short-term orientation • Customer centricity • Measurement systems focusing on exploitation • No KPIs for transformation itself • Same processes for exploration and exploitation	(Ahmad et al., 2021; Bjoerkdahl, 2020; Calabrese et al., 2020; Cichosz et al., 2020; Gruia et al., 2020; Hron et al., 2021; Imran et al., 2021; Jones et al., 2021; Krasonikolakis et al., 2020; Neumann et al., 2019; Remane et al., 2017; Setzke et al., 2021; Smith & Beretta, 2021; Sund et al., 2021)

	Complementary aspects	• Contextual ambidexterity • Sequential ambidexterity or punctuated equilibrium	• Little focus on contextual ambidexterity • If integration – contextual ambidexterity needed • Ambidextrous mindset needs to be lived throughout the whole organization • Little focus on sequential ambidexterity or punctuated equilibrium • Limited resources can lead to periods of exploration and exploitation • Evolutionary path can be seen as sequential ambidexterity or punctuated equilibrium • Shifting between exploration and exploitation can lead to long-term ambidexterity	(Hron et al., 2021; Jackson & Dunn-Jensen, 2021) (Bjoerkdahl, 2020; Bosch & Olsson, 2021; Gastaldi et al., 2018; Gastaldi & Corso, 2012; Hron et al., 2021; Jackson & Dunn-Jensen, 2021; Smith & Beretta, 2021)

Figure 1

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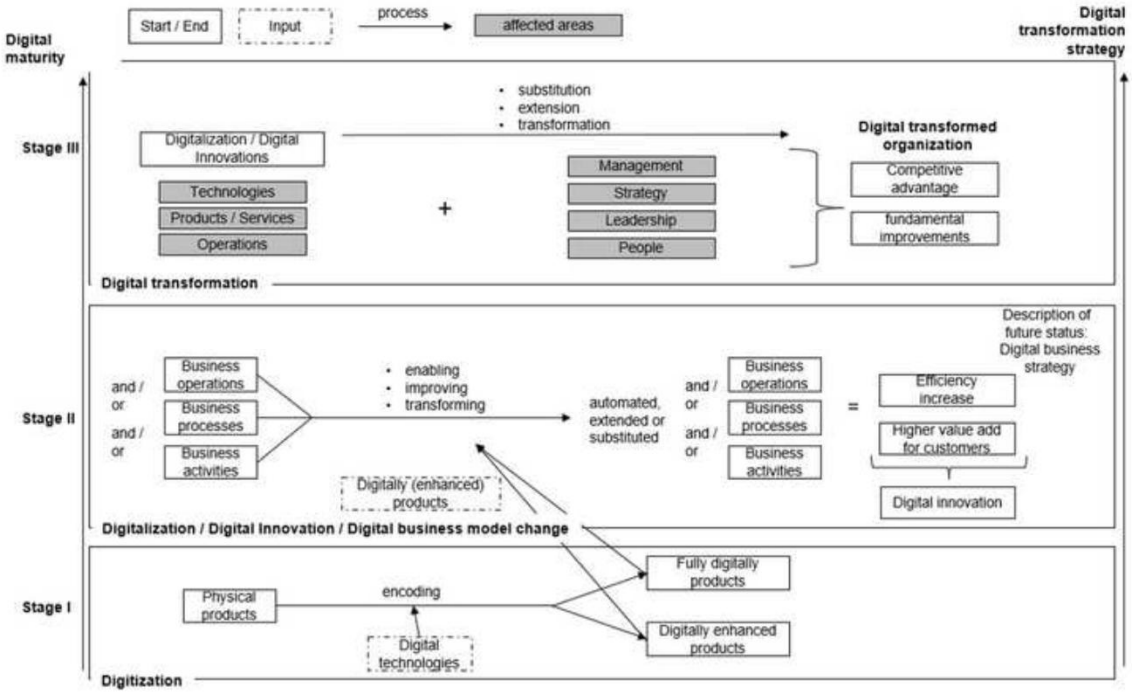

Figure 2

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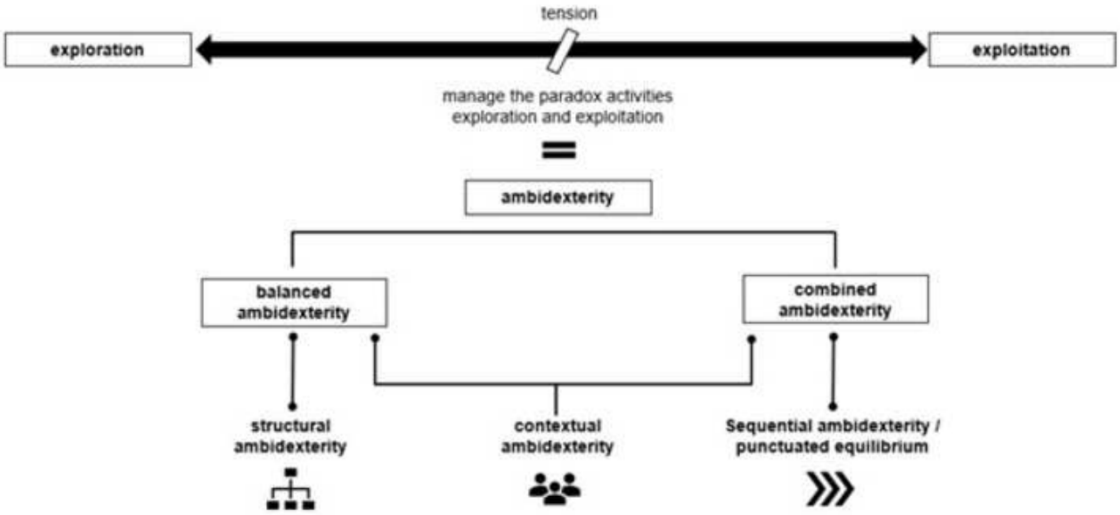

Figure 3

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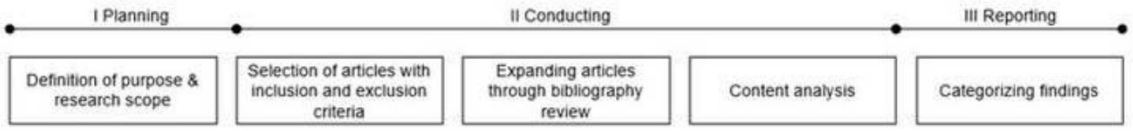

Figure 4

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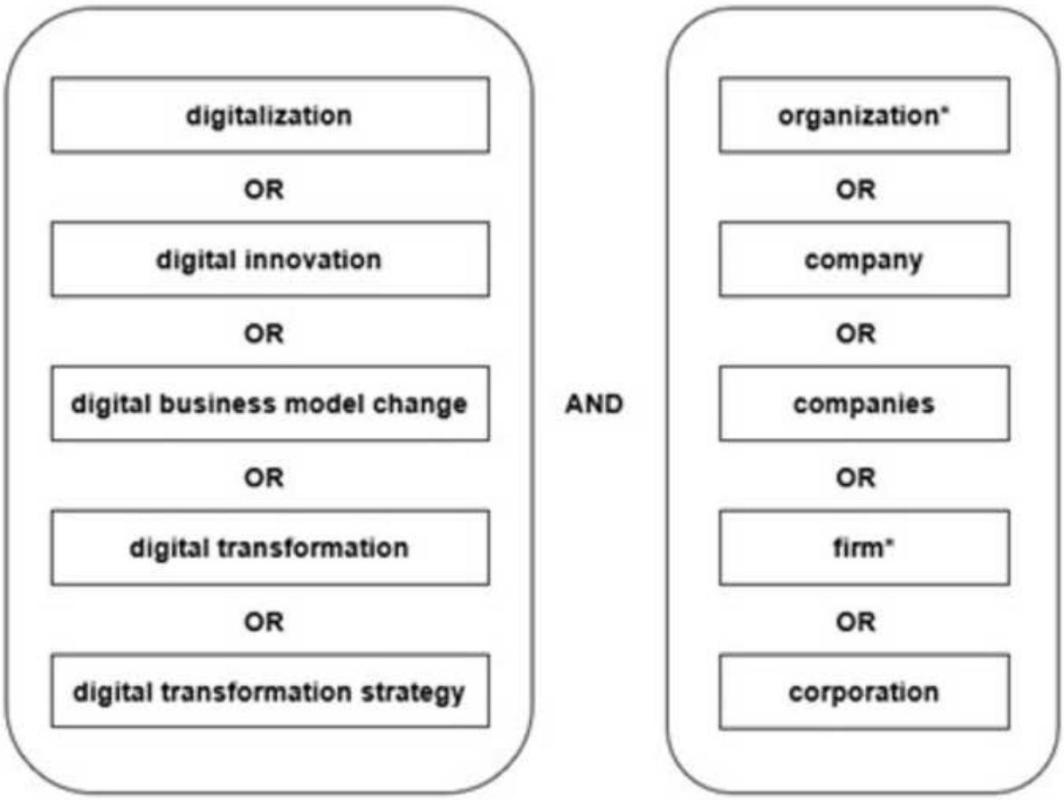

Figure 5

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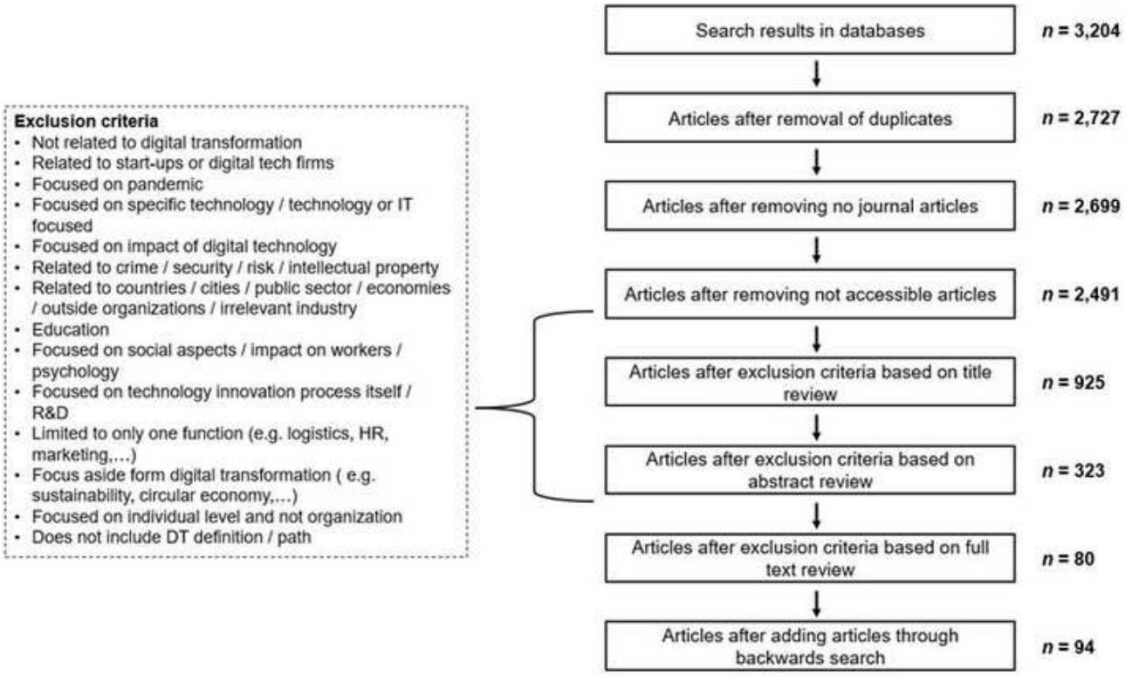

Figure 6

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Cluster	Exploration (ORA)	Exploitation (OIT)
Impact (A)	Revolutionary (AORA1)	Evolutionary (AOIT1)
	Uncertain results (AORA2)	Predictable results (AOIT2)
Focus (B)	Growth (BORA1)	Margins, productivity(BOIT1)
Activities (C)	Searching for new solutions(CORA1)	Combining existing solutions (COIT1)
	Experimentation (CORA2)	
Competencies (D)	Entrepreneurial (DORA1)	Operational (DOIT1)
Target (E)	New technologies to market (EORA1)	Cost savings (EOIT1)
		Efficiency increase (EOIT2)
	Addressing new customer needs (EORA3)	Addressing existing needs (EOIT3)
Risk (F)	High risk-taking (FORA1)	Low risk-taking (FOIT1)
Time horizon (G)	Longer period (GORA1)	Shorter period (GOIT1)

Cluster	Exploration (ORA)	Exploitation (OIT)
Impact of digital transformation	Revolutionary (AORA1)	Evolutionary (AOIT1)
Drivers and targets of digital transformation	Growth (BORA1)	Margins, productivity (BOIT1)
	New technologies to market (EORA1)	Cost savings (EOIT1)
		Efficiency increase (EOIT2)
	Addressing new customer needs (EORA3)	Addressing existing needs (EOIT3)
Activities and foci during digital transformation	Searching for new solutions (CORA1)	Combining existing solutions (COIT1)
	Experimentation (CORA2)	
	Entrepreneurial (DORA1)	Operational (DOIT1)

Paper 2

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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).

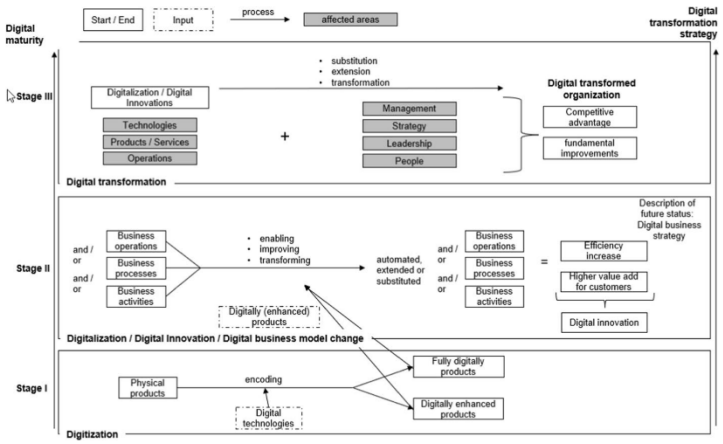

Fig. 1 Three stages of digital transformation and its associated activities, retrieved from Hoessler and Carbon (2022)

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)

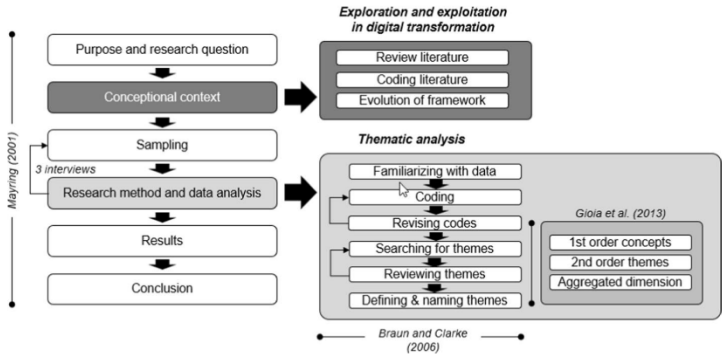

Fig. 2 Research design for a qualitative study based on Mayring (2001), Braun and Clarke (2006) and Gioia et al. (2013)

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).

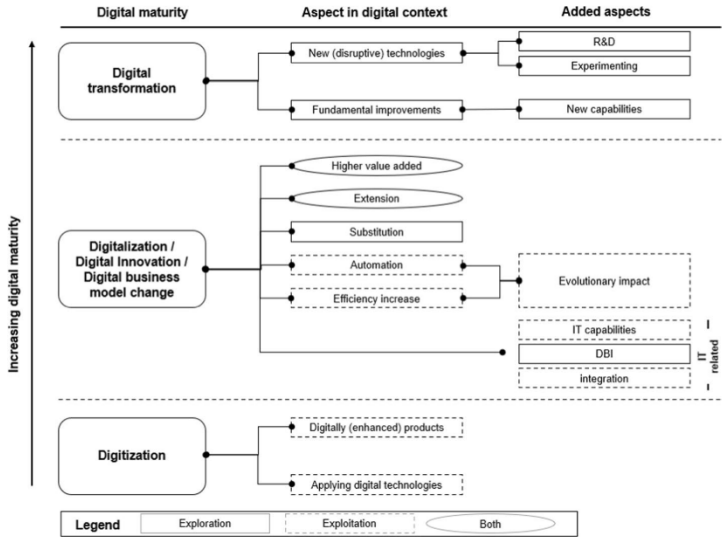

Fig. 3 Three stages of digital transformation and its associated activities mapped to exploration and exploitation in innovation

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.

Unterstanding 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

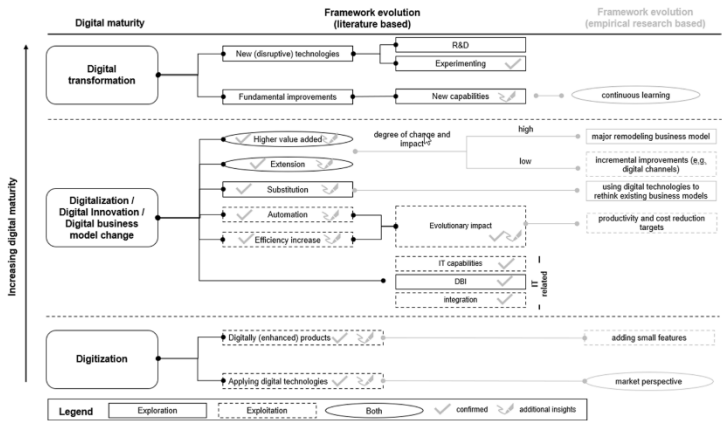

Fig. 4 Stages of digital transformation mapped to exploration and exploitation in innovation empirical research-based

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

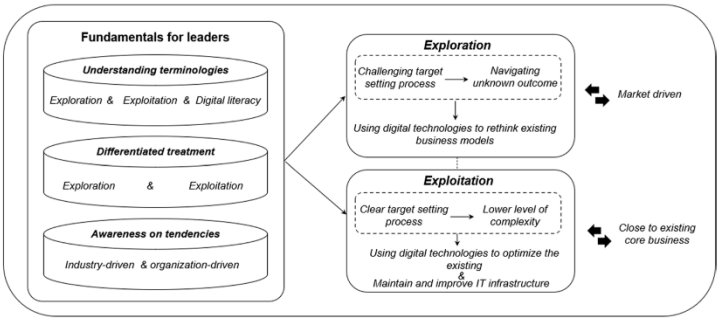

Fig. 5 Dynamic model of exploration and exploitation in digital transformation based on Gioia et al. (2013)

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		

Abbreviations
DBI Digital business intensity
OSF Open Science Framework
R&D Research & Development

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Declarations

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

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Guiding incumbent companies in navigating digital transformations: A qualitative study on structural ambidexterity and strategic leadership

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Abstract

PURPOSE: *Despite digital transformation being a focus topic for incumbent companies, organizational structures are a significant barrier to their success. Referring to the positive correlation between ambidexterity and digital innovation, our research provides guidance on structural ambidexterity for incumbent companies. Previous research has barely differentiated between exploration and exploitation in digital transformation. In the present paper, we fill part of this research gap by focusing on structural ambidexterity in digital transformations and providing guidance on how incumbent companies can overcome organizational challenges.* ***METHODOLOGY****: Our research is based on an explorative research design with 33 semi-structured interviews that allow in-depth information. The interview partners were selected using purposive sampling and represented different industry and hierarchy levels. All of them have been in a position related to digital transformation in an incumbent company for the last two years. We ensure scholarly rigor using thematic analysis to analyze our data.* ***FINDINGS:*** *Our decision tree guides separation or integration based on the closeness of digital activities to the core business and the association of the activities to exploration or exploitation. Additionally, we recommend considering the digital maturity grade in the decision-making. Developing a cross-functional digital transformation strategy and pursuing a balanced portfolio fosters ambidexterity in digital transformation. Clear responsibilities, collaborative decision-making, candidate selection, and collaboration with IT are essential leadership activities.* ***IMPLICATIONS*** *for theory and practice: Our research expands the existing research on digital transformations of incumbent companies. We specifically contribute to the limited details on how to separate digital activities considering an exploration/exploitation perspective. Our study guides practitioners to address one of their major challenges in digital transformations with the help of our decision tree.* ***ORIGINALITY AND VALUE****: Based on the positive correlation between ambidexterity and digital innovation, our study contributes to the existing research by providing in-depth knowledge of structural ambidexterity in digital transformations. This detailed information is essential to provide knowledge on enabling the positive correlation between ambidexterity and innovation in the context of structural ambidexterity.*

Keywords: *digital transformation, digitalization, organizational structures, structural ambidexterity, temporal ambidexterity, incumbent companies, guidelines*

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INTRODUCTION

Digital transformation has become a primary concern for many incumbent companies (Hess et al., 2016; Kane et al., 2015). Incumbent companies no longer question the decision to digitally transform as this is no longer an option to stay competitive (Brunetti et al., 2020; Mirković et al., 2019; Paulino, 2022; Verhoef et al., 2021). Facing market disruptions enabled by digital technologies and new market entrants, companies need to derive a strategy to embrace digital transformation (Hess et al., 2016). Incumbent companies require answers on leveraging opportunities supported by digital technologies (Westerman et al., 2014). Despite the growing interest, the research on incumbent's digital transformation is still quite narrow (Gregory et al., 2015; Oberländer et al., 2021). The availability of new technologies provides companies across multiple industries (Soto Setzke et al., 2023) with new opportunities (Göbeler et al., 2020) to change their value propositions (Soto Setzke et al., 2023). Nevertheless, incumbent companies also face challenges in that process (Klos et al., 2021; Mirković et al., 2019; Zhang et al., 2023). Often, companies fall behind on the expected financial improvements despite investments in digital offerings (Gebauer et al., 2020; Klos et al., 2021). Even if the majority of the existing literature addresses the impact of technologies on digital transformation (Coreynen et al., 2020; Mirković et al., 2019; Soluk & Kammerlander, 2021), technological know-how is not identified as a significant barrier to digital transformation (Mirković et al., 2019). Studies show that planning, developing, and implementing the technological aspects of digital transformations is most evident, but technological know-how alone is insufficient for success. Instead, the required organizational changes confront incumbent companies with additional tasks (Bjoerkdahl, 2020; Mirković et al., 2019). Developing new digital value propositions, such as digital services, requires incumbent companies to adjust processes, working models, and organizational structures (Soto Setzke et al., 2023). Therefore, aside from technological aspects, the managerial aspect of digital transformation might have substantial implications (Soluk & Kammerlander, 2021). The definition of digital transformation shows that it includes improving the existing by raising efficiencies of existing processes and enhancing products and services by integrating digital technologies. It also contains aspects with a higher level of change impact, such as rethinking business models in a radically new way (Alghamdi, 2018; Hess et al., 2016; Schiffer, 2021; Vesna Bosilj Vukšić et al., 2018; Wu et al., 2021). Also, Soto Setzke et al. (2023) point out the fundamental change character of digital transformation and the differentiation to prior technology changes.

Therefore, digital transformation comprises incremental and radical innovation activities (Hoessler & Carbon, 2022; Ismail et al., 2017) and can be linked to the concept of ambidexterity (Duncan, 1976; March, 1991). Ambidexterity is about being able to address current business needs but also addressing future developments. Ambidextrous companies can balance conflicting demands (Duncan, 1976; Gibson & Birkinshaw, 2004; Michael. Tushman & O'Reilly III, 1996). Whereas there is individual research on digital transformation or ambidexterity, research has not focused too much on ambidexterity (Brauer et al., 2021; Wu et al., 2021). Suppose ambidexterity is connected with digital transformation; in that case, the focus is often on individual aspects such as performance impact (Del Giudice et al., 2021), technical aspects (Shao et al., 2021; Wu et al., 2021), or IT structures (Iho & Missonier, 2020; Jöhnk et al., 2020; Montealegre et al., 2019). Nevertheless, research shows a positive correlation between ambidexterity and digital innovation (Del Giudice et al., 2021). One differentiating factor of the different concepts of ambidexterity is separation and integration via organizational structures, and digital transformation efforts often require structural changes (Hess et al., 2016; Soto Setzke et al., 2023). Multiple researchers explain that digital transformation influences organizational structures (Holotiuk, 2020; Schiffer, 2021), and it has been identified as a challenge for incumbent companies (Bjoerkdahl, 2020; Mirković et al., 2019). Nevertheless, this has received little research attention so far, especially not providing in-depth details. Also, a recent study highlights the need for more research on the centralizing and decentralizing dynamics in digital transformation (Plekhanov et al., 2023).

We aim to address this research gap. To guide how to manage one of the major challenges in digitally transforming incumbent companies, we focus on structural ambidexterity in digital transformations. With this, we address the research gap on how incumbent companies can overcome organizational challenges (Smith & Beretta, 2021). Addressing the lack of details on how to separate, we investigate exploration/exploitation separation, its driving factors, and how to separate or integrate digital / core business. As leadership is required to create or reinforce ambidextrous behavior (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011; Mueller et al., 2020; Probst et al., 2011), we add needed strategic leadership activities to frame our research objective. Our study aims, therefore, to answer the following research questions (RQs):

RQ1) How can incumbent companies apply the concept of structural ambidexterity to navigate digital transformation?
RQ2) What elements of strategic leadership do leaders in incumbent companies need to implement when navigating digital transformation considering structural ambidexterity?

We first develop the theoretical background, make our methodology transparent, and illustrate our results, and will then discuss the results in the face of already existing findings to draw practical conclusions for entrepreneurship, management, and innovation leadership (Hoessler & Carbon, 2022; Ismail et al., 2017).

LITERATURE REVIEW

Digital transformation

Digital transformation has gained increasing interest from researchers and practitioners (Klonek et al., 2020; Vesna Bosilj Vukšić et al., 2018; Westerman et al., 2014). Lacking one unified definition (El Sawy et al., 2020; Haffke et al., 2016), existing understandings have similarities, which we use for our combined definition in this paper. Digital transformation goes beyond technologies (Eberl & Drews; El Sawy et al., 2020). It is a leadership challenge to enable the necessary change to transform the business successfully (Hensellek, 2020). Compared to new digital start-ups, incumbent companies have already established external relationships, defined internal processes (Zhang et al., 2023), and preserved core competencies (Klos et al., 2021). Therefore, their reaction to digital transformation is different. In our study, we focus on incumbent companies to address this distinction. Digital transformation aims to create radically new ways of doing business (Berghaus & Back, 2016; Holotiuk; Nambisan et al., 2019). A fundamental change in value proposition through, for example, new business models is characteristic of digital transformation (Zhang et al., 2023). The existing way of doing business is either substituted, extended, or transformed with the help of digital technologies and leadership (Pihir et al., 2018). Especially recent developments in three-dimensional printing (Klos et al., 2021) and artificial intelligence are seen as enablers for transforming decision-making processes or business models (Klos et al., 2021; Zhang et al., 2023). Digital transformation can be seen as the most advanced stadium of a three-phase process (Hoessler & Carbon, 2022; Verhoef et al., 2021). This is a long path achieved by combining incremental and radical innovations shown in different maturity phases (Goerzig & Bauernhansl, 2018; Porfírio et al., 2021). This transformation process needs to be guided by a strategic setting (Klos et al., 2021). The first phase of digital transformation is digitization (Tekic & Koroteev, 2019). This phase is limited to technology (Yoo et al., 2010). The second phase is an intermediate stage between the initial digitization and the final target of a digitally transformed business. Words like digitalization, digital innovation, and digital business model change describe phase two. Automated, extended, or substituted business processes with higher efficiency or higher value added for the customer is the outcome (Cavalcante et al., 2011; Florek-Paszkowska et al., 2021; Li, 2020; Sousa & Rocha, 2019). Whereas there is no clear key performance indicator, when the next phase is achieved, it is more about clustering different activities on the path to digital transformation. Therefore, Saarikko et al. (2020) describe the three clusters as domains instead of stages. In this paper, we use the term "phase," as we can see them as consecutive but not as clearly moving upwards as the term "stage" would imply. Those phases can be connected to digital maturity grades (Ifenthaler & Egloffstein, 2020). Nevertheless, digital transformation is not a final stage. Instead, it is a path that includes multiple choices with potentially different outcomes (Furr et al., 2022). With the given definition, we identify that digital transformation is a process that includes incremental and radical innovations and, therefore, can be linked to the concept of ambidexterity. In the following section, we will first generate a general understanding of ambidexterity, its concepts, and how to achieve it independently of the digital context. This is followed by an analysis of the literature on ambidexterity in digital transformation.

Ambidexterity in general

Companies that balance exploration and exploitation are ambidextrous organizations (Duncan, 1976; Michael. Tushman & O'Reilly III, 1996). Exploration is characterized by experimenting and investigating radically new topics (March, 1991) and is associated with radical innovations (Beckman, 2006; Benner & Tushman, 2003). A higher level of risk is associated with exploration due to the unknown (March, 1991). Exploitation can be described as improving the existing, focusing on efficiency and productivity gains. Exploitation is closely connected to established processes or products, so the results

are more obvious and risk-averse (March, 1991). Achieving balance should be the target as too much exploration can result in high costs with no results, but too much exploitation is unfavorable as it leads to stagnation (March, 1991). Existent research proves the positive relationship between ambidexterity and a company's long-term performance (Brix, 2019). Especially in a fast-changing environment, one characteristic of digital technologies is that a long-term balance of exploration and exploitation is essential (O'Reilly III & Tushman, 2013; Yoo et al., 2012). As those activities are paradoxical, managing them is highly challenging for companies—they often have problems achieving ambidexterity. For example, companies find it difficult to find an applicable balance (Chen & Katila, 2008), not prioritizing one of the activities, especially exploitation (Chen & Katila, 2008), responding to changing environments (Halevi et al., 2015), achieving ambidexterity in superior management (Keller & Weibler, 2015) and establishing new mindsets and skills (Michael Tushman & Euchner, 2015). There is no unique definition of ambidexterity, mainly resulting from different understandings if exploration and exploitation are complementary or fundamentally incompatible and in competition. In addition, scholars represent different opinions if ambidexterity means achieving a simultaneous balance of exploration and exploitation (balanced ambidexterity) (Cao et al., 2009; Gupta et al., 2006; Levinthal & March, 1993) or if it also can be switching between them over time (combined ambidexterity) (Cao et al., 2009). Based on those various definitions, multiple concepts of ambidexterity have evolved (Cao et al., 2009). In the original literature on ambidexterity, the main concepts are *structural ambidexterity* (Benner & Tushman, 2003; Duncan, 1976; Gibson & Birkinshaw, 2004; O'Reilly III & Tushman, 2013), *sequential ambidexterity/punctuated* equilibrium (Boumgarden et al., 2012; Cao et al., 2009; Gupta et al., 2006; Simsek, 2009) *and contextual ambidexterity* (Gibson & Birkinshaw, 2004). Reasoned by the interdisciplinary characteristics of digital innovation and the fast-changing character of digital technologies, Holotiuk and Beimborn (2019) introduced a new form of ambidexterity called *temporal ambidexterity.* The different concepts of ambidexterity are not mutually exclusive but can be combined (Brauer et al., 2021; Jöhnk et al., 2020). If structural separation occurs and employees are guided to pursue exploration and exploitation activities (contextual), companies combine structural and contextual ambidexterity. This concept of ambidexterity is called *hybrid ambidexterity* (Jöhnk et al., 2020; Ossenbrink et al., 2019). We do not list this concept separately as it involves the combination of structural and contextual ambidexterity, which would duplicate the individual aspects.

Ambidexterity is often connected to dynamic capabilities, and especially in the digital context, this connection is justified. Dynamic capabilities help to address changing environments and gain competitive advantage (Teece et al., 1997). Dynamic capabilities are split into three primary activities: 1) Sensing, 2) Seizing, and 3) Transforming (Teece, 2007). On the one hand, sensing can be connected to exploration as it is about identifying new things (Birkinshaw et al., 2016; Teece, 2007). On the other hand, seizing is related to exploitation as it is about improving the existing through execution (Birkinshaw et al., 2016; Teece, 2007). Connecting dynamic capabilities with exploration, exploitation, and ambidexterity leads to the lower-level concepts of sensing (exploration) and seizing (exploitation). Those are associated with the higher-level concept of transformation, which is about splitting resources (Birkinshaw et al., 2016). Table 1 illustrates the differences between the four concepts of ambidexterity based on the main differentiating factors and dynamic capabilities perspective.

Table 1. Characterizations of concepts of ambidexterity

	Structural ambidexterity	**Sequential ambidexterity**	**Contextual ambidexterity**	**Temporal ambidexterity**
Responsibility split regarding exploration and exploitation	Separation of organizational units	Shift of focus on the firm level	Employees to split time	Employees to shift between organizational units
Way of managing trade-off between exploration and exploitation	Separation	Consecutive	Integration	Temporal separation and Alignment
Dedicated exploration or exploitation organizational unit	Either / Or	Either / Or – changes over time	Both	Both – limited time
Team structure within organizational Unit	No details available – tendency towards more fix structures	N/A as no different organizational units	N/A as no different organizational units	Flexible team structure – Employees shifting between units

	Structural ambidexterity	Sequential ambidexterity	Contextual ambidexterity	Temporal ambidexterity
Dynamic capabilities	Separated sensing/ seizing units via resource-linking capability	Sensing and seizing managed via focus-shifting capability	Sensing and seizing managed via context-shaping capability	Separated sensing/ seizing units via resource-linking capability, temporal focus-shifting capability

Source: Birkinshaw et al. (2016), Hoessler and Carbon (2022), and Holotiuk and Beimborn (2019).

With the help of dual structures, such as separating by setting up business units dedicated to either exploration or exploitation, the two competing activities can be balanced when following the concept of *structural ambidexterity* (Duncan, 1976; Gibson & Birkinshaw, 2004). Separated sensing/seizing units are managed via a resource-linking capability (Birkinshaw et al., 2016). When a company's focus is set to either exploration or exploitation over a more extended period and then shifted consecutively on a company level, companies pursue *sequential ambidexterity* (Gupta et al., 2006; Simsek, 2009). Sensing and seizing are managed via a focus-shifting capability (Birkinshaw et al., 2016). Companies enabling employees to split their time between exploration and exploitation choose *contextual ambidexterity* by integrating exploration and exploitation. There is no focus on exploration or exploitation (Gibson & Birkinshaw, 2004). Sensing and seizing are managed via context-shaping capability (Birkinshaw et al., 2016). *Temporal ambidexterity* combines structural, sequential, and contextual ambidexterity as selected employees shift to the digital innovation lab for a limited time and focus on exploration during this time. With this flexible team structure, employees return to their original business and concentrate again on exploitation (Holotiuk & Beimborn, 2019). Separated sensing/seizing units are managed via resource-linking and focus-shifting capability for employees shifting between units (Birkinshaw et al., 2016). Overall, there is no universal right decision. Instead, the leadership is responsible for placing the company in a suitable composition of exploration and exploitation to gain a competitive advantage (Keller & Weibler, 2015). This also highly depends on the context, such as industries and other environmental factors (Bell & Hofmeyr, 2021; Havermans et al., 2015; Wasono & Furinto, 2018). Empirical research proves a positive relation between ambidexterity and superior company performance (Brix, 2019), and leadership is required to create or reinforce ambidextrous behavior (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011; Mueller et al., 2020; Probst et al., 2011). Leadership in this paper implies "lead[ing] oneself and human communities […] into an innovative and creative future in open and complex situations under unclearly defined and dynamic conditions" (Faix et al., 2020, p. 61). Aside from motivating people to change, providing direction and vision and aligning people are leadership responsibilities (Kotter, 2017). This definition also considers the requirements and specifics of current times (Faix et al., 2020). According to (Samimi et al., 2020, p. 3), leadership includes "managing conflicting demands," implicating a connection to ambidexterity.

Ambidexterity in digital transformation

IT ambidexterity is a research stream covering a portion of ambidexterity in digital transformation (Park et al., 2020). It does not cover the full scope of digital transformation. Instead, it is limited to the paradoxes of IT transformations, such as IT portfolio decisions or IT architecture (Gregory et al., 2015) and infrastructure changes (Montealegre et al., 2019). In addition, IT ambidexterity applies the described concepts of structural, sequential, or contextual ambidexterity to the IT context (Park et al., 2020). Nevertheless, those concepts are limited to the technology character and purpose of IT without considering the full intent of digital transformation. For example, Park et al. (2020) refer to digitization as not covering the aspects of digital transformation. Individually, sequential ambidexterity (Smith & Beretta, 2021) and contextual ambidexterity (Hoessler & Carbon, 2022; Hron et al., 2021) are only sporadically brought into the context of digital transformation. Smaller companies, mainly, have limited resources and, therefore, pursue a path of digital transformation with different focus areas over time (Bjoerkdahl, 2020). This concept can be indirectly linked to sequential ambidexterity. Asking leaders to provide the context for employees to focus on suitable activities can be indirectly mapped to contextual ambidexterity (Göbeler et al., 2020; Hoessler & Carbon, 2022; Hron et al., 2021).

The highest popularity within the digital transformation context receives structural ambidexterity, mainly focusing on digital innovation labs (Holotiuk, 2020; Raabe et al., 2020) or separating the traditional from the new digital business (Kaiser & Stummer, 2020). Structural ambidexterity is described as a concept especially applicable to incumbent companies, allowing them to continue the existing but also step into the digital world (Schiffer, 2021). In addition,

we see the closely associated concept of temporal ambidexterity due to its origin in the digital context as a focus area (Holotiuk & Beimborn, 2019). This paper focuses on structural ambidexterity as organizational structures are identified as one major challenge of digital transformations of incumbent firms (Mirković et al., 2019). We identified the literature connecting digital transformation with ambidexterity, mainly focusing on structural ambidexterity, and analyzed the existing research. We selected "Web of Science" as the scientific platform using the databases CPCI-SSH , CPCI-S , SCI-EXPANDED , SSCI for our research. "Digital AND ambidex*" is the search topic we used to identify research connecting digital transformation and ambidexterity. As digital transformation is an emerging research field that has started growing in the last 15 years (Hoessler & Carbon, 2022; Pihir et al., 2018), we limited our search to 2008-2023. Our initial search results included 193 articles. After eliminating the non-accessible ones, we reviewed 174 articles. Our exclusion criteria removed articles with no digital context, different focus areas, no or minimal ambidexterity qualitative context, limited to technologies, no business context, and not related to incumbent companies. The result was 23 articles. Details can be found in Figure 1.

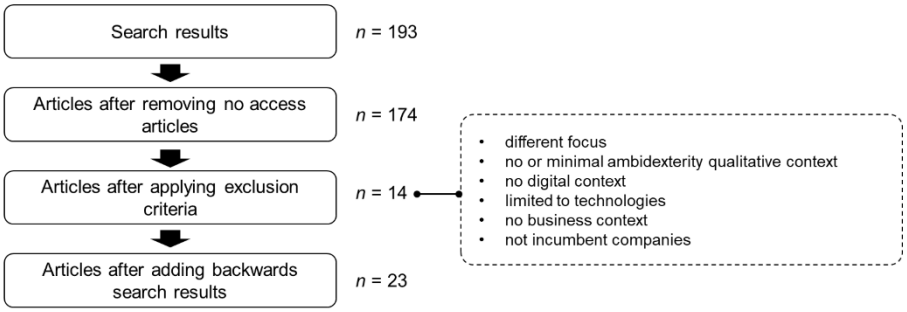

Figure 1. Process of literature review

Combining the traditional understanding of separating exploration/exploitation activities via organizational structures as structural ambidexterity, we categorized the 23 articles into four categories:

1) Not distinguished between exploration/exploitation in digital business (7).
2) Fuzzily distinguished exploration/exploitation in digital business (7).
3) Clear distinguished exploration/exploitation in digital business (4).
4) N/a; no details provided (5).

The comparison of the categories shows that most of the existing research either provides no details, neglects the differentiation of exploration/exploitation in digital business, or provides only minimal information about the separation. Only 4 out of 23 analyzed papers clearly distinguish between exploration/exploitation in digital business. Here, the authors clearly state the separation of exploration from exploitation in digital business (Brauer et al., 2021; Holotiuk & Beimborn, 2019; Hron et al., 2021). An example of providing a low level of distinguishing between exploration/exploitation in digital business is the work of Hess et al. (2016). Hess et al. (2016) recommend separating new digital products and integrating hybrid products related to the core business in the core organization. Sia et al. (2021) and van den Buuse et al. (2021) extend the scope from product to offerings and propose separating them. Nevertheless, there is no indication of how incremental or radical the new offerings are. From a process perspective, Sia et al. (2021) provide clear guidance to integrate automation activities into the core organization. This aligns with the literature review of Hoessler and Carbon (2022), who classified the automation of existing processes as exploitation. In addition, existing literature suggests considering innovation stages (Hellmich et al., 2021), focus areas (Jöhnk et al., 2020), and levels (Jaspert & Ebel, 2022). 7 out of 23 papers do not distinguish between exploration/exploitation in digital business. Even if a lot of the research does not label it structural ambidexterity (Schiffer, 2021), research is showing that companies separate new digital businesses with the help of separate business units (Sund et al., 2021) or sub-companies (Kaiser & Stummer, 2020). So-called digital units or digital innovation labs are separated to conduct digital innovations. Nevertheless, there is no distinction between exploration

and exploitation within digital innovation (Åkesson et al., 2018; Göbeler et al., 2020; Holotiuk, 2020; Kaiser & Stummer, 2020; Schiffer, 2021; Smith & Beretta, 2021; Sund et al., 2021). A case study conducted by Göbeler et al. (2020) shows problems arising from separating all digital activities. In addition to the four categories mentioned above, we analyzed the literature to see if they mention details on how organizational structures can change over time. It is brought up by some authors that a digital innovation hub can be a temporary separation and dissolved over time (Åkesson et al., 2018; Göbeler et al., 2020; Hron et al., 2021; Svahn et al., 2017). Also, we identified that more than half of the existing studies focus on one industry. As digital transformation affects a wide range of industry sectors (Hess et al., 2016; Kane et al., 2015), we see this as a limitation and recommend a study not limited to one specific sector. Table 2 summarizes the results of our literature research on digital transformation and structural ambidexterity.

Table 2. Literature research on digital transformation and structural ambidexterity

	Number (%)	Details and sources
Not distinguished exploration/exploitation in digital business	7 (30%)	Everything related to digital separated (Åkesson et al., 2018; Göbeler et al., 2020; Holotiuk, 2020; Kaiser & Stummer, 2020; Schiffer, 2021; Smith & Beretta, 2021; Sund et al., 2021) but closely connected to core organization (Smith & Beretta, 2021) or integration of exploration outcome (Holotiuk, 2020) Case studies show problems arising from separating all digital activities (Göbeler et al., 2020)
Fuzzily distinguished exploration/exploitation in digital business	7 (30%)	Hybrid products related to core business integrated into the core organization and new digital products are separated (Hess et al., 2016) Automation core business (Sia et al., 2021), new digital offerings separate unit (Sia et al., 2021; van den Buuse et al., 2021) Renewal and refinement units (limited to digital platforms) (Montealegre & Iyengar, 2021) Different set-ups depending on the innovation stage (Hellmich et al., 2021), focus areas (Jöhnk et al., 2020) and levels (Jaspert & Ebel, 2022)
Clear distinguished exploration/exploitation in digital business	4 (17%)	Exploration in a separate unit (Brauer et al., 2021; Holotiuk & Beimborn, 2019; Hron et al., 2021; Raabe et al., 2020) but drift to exploitation (Hron et al., 2021)
N/a; no details provided	5 (22%)	No details overall on the responsibilities of separate unit (e.g., innovation hub) vs. core (Kronblad et al., 2023; Soto Setzke et al., 2023; Svahn et al., 2017) No separation (Gastaldi et al., 2018; Oberländer et al., 2021)
Total	*23*	
Change over time	4 (17%)	Dissolvement of innovation hub (Åkesson et al., 2018; Göbeler et al., 2020; Hron et al., 2021; Svahn et al., 2017)
No details on change over time	19 (83%)	No details on changes in separate hub (Brauer et al., 2021; Hellmich et al., 2021; Hess et al., 2016; Holotiuk, 2020; Jaspert & Ebel, 2022; Jöhnk et al., 2020; Kaiser & Stummer, 2020; Kronblad et al., 2023; Montealegre & Iyengar, 2021; Raabe et al., 2020; Schiffer, 2021; Sia et al., 2021; Smith & Beretta, 2021; Soto Setzke et al., 2023; Sund et al., 2021; van den Buuse et al., 2021)
Total	*23*	
One industry	13 (57%)	(Åkesson et al., 2018; Gastaldi et al., 2018; Göbeler et al., 2020; Hron et al., 2021; Jaspert & Ebel, 2022; Kaiser & Stummer, 2020; Kronblad et al., 2023; Schiffer, 2021; Sia et al., 2021; Smith & Beretta, 2021; Sund et al., 2021; Svahn et al., 2017; van den Buuse et al., 2021)
Multiple industries	9 (39%)	(Brauer et al., 2021; Hellmich et al., 2021; Hess et al., 2016; Holotiuk, 2020; Holotiuk & Beimborn, 2019; Jöhnk et al., 2020; Oberländer et al., 2021; Raabe et al., 2020; Soto Setzke et al., 2023)
Unclear	1 (4%)	(Montealegre & Iyengar, 2021)
Total	*23*	

METHODOLOGY AND RESEARCH METHODS

The underlying method to answer our research question is based on Mayring (2001) and enriched with guidance provided by Braun and Clarke (2006) for code development. Figure 2 displays the method used in the present paper.

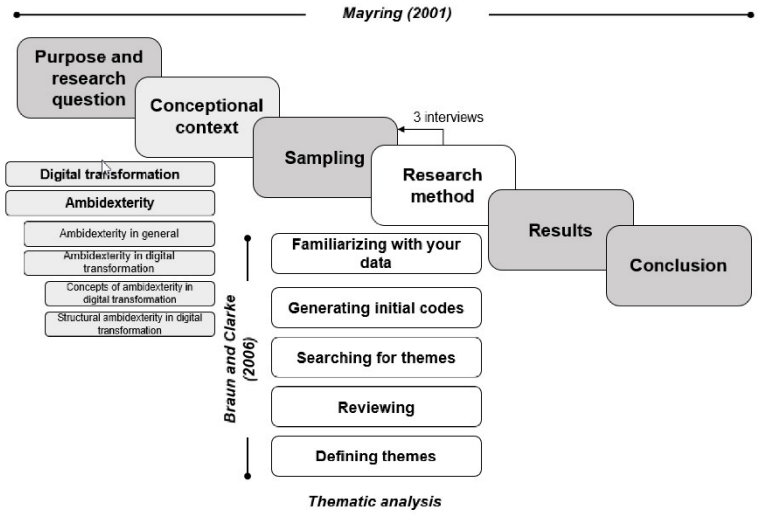

Figure 2. Research design for a qualitative study
Source: Mayring (2001) and Braun and Clarke (2006).

Our study has the *purpose* of addressing the research gap on how to overcome organizational challenges (Smith & Beretta, 2021) and master structural ambidexterity in digital transformations. Therefore, we provide guidance for incumbent companies on achieving structural ambidexterity in digital transformations. Therefore, one of our two research questions is: How can incumbent companies apply the concept of structural ambidexterity to navigate digital transformation? In our study, we investigate exploration/exploitation separation and its driving factors, as well as how to separate or integrate digital/core business. The baseline for those focus areas in our research is the literature research illustrated in Table 2. Explained by the necessity of leadership to achieve ambidexterity (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011; Mueller et al., 2020; Probst et al., 2011) we also consider needed strategic leadership activities in our research objective. Related to this, our second research question is: What elements of strategic leadership do leaders in incumbent companies need to implement when navigating digital transformation considering structural ambidexterity? After defining the purpose and research question, as a second step, we provide insights into the *conceptional context* by providing definitions of the affected research streams digital transformation and ambidexterity. In addition, we combine the two topics, focusing on structural ambidexterity following our research questions.

Sampling: One aspect of our purposive sampling (Etikan et al., 2016) was ensuring our 33 interview partners work in incumbent companies, not digital startups (Misoch, 2019). Another characteristic of the expertise of the selected participants is the job title. Our selection criteria of being in a position related to digital transformation in an incumbent company in the last two years ensured familiarity with the research topic. Different hierarchy levels provide a heterogeneous sample for the leadership aspects we address with our research. In addition, we identified that a perspective on multiple industries is beneficial, so we clustered our interview partners using the Global Industry Classification Standard. Interviewing study participants from different industries increases the robustness and credibility of our findings as we allow a holistic view considering multiple industries. This is especially relevant due to the wide-spread impact of digital transformation on multiple industries. In addition to industry experience, we included researchers or lecturers in our study to cover the research side. Split by the variables sector experience and hierarchy levels, Table 3 shows the composition of our interview partners.

Table 3. Study participants

Variables	Variable description	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*

Research method: While research on ambidexterity and leadership often uses a quantitative research design (Baškarada et al., 2016), we decided to use a qualitative research design followed by a thematic analysis (Braun & Clarke, 2006). As we addressed the research gap in in-depth detail on structural ambidexterity in digital transformation, the explorative research design offers this possibility. In addition, as there is still limited research combining the individual research streams of digital transformation and structural ambidexterity (Holotiuk & Beimborn, 2019; Jaspert & Ebel, 2022), the explorative research design fits our study requirements. After coding each batch of three interviews, we examined whether we accomplished code saturation (Hennink et al., 2017). We reached code saturation after 11 rounds of reviewing three interviews in a batch, which resulted in 33 interviews. Driven by our sample size and as we suggest further testing our study results with a quantitative or longitudinal study, our research can be treated as a pilot study (van Teijlingen & Hundley, 2001). To increase the robustness of our study, one researcher did the initial coding of the transcripts, and the second researcher performed an inter-coder check (Mayring, 2014). The research partner acted as supervisor with unlimited access to all material related to the research. The second reviewer confirmed the suggested coding and conclusions. To ensure consistency (Misoch, 2019) we conducted semi-structured interviews as a qualitative research approach. Based on the main findings of our literature research on digital transformation and structural ambidexterity, our open-ended questions focused on separation/integration in digital transformations of incumbent companies as well as associated leadership aspects and what could trigger changes over time. The software MicrosoftTeams allowed us to interview study participants globally. Between May 2023 and July 2023, the first author conducted all interviews using Microsoft Teams©. To be able to familiarize with the data, we transcribed all interviews. MicrosoftTeams enabled the first raw transcription which we imported into MAXQDA (VERBI Software, 2021). The naturalized/ intelligent verbatim approach helped us generate easily readable transcripts from the raw transcripts (McMullin, 2023). We used timestamps to connect the transcripts with the recorded audio files from Microsoft Teams and anonymized all data. The steps described in Figure 2 following "Familiarizing with data" are described in the following section.

RESULTS

Our literature research on organizational structures, displayed in Table 2, served to set the level of abstraction. We are therefore focusing in our thematic analysis on how the separation is done (exploration/exploitation, digital/core business), driving factors behind the separation, changes over time, and aspects of temporal ambidexterity. The guidance for code development provided by Braun and Clarke (2006) is the baseline to answer our research question. Appendix (Tables 4, 5, and 6) displays the details of our process, from our initial coding to defined themes (Braun & Clarke, 2006). To enhance our

research from a scholarly rigor perspective, we applied the procedure described by Gioia et al. (2013) for code clustering and illustration. As a first step, we generated initial codes, which were revised by either rewording, summarizing, or deleting. The result of this process step is 1st order concepts. Those are reviewed and combined in 2nd order themes (Gioia et al., 2013). As a final step, we aggregated all 2nd order themes into aggregated dimensions (Gioia et al., 2013). Figure 3 visualizes the summary of our results.

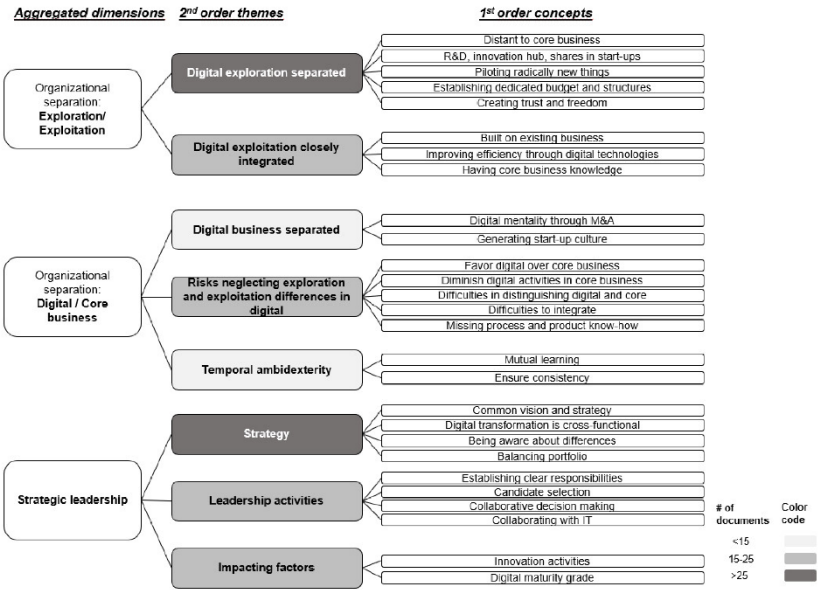

Figure 3. Structural ambidexterity in digital transformation and strategic leadership aspects

Organizational separation: Exploration/Exploitation

Following the literature on ambidexterity (March, 1991), structural separation of exploration and exploitation is one of the main concepts to become ambidextrous (Benner & Tushman, 2003; Duncan, 1976; Gibson & Birkinshaw, 2004; O'Reilly III & Tushman, 2013). Separation is also the most addressed concept in the context of digital transformation. Based on our interview results, we provide insights on when to separate and integrate digital business in terms of exploration and exploitation and the details explaining the rationale.

Digital exploration separated: Our study results show that one decision criterion to separate or integrate is how close the digital business is to the core business. Our interview partners suggest that if the digital exploration is *distant to the core business,* separate it. With these distinguishing criteria of closeness to business, we can provide further details on the differentiation made in the literature of new digital products (Hess et al., 2016) and offerings (Sia et al., 2021; van den Buuse et al., 2021). One of our interview partners states it with the following words: "Running digital initiatives, more on the exploration area, [***] do[ing] something fundamentally different, doing that through a separate group [***] or even legal entity." The recommendation is even to place the separate digital exploration unit geographically distant. Separate units can be carved out internally within a *Research and Development organization*, an *exploration (digital) innovation hub,* or a *think tank* for explorative activities. All those set-ups allow employees to focus on explorative digital activities. Aside from internal separation, externally *buying shares of startups* also enables incumbent companies to have digital exploration activities separated. The activities of a separate digital innovation unit are characterized by *piloting radical new things*. According to our interview partners, the separation allows "try[ing] something completely new" and "always keep[ing]

the pipeline of ideas filled" by scouting new technologies. We also found out that the aspect of piloting by "start[ing] small and [***] try[ing] very different things" is needed to think outside the box and possibly within a separate unit.

When separating, our interview partners suggest that incumbent companies *establish dedicated budgets and structures*. Having a dedicated budget was especially important as, without a budget, improving existing topics wins over digital exploration due to short-time prioritization and quicker and more known returns. As the budget is often allocated through performance achievement measured by KPIs, digital exploration units would risk not getting the needed funding. We suggest implementing different processes and structures in a separate digital exploration unit to ensure the needed speed and flexibility. Ideas brought up are flat hierarchies or product owner structures instead of hierarchical organizations. Associated with different processes is the need to create *trust and freedom*. One of our interview partners described it with the following words: "Create the atmosphere, the room for that explorational task [***], give the freedom to the people on different levels to work on the future." It is essential not to overwhelm employees with too much guidance and control mechanisms, especially in the early stages of exploration. Instead, leaders should create a safe space to explore new solutions without fear. The separation of digital exploration enables leaders in incumbent companies to develop that trust and freedom and not get wound up in the follow-up culture of the core business.

Digital exploitation closely integrated: Following the same logic as for separation, our study results suggest not separating but instead integrating digital exploitation closely connected to the existing business. When, for example, digitizing the existing product portfolio or automating processes with the help of digital technologies, the baseline are the existing products or processes of the incumbent company. Digital exploitation is *built on the company's existing business*. Therefore, integrating digital exploitation is recommended by our interview partners. One study participant summarizes this with the following statement:" [It] would not make [***] sense to separate this from each other structurally. You need the process expertise and the digitalization expertise in this field [***] and you must bring this as closely together as possible and not separate this:" Detailed examples are integration in business units via centralized departments or even closer to the day-to-day business via support functions or directly in the business. This integration and close connection to the existing core business is essential to understanding processes to *improve efficiency through digital technologies*. Also, as digital technologies are one enabler to more efficient processes, integration can be explained by the business ownership to improve. Even if there is a high priority on improving internally incrementally, as one interview partner stated: "Make my daily work better and not do[ing] something completely radical," it is not limited to internal aspects but also addressing product improvements. The necessity of *having core business knowledge* is one major result in our study explaining the recommendation for integration. Our interview partners further distinguish in process, product, and customer knowledge. It can be described in the words of one of our study participants: "The functional experience has a more important role because [***] we focus on the current status and [***] you're discussing on a process level. You need to know how the processes are built, what are some standards [***] and what are the pain points." Also, having customer relationships and knowing how the company engages with customers is important and explains the integration.

Organizational separation: Digital/Core business

Aside from separating exploration and exploitation in digital transformations, our literature research shows that some authors refer to a separation of all digital activities (Åkesson et al., 2018; Göbeler et al., 2020; Holotiuk, 2020; Kaiser & Stummer, 2020; Schiffer, 2021; Smith & Beretta, 2021). Nevertheless, the existing research lacks details here, and our study results provide insights on occasions supporting this separation and associated risks.

Digital business separated: Our study shows that one reason for separating all digital activities from the core organization is to build up a *digital mentality through merger & acquisitions (M&A)*. One interview partner explained it in the following words: "That's why we decided to use the resources from outside, use startups [and] disruptive technologies." More specifically, startups in the digital area are often acquisition targets to bring a digital mindset into an incumbent company. Similar to building up a digital mentality through a merger, M&A is the idea of separating a unit to *generate a startup culture internally*. Benefits related to the digital context are that those startups within an incumbent company can be more flexible, agile, dynamic, and faster. All requirements are often mentioned in the context of fast-changing technologies. The separation explains how incumbent companies can focus on necessities specific to the digital context they have not been growing with.

Risks neglecting exploration and exploitation differences in digital: Building up a digital mentality through M&A and generating a startup culture are reasons we identified justifying separating all digital activities. Nevertheless, our study results show, similar to the work of Göbeler et al. (2020), that there are risks associated with this kind of separation. One

risk with separating digital from the core business is that incumbent companies could *favor digital over core business*. Digital is often associated with something new, fancy, and something people want to belong to. Not educating people enough about what digital means, especially the link to the core business for digital exploitation, can lead to the fact that the digital unit is favored over the core business. Some injustice could arise as the core business feels like being alone and responsible for the company's profit, and digital is seen as the part of the company that is getting investments such as new office spaces. One of our study participants summarizes this: "How do you feel belonging to the legacy part, to the classic part? While the others are the ones getting the invest[ments] and the others are [***] asked for more EBIT to support them? [***] You can either be on the sunny side [and] spend the money, or you can [***] be on the maybe classical side." Also, Oberländer et al. (2021) describe the tensions between the core business and the digital business. As mentioned above, we identified that digital exploitation needs to be closely connected or integrated into the core business. If the separation is now based on digital/core business, we identified a risk of *diminishing digital activities in the core business* due to the separation. Without a close connection, knowledge about new technologies and mindsets cannot be transferred to the core organization, resulting in increased efficiencies. One of our interview partners condensed it by saying: "If you have a digital hub where everything digital happens, the old company will stay in the non-digital world." In addition, separating all digital activities could lead to a focus on more radical new activities, and no digitalization activities are performed for the existing business, neglecting the ambidexterity concept. We also identified that in the current stage of having a lot of digital technologies readily available, with the speed of new developments increasing and somehow already integrated into the business, we see *difficulties in distinguishing digital and core* for a separation. The non-digital and digital world continuously merges, and as one study participant said: "Nowadays, digital is a necessity. I can't imagine one workshop where you try to develop your existing portfolio where you don't think about incorporating digital." Therefore, we see a risk in drawing a clear line between digital/core business, especially the more advanced a company is in its digital transformation.

Another risk associated with *difficulties distinguishing digital from core* is that scaling up new digital ideas, such as new products or business models, does not require to be ringfenced anymore but instead requires a sales organization and more structures. Therefore, our interview partners stated the necessity of integrating digital at one point to gain efficiencies and grow the business. One study participant summarizes the thoughts of this risk: "If this is too much disconnected from the core business, tr[ying] to exploit [***] and try[ing] to make things more efficient, then you have [a] challenge." This risk becomes even more relevant for digital exploitation as the digital unit could explore technologies that are not feasible for the use cases. *Integration into the core business* is seen as a challenge if the core business needs are not addressed. This risk is closely connected to the risk of *missing process and product know-how*. If a digital unit is separated without or low interaction with the core business, there is a lack of the needed process and product know-how from experienced employees. One interview partner explained this aspect: "They might not be that good [in] being creative or experimenting with technology or building prototypes. [Instead] they are good in having a product or a service and scaling that, dealing with customers, having operational sales divisions and customer exchange. This [***] explains why in acceleration it is better to be closer to existing business again." Separating all digital activities could lead to the fact as one study participant states: "That you create something that the market is not looking for."

Temporal ambidexterity: Temporal ambidexterity is an aspect brought up less in the interviews; nevertheless, it was mentioned by multiple participants and justifies that we include it in our results. We follow the definition of temporal ambidexterity given in the Literature review section. With a flexible team structure, employees work in the digital innovation lab for a limited time, and employees return to their original business (Holotiuk & Beimborn, 2019). The study of Holotiuk and Beimborn (2019) assumes that the digital innovation lab is only responsible for exploration. Following this understanding, our interview partners see temporal ambidexterity as helpful for *mutual learning*. On the one hand, it helps mitigate the risk of difficulties integrating innovations later. The words of one of our interview partners illustrate this: "I think the success of the exploration also depends on if the ideas can be brought back to the process. If they can be brought to the exploitation. So maybe it would help to have colleagues [***] working on already existing processes that they get some time, [for example] one day a week time to work in the innovation hub." On the other hand, assuming temporal ambidexterity can also be applied to the separation of digital/core business, this can help foster mutual learning in terms of process and product knowledge for the employees in the digital lab, but also digital skills and work methods for employees located in the core business. Again, this mitigates the risks of missing process and product know-how and diminishes digital activities in the core business. Nevertheless, it was mentioned multiple times that leaders must *ensure*

consistency in flexible structures. This is explained by having a stable core team to ensure processes are known, and it is not always a starting from scratch.

Strategic leadership

As it is a leadership challenge to enable the necessary change in digital transformations (Hensellek, 2020) and reinforce ambidextrous behavior (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008; Keller & Weibler, 2015; Lin & McDonough III, 2011; Mueller et al., 2020; Probst et al., 2011), we will cover strategic leadership topics associated with structural ambidexterity.

Strategy: Our study results show that a clear *company vision* and how digital transformation is embedded is crucial. The vision makes the targeted future of the company transparent, including aspects such as where the company wants to be active and how the company wants to be seen. The strategy and road map are associated with a vision, detailing how the company intends to achieve the target picture. This also includes organizational structures and innovation activities exploration and exploitation. One interview partner states: "Have a clear vision of where they [want to] go and what they want, [for example] the different steps they need to take in the exploration and in the exploitation to get there and then keep on track [of] both" as important. Our study results emphasize that digital transformation activities need to be aligned with the corporate and digital transformation strategy covering exploration and exploitation based on the vision. Our interview partner sees the top management responsibility as the following: "C-level needs to provide some kind of strategic framing. So simply to avoid that [***] innovation [focused employees] are working on topics that are not in line with the strategic route of the company." In addition, we want to highlight that transparency and continuous communication of the vision and strategy is crucial. Aside from *having a common vision and strategy, cross-functional collaboration* is vital in digital transformation. Having diverse teams and collaborating with different functions and departments to pursue the strategy and vision was mentioned as relevant. The fast-changing character of digital technologies forces companies to not rely on individuals but instead cross-functional teams to leverage the most of it. Closely associated with ambidextrous leadership, our study results provide evidence about the necessity of *awareness about differences of exploration and exploitation* in the top management. Different leadership is required for exploration and exploitation; not everything in digital should be treated the same way. One study participant phrased it like this: "I think it's awareness and also teaching the organization that there are different things and not digital is digital." Aside from knowing the difference, keeping in mind that both activities are relevant for long-term success and, therefore, achieving a long-term balance was emphasized as an essential topic for top management. We can connect this aspect to the vision and strategy as top management should integrate both activities. This can be summarized with the words of one of our interview partners: "A leader must be conscious or must know for himself that these two tasks that he has need to be balanced." Closely associated with this is the 1st order concept *balancing portfolio*. Regarding balancing exploration and exploitation in digital transformation, our interview partners referred to balancing activities with the help of portfolio management. This means ensuring that activities in digital transformation related to exploration with a higher level of risk are more future-oriented while also exploiting the existing business with the help of digital technologies. The innovation portfolio should be composed of both. Exploitation activities ensure the current product portfolio continues to deliver a constant cash flow, which can be allocated to invest in exploration activities. A balanced portfolio is seen as crucial, as one interview partner described with the following words: "If you just exploit it and don't explore, you will die from lack of innovation. If you just explore, not exploit, you will starve." Our interview partners combined this recommendation with the product life cycle and connected the approach with the Boston Consulting matrix (BCG). One study participant explained it that way: "If you take the classical BCG matrix [***], then you [***] would consider the stars or sometimes even the cash cows to be your products which are in your portfolio really established and you still have to work on these products to improve them and to still earn money with them [***]. And [***] it's more the direction or the positioning of these question marks to be considered as the more innovative products where [***] exploration activities will happen in [***] your portfolio."

Leadership activities: Aside from creating a strategic framework, we identified further leadership activities as relevant for structural ambidexterity in digital transformations of incumbent companies. Our study results indicate that leaders need to establish *clear responsibilities*. This includes being clear about what precisely exploration and exploitation mean. Especially in cases of separation, the scope and task of the separate unit need to be clearly defined and communicated to avoid the feeling of injustice. Establishing leaders with clear job descriptions for separate entities supports this suggestion. Closely connected to responsibilities, top management must ensure they *select fitting candidates* for exploration and exploitation responsibilities in digital transformation. One study participant explains this with the words: "Leadership

needs to identify what people are [***] best for and put the right people in the right [***] position [***] or organization." Different skill sets and personnel preferences are required on the individual employee level, especially when it comes to exploration and exploitation. It can be further detailed with the words of one of our interview partners: "[Who] is very innovative should be focusing on explor[ing] things and the ones that are very structured, of course, you need to be a little bit innovative [***] for exploitative things, but if you are a researcher, for example, that isn't the best choice for that." Of course, a mindset that fits the digital context should also be considered for candidate selection. Knowing that most leaders similar to employees have slight preferences for exploration or exploitation, our interview partners suggest *collaborative decision-making* as a countermeasure to foster ambidexterity. Based on the study results, we suggest having a sounding board and increasing diversity in the leadership team to support ambidexterity. One interview partner explained that "[the leader] needs to find where he is good in and needs to get the others [***] helping him to do the other thing." Connected to skill set, candidate selection, and cross-functional projects, we identified the importance of *collaborating with IT*. Due to the nature of digital transformation in digital technologies, some digital literacy is crucial and involves experts from the IT department.

Impacting factors: We identified in the Literature review section that only a view paper focus on changes over time in terms of separation and integration (Åkesson et al., 2018; Göbeler et al., 2020; Hron et al., 2021; Svahn et al., 2017). We have been focusing on this aspect in our research to gain more insights. Our interview partners argued that exploration and exploitation should not be isolated in the sense of incremental and radical innovations. Instead, an innovation can be looked at as having different *innovation phases*. The innovation can start with an exploration phase and then mature with exploitation at one point. Therefore, we recommend establishing a minimum level of collaboration, especially when separating exploration and when it is close to the core business. One study participant summarized it with the following statement: "[There] [s]hould be a[n] [***] intense link to the exploitation organization, that the transfer is fast because otherwise, the benefit out of the exploration [***] is maybe not that big." Therefore, we identified that the shift from exploration to exploitation can be a trigger to integrate activities into the core business. In addition, we identified the maturity grade incumbent companies within digital transformation as an impacting factor on separation and integration decisions. The *digital maturity grade* is a trigger point to rethink separation decisions. This can be connected to the three-phase approach we described in the Literature review. Similar to the guidance we provided in generating a startup culture, at the beginning of the digital transformation, a separation of all digital activities is recommended based on our study results. One of our interview partners explained this with the words: "In the beginning, it was very [***] central because that knowledge did not exist in the organization." So, generating digital literacy and creating first successes can help establish a digital mindset and acceptance with the company by having a dedicated separate unit. Depending on the closeness of the core business, the more mature companies become, the more pull for digital improvements for the core business is generated, which is a trigger to dissolve the digital hub.

Connecting to the color coding displayed in Figure 3, we identified that the traditional way of structural separation focusing on exploration and exploitation is associated with most counts. The comparable lower number of counts related to "Digital business separated" and the medium number of counts linked to the risks let us conclude that separating all digital activities can be recommended at certain times as a solution, but leaders need to be aware of the risks. As the risks are often closely associated with exploration and exploitation, which are different activities requiring different skills and leadership, this justifies the importance of the traditional ambidexterity concept. Therefore, we recommend that leaders monitor the impacting factors and risks to make a suitable decision on separation.

DISCUSSION

As the significant challenge of incumbent companies in digital transformation is related to organizational structures (Bjoerkdahl, 2020; Mirković et al., 2019) and limited in-depth research on organizational ambidexterity, our study answers this research gap. Our research addresses the lack of details on separation by investigating exploration/exploitation separation, its driving factors, and digital/core business separation. Figure 4 illustrates our main findings regarding separation and integration in a matrix. As our literature research in Table 2 illustrates, most authors do not distinguish between exploration/exploitation in digital transformation or provide only minimal details. Questioning our 33 interview partners enabled us to generate deeper insights and advance the research. We identified that the closeness of the digital activities to the core business and whether the activities are related to exploration or exploitation should drive the decision to separate or integrate those activities. We recommend separation if incumbent companies set an exploration focus for

digital activities that are far from the core business. Concrete examples include a Research and Development organization, an exploration (digital) innovation hub, or a think tank for explorative activities. Separating distant digital exploration activities enables companies to ensure freedom, establishing different processes and dedicated budgets to drive digital exploration successfully. We see two options if incumbent companies target exploring digital activities but still have some closeness to the core business. On the one hand, companies can separate those activities but ensure collaboration with the core organization. On the other hand, incumbent companies can integrate those activities into the core organization but ensure enough freedom and a dedicated budget. This recommendation is based on our findings on exploration/exploitation distinguishing and closeness/distance to the core business. As the constellation of exploration of digital activities close to the core business affects both aspects, we see two options regarding organizational structures. In addition, our interview partners identified risks for integrating exploration activities closely connected with the core business, which are separated, but also recommended a dedicated budget and structures for exploration activities.

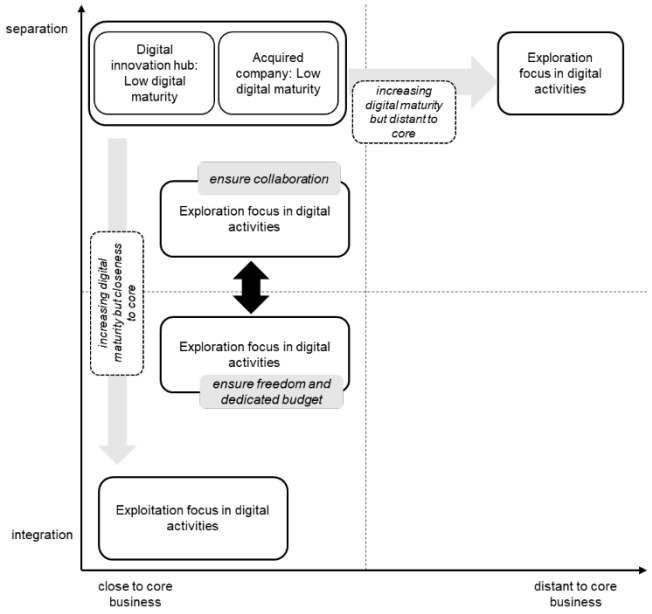

Figure 4. Decision-matrix for structural ambidexterity in digital transformation

Our interview results provide evidence of our recommendation to integrate digital exploitation activities closely related to the core business. We explain this with the need for core business knowledge such as process, product, and customer familiarity. Some authors refer in their work to the separation of digital business from the core business (Åkesson et al., 2018; Göbeler et al., 2020; Holotiuk, 2020; Kaiser & Stummer, 2020; Schiffer, 2021; Smith & Beretta, 2021; Sund et al., 2021) but also providing indicators of problems arising in this context (Göbeler et al., 2020). Based on our study results, we recommend that incumbent companies decide on separating digital and core business based on their digital maturity grade. Especially in the early stages of digital transformations, separating digital activities allows them to generate a startup culture internally. Higher flexibility, speed, and agility will enable an adaptation to the digital context. Connecting this to our guidance based on exploration/exploitation, we recommend seeing different innovation phases as trigger points for change. Moving toward integration in case of increasing digital maturity and closeness to the core business or continued separation in case of exploration focus distant to the core business.

Aside from the pure organization structure to support ambidexterity, our study addresses strategic leadership aspects that are necessary to foster ambidexterity (Alghamdi, 2018; Bell & Hofmeyr, 2021; Jansen et al., 2008; Keller & Weibler,

2015; Lin & McDonough III, 2011; Mueller et al., 2020; Probst et al., 2011). Figure 5 summarizes our recommendations on organization structures in digital transformation in a decision tree and connects it with strategic leadership aspects and a dynamic capability perspective. The baseline for organizational ambidexterity achieved through a structural separation is a cross-functional digital transformation strategy, which should be embedded in the company strategy. We identified a clear vision and strategy as crucial to guiding employees and managers. Senior leadership should be aware of the differences between exploration and exploitation, the role of those activities, and their balance in their digital transformation strategy. Using a portfolio approach to ensure balancing exploration and exploitation and then setting up organizational structures based on our recommended decision tree will foster ambidexterity in digital transformations of incumbent companies. In addition to the traditional concept of structural ambidexterity, our study includes the concept of temporal ambidexterity, which was developed in the digital context (Holotiuk & Beimborn, 2019). This could be applied in the case of separation based on digital/core business and exploration/exploitation. Nevertheless, we identified the necessity for a certain degree of consistency. Our identified leadership activities establishing clear responsibilities, collaborative decision making, candidate selection, and collaborating with IT are required to support the balance in digital transformation in incumbent companies continuously. As dynamic capabilities are often brought up in the context of ambidexterity, we incorporated related aspects based on the research of Hoessler and Carbon (2022) and Birkinshaw et al. (2016). Separation is associated with separated sensing and seizing units linked via resource-linking capability. Temporal ambidexterity adds a temporal focus-shifting capability.

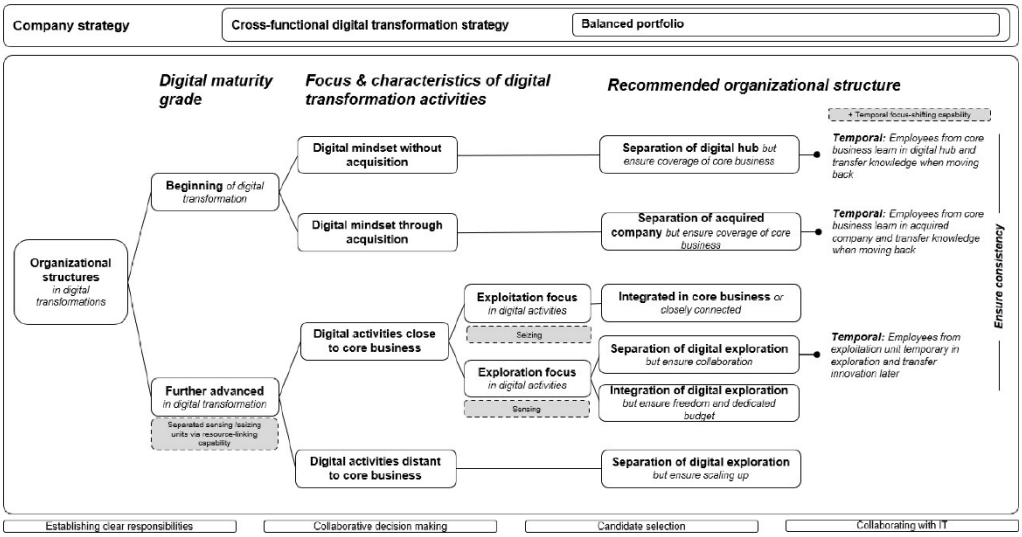

Figure 5. Structural ambidexterity in digital transformation: Decision tree embedded in a strategic framing

CONCLUSION

This study aimed to develop guidance for incumbent companies on the question of separation and integration in their digital transformations. Existing research either neglects or provides little insight into the differentiation between exploration and exploitation. Our results show the importance of understanding the differences between exploration and exploitation in digital transformation. Exploration is associated with piloting radical new things, a higher level of risk, and being more future-oriented. Exploitation is characterized by using the incumbent company's existing products or processes as a baseline. The returns are quicker and defined with a higher level of certainty. One of the major drivers for exploitation is incremental efficiency increase enabled by digital technologies. The understanding of exploration and

exploitation in digital transformation follows March (1991). Our study helps incumbent company leaders overcome the challenges posed by digital transformation using structural ambidexterity. As incumbent companies often fall behind their expectations in digital transformation, we provide with our decision tree guidance to help them evaluate which activities should be separated or integrated to capture the expected results. We also provide descriptions and examples of exploration and exploitation activities to allow practitioners to apply this in their incumbent companies. Our study enlightens incumbent companies about the crucial differences between exploration and exploitation activities in digital transformation. For instance, we clarify the distinction between piloting radical new initiatives and targeting incremental efficiency increases enabled by digital technologies. This increased transparency about different digital transformation activities helps incumbent companies avoid separation based on digital vs. non-digital business without being aware of the associated risks, such as not addressing business and customer requirements. In addition, our study helps practitioners rethink their structural set-up over time, allowing them to adapt structures as necessary based on, for example, increased digital maturity grades. As incumbent companies see organizational structures as a major challenge, and there is evidence of a positive correlation between ambidexterity and digital innovation, we provide further insights with our study results. We reveal that the closeness of digital activities to the core business and whether the activities are related to exploration or exploitation are major decision-making criteria for leaders. Our recommendation for exploration digital activities that are distant to the core business is separation. In contrast, exploitation digital activities closely connected to the core business should be integrated. Exploration digital activities close to the core business can be either separated or integrated by including both decision-making criteria.

Nevertheless, we recommend ensuring collaboration with the core organization in case of separation and generating enough freedom and a dedicated budget in case of integration. Incumbent companies with a low digital maturity grade are supported with a separation to build up knowledge and have a digital startup culture. However, we recommend integration when increasing the digital maturity grade and closeness to the core business is given. The broader company vision provides guidance to leaders and employees about the targeted future state of a company to ensure that resources are used effectively, supporting the company's goals and a unified direction of ongoing and planned activities. Aligning the digital transformation strategy with the overall company strategy based on the vision is essential that digital transformation initiatives are prioritized based on their strategic impact. As a company's vision considers the target market, ensuring digital transformation projects are market-driven, and market changes will also be addressed. Furthermore, as the overall vision is long-term focused, an alignment supports concentrating on exploration and exploitation in digital transformation rather than prioritizing short-term gains due to quicker payoffs. In addition, breaking down the digital transformation strategy into a roadmap allows differentiation into exploration and exploitation. It helps to ensure effective and efficient resource management, supporting the long-term goals of the company if this is aligned with the broader vision.

Furthermore, integrating digital transformation with the company's strategy allows employees to identify their contribution to the overall goals and can support employee motivation and commitment. Especially in cross-functional digital transformation activities, the alignment can give a common purpose and enhance the required change management process. Therefore, incorporating a cross-functional digital transformation strategy in the company strategy and developing a balanced portfolio supports fostering ambidexterity in digital transformation. We identified the necessity for leaders to consider employees' skill sets and personnel preferences to foster innovation. Primarily related to exploration, leaders need to allow freedom to explore new digital technologies and apply them to business cases. Leaders driving exploration activities supporting innovation in the digital context must create trust and freedom to explore new solutions without fear. The fast-changing character of digital technologies requires leaders to engage employees in constantly scouting new technologies and piloting ideas to address the complexities of digital disruption. In addition, we identified that leaders need to consider a balance of exploration and exploitation to avoid a lack of innovation in the case of a pure focus on exploration or a lack of results in the case of only exploration. We identified temporal ambidexterity as a possibility for collaboration between employees working in a digital hub and the core business. Especially if exploitation activities in digital transformation are separated in a digital hub, this collaboration is required to ensure process and product knowledge, ensuring effective impacts of the activities. Leaders engaging employees moving between the departments support the needed collaboration. In addition, building cross-functional teams allows companies to leverage the expected results of digital transformation. The close alignment and interaction with the IT department support digital transformation efforts as expert knowledge about existing infrastructure or new trends is incorporated. We included aspects of strategic leadership in our qualitative study. Even though we included aspects of strategic leadership in our qualitative study, we see the potential for future studies to focus more on the role of leadership. We suggest examining how leadership fosters

ambidextrous capabilities in the context of digital transformation. In addition, a study exploring the long-term effects of structural ambidexterity on the organizational performance of incumbent companies undergoing digital transformation would create additional insights and justify our results.

Our explorative research design includes a purposive sampling of 33 interview partners with work experience in digital transformations in incumbent companies or covering the research stream of digital transformation. Even though we covered various hierarchies and industries with our study participants, the count of 33 interview partners can still be seen as a weakness. Our clearly defined research process, including a detailed description of the conducted thematic analysis, and an explanation of how we achieved code saturation, helps offset this limitation.

In addition, we suggest further research to consider the digital maturity grade of the incumbent companies to cluster the findings further in that direction, as we identified this as one primary decision criterion. Combining this with how we achieved code saturation, we did not perform this check on the level of the digital maturity grade of the companies the study participants represent. This could influence our study results by achieving code saturation earlier and, therefore, missing some additional insights that are specifically relevant depending on sector experience or digital maturity grade. Therefore, we suggest that in a future study, the research sample can be clustered by sector experience, digital maturity grade, and testing for code saturation on this level. In addition, longitudinal studies with incumbent companies moving through different maturity grades could help gain further in-depth insights. The work of Del Giudice et al. (2021) provides evidence of the positive relation between ambidexterity and digital innovation. Coreynen et al. (2020) see limitations regarding digital servitization. Nevertheless, Coreynen et al. (2020) show that when reaching a medium level of exploitation, there is an exponential impact on the relation between exploration and digital servitization. Knowing this, we can see our study as a pilot for a quantitative study to investigate the correlation between digital maturity grades and our proposed organizational structure. Associated with this suggestion, future research could provide more in-depth insights into innovation phases. One interview partner provided insights on different phases in exploration, which could be seen to gain even further details on trigger points of separation/integration decisions within exploration activities. In addition, it is not part of this study to investigate different working methods and decision-making forms within different organizational units. New circumstances and the availability of new technologies require leaders to rethink and adapt existing processes. Existing research addressing the digital contexts often associates this with agile structures (Mustafa et al., 2022). Therefore, we see potential in addressing the applicability of agile work methods in digital activities related to the core business and how structures could change with increasing maturity grades. We addressed the concept of structural and temporal ambidexterity, therefore, we suggest future research to investigate the role of contextual ambidexterity in digital transformation or even combine this with this research in the form of hybrid ambidexterity.

We know that a potential analysis bias can impact our study results by having the risk of selective coding. To overcome this, one researcher did the initial transcripts coding, and the second researcher, acting as supervisor, performed an inter-coder check. In addition, we see the risk of interviewee bias leading to answers the interviewees think are expected rather than their honest opinion. Also, as we were aware of the company they work for, this could result in a potential bias toward reporting more positive aspects. To overcome this, we ensured the anonymity of the interview partners' personnel information as well as company-related information. In addition, interpersonal dynamics between the researcher and the interview partners can impact the level of detail and quality of the shared insights and, therefore, the quality of our study results. We mitigated this limitation by having semi-structured interviews and applying an interview guide. Another methodological limitation is the replicability of qualitative research. As interviews are associated with a defined context and a set of participants, replication is challenging. We address this limitation by describing our research process and clustering our participants by sector experience and hierarchy levels.

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Appendix

Table 4. Building 1st order concepts

Original Code (1st order concepts)	Count	Description of changes	Final code (1st order concepts)
Not close to core	10	Summarized	Distant to core business
Different location	1		
Explore and experiment	6	Summarized	Piloting radical new things
Piloting	4		
Research	3		
Scouting	2		
Searching new solutions	4		
Trust and freedom	15	Rephrased	Creating trust and freedom
Different processes	5	Summarized	Establishing dedicated budget and structures
Different structures	4		
Dedicated budget	4		
Innovation hubs, R&D, shares in start/ups	11	Summarized	R&D, innovation hub, shares in startups
Get ideas	1		
Built on existing in business or close	12		Built on existing in business or close
Customer relationships	3	Summarized	Having core business knowledge
Product and process know-how	5		
Understand core business	12		
Improve efficiency through digital technologies	12	Rephrased	Improving efficiency through digital technologies
M&A	6	Rephrased	Digital mentality through M&A
Startup culture	10	Rephrased	Generating startup culture
One better	7	Rephrased	Favor digital over core business
Need digital also in core business	8	Rephrased	Diminish digital activities in core business
difficult to differentiate sometimes	12	Rephrased	Difficulties in distinguishing digital and core
Integration if applications for core difficult with separation	14	Rephrased	Difficulties to integrate
needed product & process know/how missing	8	Rephrased	Missing process and product know-how
Costs	1	Eliminated	
Learn from each other	7	Rephrased	Mutual learning
Some fix people needed	6	Rephrased	Ensure consistency
Cross-functional	10	Rephrased	Digital transformation is cross-functional
Collaborating with IT	11		Collaborating with IT
Common vision and strategy	30	Summarized	Common vision and strategy
Communication of strategy	4		
Portfolio	22	Rephrased	Balancing portfolio
Clear responsibilities	11	Rephrased	Establishing clear responsibilities
Candidate selection	8		Candidate selection
Collaborative decision making	8		Collaborative decision making
Awareness	19	Rephrased	Being aware about differences
Integration e-->e	16	Rephrased	Innovation activities
Maturity grade	18	Rephrased	Digital maturity grade

Table 5. Building 2nd order themes

1st order concepts	2nd order themes
Distant to core business	Digital exploration separated
R&D, innovation hub, shares in startups	
Piloting radical new things	
Establishing dedicated budget and structures	
Creating trust and freedom	
Built on existing in business or close	Digital exploitation closely integrated
Improving efficiency through digital technologies	
Having core business knowledge	
Digital mentality through M&A	Digital business separated
Generating startup culture	
Favor digital over core business	Risks neglecting exploration and exploitation differences in digital
Diminish digital activities in core business	
Difficulties in distinguishing digital and core	
Difficulties to integrate	
Missing process and product know-how	
Mutual learning	Temporal ambidexterity
Ensure consistency	
Common vision and strategy	Strategy
Digital transformation is cross-functional	
Being aware about differences	
Balancing portfolio	
Establishing clear responsibilities	Leadership activities
Candidate selection	
Collaborative decision making	
Collaborating with IT	
Innovation activities	Impacting factors
Digital maturity grade	

Table 6. Building aggregated dimensions

1st order concepts	2nd order themes	Aggregated dimensions
Distant to core business	Digital exploration separated	Organizational separation: Exploration/ Exploitation
R&D, innovation hub, shares in startups		
Piloting radical new things		
Establishing dedicated budget and structures		
Creating trust and freedom		
Built on existing business or close	Digital exploitation closely integrated	
Improving efficiency through digital technologies		
Having core business knowledge		
Digital mentality through M&A	Digital business separated	Organizational separation: Digital/Core business
Generating startup culture		
Favor digital over core business	Risks neglecting exploration and exploitation differences in digital	
Diminish digital activities in core business		
Difficulties in distinguishing digital and core		
Difficulties to integrate		
Missing process and product know-how		
Mutual learning	Temporal ambidexterity	
Ensure consistency		

1st order concepts	2nd order themes	Aggregated dimensions
Common vision and strategy	Strategy	Strategic leadership
Digital transformation is cross-functional		
Being aware about differences		
Balancing portfolio		
Establishing clear responsibilities	Leadership activities	
Candidate selection		
Collaborative decision making		
Collaborating with IT		
Innovation activities	Impacting factors	
Digital maturity grade		

Biographical notes

Sabrina Hoessler is a PhD student at the University of Bamberg. She holds a Master's Degree International Management (M. Sc.) from the School of International Business and Entrepreneurship (Steinbeis University). Her research work is in the area of digital transformations and the implication on leadership.

Claus-Christian Carbon studied Psychology (Dipl.-Psych.), followed by Philosophy (M.A.), both at University of Trier, Germany. After receiving his PhD from the Freie Universität Berlin and his "Habilitation" at the University of Vienna, Austria, he worked at the University of Technology Delft, Netherlands and the University of Bamberg, Germany, where he currently holds a full professorship leading the Department of General Psychology and Methodology and the "Forschungsgruppe EPAEG"—a research group devoted to enhancing the knowledge, methodology and enthusiasm in the fields of cognitive ergonomics, psychological aesthetics and Gestalt (see www.experimental-psychology.com and www.epaeg.de for more details). He is the author of more than 500 publications, including more than 200 peer-reviewed international journal articles, mainly addressing perceptual topics, and has conducted more than a dozen research projects with a total budget amount of approx. 5 mill. EURO on perception and marketing issues and a renowned contributor and invited speaker at international research conferences. CCC is Editor-in-Chief of the scientific journal Art & Perception, Section Editor of Perception and i-Perception, Associate Editor of Frontiers in Psychology, Frontiers in Neuroscience, Journal of Perceptual Imaging and Advances in Cognitive Psychology and a member of the Editorial Boards of Open Psychology, Musicae Scientiae and Leadership, Education and Personality. Since 2023, CCC is an ordinary member of the European Academy of Sciences and Arts.

Author Contribution

Sabrina Hoessler: Conceptualization, Sampling, Data Collection, Methodology, Formal Analysis, Project Administration, Visualization, Writing. **Claus-Christian Carbon**: Conceptualization, Sampling, Methodology, Formal Analysis, Project Administration, Visualization, Writing, Supervision, Review & Editing.

Conflicts of interest

The authors declare no conflict of interest.

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