6-18-2022

Towards Dynamic Exploration and Exploitation – Reviewing Ambidexterity in the Digital Era

Satu Iho
University of Lausanne, satu.iho@unil.ch

Stephanie Missonier
University of Lausanne, stephanie.missonier@unil.ch

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TOWARDS DYNAMIC EXPLORATION AND EXPLOITATION – REVIEWING AMBIDEXTERITY IN THE DIGITAL ERA

Research Paper

Satu Iho, University of Lausanne, Lausanne, Switzerland, satu.iho@unil.ch

Stéphanie Missonier, University of Lausanne, Lausanne, Switzerland, stephanie.missonier@unil.ch

Abstract

The proliferation of digital technologies is providing organisations with new business opportunities as well as challenging them to transform their existing business models. Accordingly, IS scholars are increasingly striving to understand how incumbents are able to leverage digital technologies, while also maintaining efficiency and reliability of existing operations. A prominent concept that IS scholars have drawn upon to examine these opposing activities is ambidexterity. As yet, we however lack a synthesised view of ambidexterity approaches and outcomes in the digital era. We conduct a systematic literature review to examine what ambidexterity approaches exist for incumbents and what is known about the outcomes of ambidexterity in the digital era. We synthesise three ambidexterity approaches recently put forward by IS scholars and conclude that ambidexterity outcomes remain somewhat obscure. Finally, we suggest four avenues for future IS research on ambidexterity.

Keywords: Ambidexterity, Literature Review, Digitalisation.

1   Introduction

The proliferation of new digital technologies is providing organisations with new business opportunities as well as challenging them to transform their business models to match rapidly evolving competitor offerings and consumer needs. Especially incumbent organisations risk being disrupted by new entrants or competitors adopting digital innovations with the potential to drastically transform their industries (Dixon et al., 2017). Consequently, IS scholars are increasingly striving to understand how organisations are able to leverage digital technologies to make the most of digital opportunities and to combat turbulence in their environments, while also maintaining efficiency and reliability of existing operations. A particularly prominent concept that IS scholars have recently drawn upon to examine these opposing activities is ambidexterity.

Ambidexterity is seen as the simultaneous pursuit of the strategic activities of exploration and exploitation (March, 1991; Tushman and O'Reilly III, 1996). Within a digital context, ambidexterity can be understood as a firm's capability to explore new digital solutions and practices and to exploit existing technology assets simultaneously (Lee et al., 2015). Ambidexterity provides a well-suited framing to study the contrast between and the balancing of the exploration of new digital technologies and methodologies, on the one hand, and the exploitation of traditional skill sets and legacy technologies, on the other. In contrast to digital native organisations, the highly opposing nature of these two activities is especially apparent in incumbent organisations with rigid pre-existing structures, routines and resource allocations (Oberländer et al., 2021). Exploration and exploitation are however both seen as

essential strategic activities for incumbents who are most at risk from being disrupted by new entrants and digital innovations adopted by competitors.

Although ambidexterity has been a prominent concept in IS research in recent years, as yet we lack a synthesised view of ambidexterity approaches and outcomes in the specific context of digitalisation. Especially for practitioners, the contributions may appear somewhat scattered, and one paper may use the ambidexterity concept differently from another, which may hinder forming an overall picture of how ambidexterity can be pursued in practice. We propose that examining ambidexterity in such a specific context is necessary as digital technologies hold underlying potential to alter ambidexterity as a strategic activity. Previous research has suggested that digital innovations are most likely to result when new external knowledge is successfully combined with specific knowledge of the existing business (Holotiuk and Beimborn, 2019; Kohli and Melville, 2019). This suggests that an intimate entanglement of exploration and exploitation is needed to produce digital innovations and to remain competitive. Once external and internal knowledge have been combined into an innovative solution, digital technologies enable drastic modifications to be made to the solution even after its initial implementation (Nambisan et al., 2017), raising the question of where exploration ends, and exploitation begins. Put together, this suggests an evolution of ambidexterity from its traditional notions of strictly separate exploration and exploitation activities into a more dynamic blend of the two activities. What remains consistent though, is the principal idea that successful balancing of exploration and exploitation is essential for today's organisations. This is in particular the case for incumbents so that they can reap the benefits of both new digital technologies and existing IT assets that have been built up over the years (Holotiuk and Beimborn, 2019; Kranz et al., 2016). Incumbent organisations, whose success was built in the pre-digital economy, are uniquely placed in terms of ambidexterity as they have an extensive base of existing knowledge and capabilities that can be combined with digital technologies to produce value-adding combinations (Sebastian et al., 2017). Consequently, having an updated and synthesised view of ambidexterity specifically in the digital era is of the essence for both IS scholars and practitioners.

To start to shed light on this matter, we perform a systematic literature review of how IS scholars have used the ambidexterity concept to understand how firms are dealing with opportunities and challenges introduced by digitalisation. More specifically, we synthesise recent IS research focusing on ambidexterity approaches and outcomes in the digital era. Although ambidexterity is relevant for all organisations, we focus on incumbent organisations in our review. We choose this focus as, in comparison with digital natives, pursuing ambidexterity can be particularly challenging for incumbents with long-established, rigid structures and processes and it is these challenges that we wish to inform with our review. Our work builds on the ambidexterity literature review by Werder and Heckmann (2019) which while extensive, is not dedicated to the specific context of digital technologies. Consequently, it excludes several contributions put forward in recent years in the rapidly advancing research area of ambidexterity and digital technologies (e.g. Brauer and Schirmer, 2021; Dixon et al., 2017; Fuchs et al., 2019; Holotiuk and Beimborn, 2019). The research questions guiding this paper are thus: *1. What ambidexterity approaches exist for incumbents in the digital era? 2. What is known about the outcomes of ambidexterity in the digital era?*

To examine these research questions, we conduct a systematic literature review, following the concept-centric approach suggested by Webster and Watson (2002). We choose this approach since although the concept of ambidexterity has been used extensively in the strategy literature, its use in the context of digitalisation is more emergent in the IS literature and it can hence be considered an emergent topic. Our paper makes two main contributions. First, we propose that digitalisation challenges the traditional approaches of pursuing ambidexterity. To this end, we synthesise three ambidexterity approaches relevant for incumbents: dynamic, hybrid and temporal ambidexterity. All three bring about a level of dynamism to ambidexterity, where the traditional approaches of structural and contextual ambidexterity are seen as complementing rather than competing strategies. Our findings suggest that incumbents should aim to dynamically pursue exploration and exploitation and put in place structures and policies that enable projects, teams and individual employees to autonomously move from one activity to the other. Second, we conclude that extant research has focused on how organisations approach

ambidexterity in the digital era, but outcomes associated with these approaches still remain somewhat obscure, affording – among three others – a fruitful avenue for future research. For practitioners, our paper details three ambidexterity approaches (dynamic, hybrid and temporal) in the digital era which can be helpful in their pursuits of ambidexterity and digital transformation.

2   Background

In his influential paper on organisational learning, March (1991) describes exploitation as "refinement, choice, production, efficiency, selection, implementation, execution", while exploration is described as "search, variation, risk taking, experimentation, play, flexibility, discovery, innovation" (p. 71). The former has been associated with incremental innovation, and the latter with discontinuous innovation (Tushman and O'Reilly III, 1996). The general consensus in the strategy literature is that to achieve sustained success and survival an organisation needs to pursue both activities simultaneously (O'Reilly III and Tushman, 2013). The ability "to simultaneously pursue both incremental and discontinuous innovation" has been labelled as ambidexterity (Tushman and O'Reilly III, 1996, p. 24).

Due to the contrasting nature of exploration and exploitation, pursuing ambidexterity implies that firms need to host "multiple contradictory structures, processes and cultures within the same firm" (Tushman and O'Reilly III, 1996, p. 24). To do so, three modes of ambidexterity are commonly distinguished in the strategy literature: sequential, contextual and structural (e.g. Lavie, Stettner and Tushman, 2010; Stadler, Rajwani and Karaba, 2014). In sequential ambidexterity, exploration and exploitation activities are performed in subsequent cycles, one after the other (Lavie et al., 2010). In contextual ambidexterity individuals or teams change their way of working depending on the task or project they are working on at any one time (Napier et al., 2011; Stadler et al., 2014). In structural ambidexterity, exploration and exploitation activities are pursued by separate organisational units specialised and dedicated to each activity (Lavie et al., 2010). Structural ambidexterity therefore separates the two activities spatially at the organisational level, whereas contextual ambidexterity separates them behaviourally at the individual or team level (Stadler et al., 2014).

The continued proliferation of new digital technologies and resulting digitalisation – the process of adopting and using digital technologies – is forcing today's incumbent organisations to rethink their internal organisational structures, methods and skill sets (Legner et al., 2017). As incumbents adopt novel digital technologies, their existing system landscapes are transformed into digital infrastructures, consisting of legacy systems and applications built on new digital technologies, such as social, mobile, analytics and cloud (SMAC) technologies (Bygstad, 2017; Legner et al., 2017). The management of such technologies and applications requires vastly distinct approaches, with the former focusing on ensuring stability and the latter on enabling experimentation and innovation (Bygstad, 2017). The successful management of both implies a contradiction in organisational structures, methods and skill sets for IT needed within the organisation.

In turn, within their external competitive environment, digitalisation is forcing incumbents to reassess their business models (Gerster, 2017). More specifically, they simultaneously have to explore digital opportunities to develop future revenue streams while also exploiting their existing assets to safeguard current revenue streams. Their very survival can depend on their ability to develop digital innovations and recombine them with their existing offerings (Dixon et al., 2017), namely to identify appropriate digital technologies and to combine them with existing physical services and/or products to cater for rapidly evolving customer needs (Gerster, 2017; Legner et al., 2017). Again, incumbents are faced with a contradiction of having the appropriate structures, methods and skills to successfully pursue both business model avenues.

Rooted in the notion of hosting multiple contradictory structures, processes and cultures within the same organisation (Tushman and O'Reilly III, 1996), the concept of ambidexterity provides a well-suited framing to study the contrast between legacy approaches to IT (i.e. exploitation) and novel digital approaches to IT and digital innovation (i.e. exploration). Given the prominent role technology plays in any modern organisation, it comes as no surprise that the concept has been embraced by IS scholars in

recent years. This can be observed in Werder and Heckmann's (2019) extensive review of the ambidexterity concept in IS literature which finds that IS scholars have used the concept to pursue six distinct research streams, ranging from ambidexterity in ISD projects and IT capabilities to ambidextrous strategies and inter-organisational relationships. While their review provides a broad analysis of the ambidexterity concept in IS literature up to 2016, we focus specifically on ambidexterity in the context of digitalisation. We choose this focus for two reasons grounded in previous work by IS scholars. First, previous research has argued that digital innovations that can add genuine business value and that will be hard for competitors to replicate, are dominantly the product of successfully combining new external and existing internal business knowledge (Božič and Dimovski, 2019; Holotiuk and Beimborn, 2019; Kohli and Melville, 2019), such as specific knowledge of existing products, customers or markets. This suggests that exploration (externally searching for new knowledge) and exploitation (using existing knowledge) need to be intimately entangled as both play an essential role in coming up with a digital innovation. Second, IS scholars have argued that digital technologies add a degree of fluidity into the innovation process and dismantle the discrete boundaries between development and completion phases (Nambisan et al., 2017). In other words, since digital technologies allow for solutions to be iteratively modified and changed even in drastic ways after their initial implementation, it becomes less clear when a digital innovation is 'complete'. In terms of ambidexterity, thus, it becomes less clear when exploration ends, and exploitation starts. Coupled with iterative ways of working and rapid development cycles that are characteristic of the digital innovation development process (Nambisan et al., 2017), distinguishing strictly between exploration and exploitation seems harder still. This demonstrates heightened blending of exploration and exploitation in modern organisations and consequently, suggests evolution of ambidexterity as a strategic activity.

While digitalisation seems to call into question some of these underlying notions of ambidexterity, the continued prominence of the ambidexterity concept is reflected in the number of noteworthy advances that IS scholars have made in recent years using it. For instance, Dixon et al. (2017) use ambidexterity to examine the dynamics of embedding digital innovations into existing business models. Similarly, Leonhardt et al. (2017) use an ambidexterity framing to study how IT functions are managing the opposing demands of exploring of digital technologies, on the one hand, and exploiting existing systems landscapes, on the other. Others have deployed the ambidexterity concept to investigate organisational structures dedicated to digital innovation, such as digital innovation units (Fuchs et al., 2019), digital labs (Holotiuk and Beimborn, 2019) and digital accelerators (Brauer et al., 2021) that have proliferated in recent years especially among incumbents. Given these recent developments, it seems well-timed to take stock on what we have learnt about ambidexterity specifically in the context of digitalisation.

3   Methodology

Literature reviews are well suited for analysing how theoretical concepts have been applied to understand a particular phenomenon and the progress that has been made in a certain research area (Paré et al., 2015). Accordingly, our aim in this paper is to understand how the concept of ambidexterity has been used to research how incumbents are responding to the opportunities and challenges brought about by digitalisation. Given the emergent nature of digitalisation, our systematic literature review follows a concept-centric approach suggested by Webster and Watson (2002). To guide and scope our analysis, we focus on three overarching phenomena associated with digitalisation: the disruptive potential of digital technologies, digital business models and the overall digital transformation of an organisation (Legner et al., 2017). We used EBSCO Host and the AIS eLibrary as our initial inquiry databases, covering the Basket of Eight of IS journals and AIS conferences respectively[1]. Including conference papers allowed us to incorporate also more nascent ideas and novel research topics on digitalisation and ambidexterity. Our search string was: (ambidexterity OR ambidextrous) AND digital.

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[1] EBSCO Host was used to search the following 7/8 journals from the basket of eight: European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of Information Technology, Journal of MIS, Journal of AIS, MIS Quarterly. Elsevier was used to search Journal of Strategic Information Systems.

In the first step, we searched each database and performed an initial review on the search results. An article was considered relevant and included in the final review if two thematic criteria were met: firstly, the concepts of ambidexterity and/or exploration and exploitation were the main concepts used in the article and secondly, the article's central theme was digitalisation in an organisational context (i.e. one or more of the three dimensions mentioned above: digital technologies, digital business models or overall organisational digital transformation). After careful consideration, we opted to also include articles where ambidexterity was used for instance to examine the interplay of agile vs. traditional development methods (Cram and Marabelli, 2015) or bureaucratic vs. collaborative IS project control methods (Gregory and Keil, 2014). While the articles themselves did not explicitly mention digital transformation, such phenomena are typically seen in organisations as part of wider digital transformation initiatives which is why we considered their inclusion appropriate for additional contextual insight. We included both empirical and conceptual articles. We only included articles written in English. Following this selection criteria, the first search step resulted in 8 + 16 relevant articles from each database respectively.

In the second step, to account for further IS journals and conferences, we conducted an additional search in the Elsevier (Computer Science subject matter) database. This search produced 6 additional articles. Finally, we performed forward and backward searches (vom Brocke et al., 2015; Webster and Watson, 2002) on the articles chosen in the first two steps which resulted in 7 additional articles. Altogether, we therefore had a total of 37 articles in our analysis as shown in Table 1. Only four of these articles were from pre-2016 and the vast majority (24 out of 37) were very recent, having been published 2019-2021.

	Search results	**Relevant**
EBSCO Host	20	8
Elsevier (Computer Science)	117	6
AISeL	50	16
Backward and forward searches		7
Total	**187**	**37**

Table 1.   Literature search results.

As we carefully read the selected articles, we classified them according to the three digitalisation dimensions mentioned above, to maintain consistency with the research focus (Templier and Paré, 2015). Moreover, we classified the articles according to our guiding research questions, namely whether they related to ambidexterity approaches or outcomes. Other classification categories related to publication outlet, research approach (qualitative, quantitative, conceptual) and level of analysis (firm, programme, project, individual). Throughout the reading process, we looked for additional patterns (Webster and Watson, 2002), which resulted for instance in the emergence of the two ambidexterity definitions we present in the next section. We also paid careful attention to ambidexterity aspects that were *not* mentioned (Baxter et al., 2007), which resulted for instance in the observation that potentially negative aspects of ambidexterity had received little attention from IS researchers so far, as we discuss in more detail below.

4   Findings

As a foundation for our findings, we first describe two dominant definitions for ambidexterity in the digital era that we observed in the articles included in the review. We then move on to presenting our findings for our research questions: *1. What ambidexterity approaches exist for incumbents in the digital era?* and *2. What is known about the outcomes of ambidexterity in the digital era?*

4.1   Defining ambidexterity in the digital era

Our analysis revealed two dominant definitions for ambidexterity in the digital era. First, *IT ambidexterity* is rooted in exploring the disruptive potential of digital technologies and using them to

drive the overall digital transformation of an organisation. Second, *innovation ambidexterity* also uses the disruptive potential of digital technologies as its starting point but takes a more product-centric view leading to digital business model development and change. Table 2 summarises the two definitions.

IT ambidexterity. A significant proportion of the papers we analysed viewed IT ambidexterity as the IT function's ability to simultaneously explore emerging technologies while also exploiting existing IT assets. For instance Leonhardt et al. (2017) define *IT ambidexterity* as: "ability of an IT function to simultaneously explore new IT resources and practices (IT exploration) as well as exploit current IT resources and practices (IT exploitation)" (p. 972). They further define *IT exploration* as "the IT function's ability to devote resources to learn about emerging technologies, methodologies, and skills and experiment with them in order to select those that are of highest value for the firm" and *IT exploitation* as "the IT function's ability to manage existing IT assets well and improve the effectiveness and efficiency of the employed IT resources in order to ensure their best utilisation" (p. 973). In the digital context, IT ambidexterity thus aligns with the notion of disruptive potential of digital technologies and incumbents having to dedicate resources for continuously scanning the environment for emerging technologies and evaluating their potential uses, in particular for radical innovations. The IT function plays a prominent role in IT exploration and exploitation activities and ultimately, acts as an enabler for digitalisation and the overall digital transformation of an organisation (Leonhardt et al., 2017). IT exploration thus requires increased knowledge not only on technologies and systems per se, but in-depth knowledge of the business in order for any new solutions and innovations to provide meaningful business value (Legner et al., 2017). While indeed the majority of the papers assign this capability to the IT function, some view IT ambidexterity as the entire firm's dynamic capability to pursue both efficiency, productivity (exploitation) and agility, innovativeness and growth (exploration) (Göbeler et al., 2020; Ortiz de Guinea and Raymond, 2018).

Innovation ambidexterity. Closely related, other authors view ambidexterity in the digital era to be strongly related to innovation leveraging digital technologies (Božič and Dimovski, 2019; Fuchs et al., 2019; Oberländer et al., 2021). More specifically, they differentiate between incremental and radical innovation, where the former is associated with exploitation and the latter with exploration. For instance, Božič and Dimovski (2019) anchor their study in the idea that business intelligence and analytics (BI&A) technologies can not only enable the exploration of external knowledge, but also the successful exploitation of such new knowledge within the organisation. Their notion of innovation ambidexterity refers to "finding a balance between exploitative and explorative innovation activities so as to introduce incremental and radical innovation for a superior sustainable performance" (p. 3). They thus view BI&A as a technology that can help organisations balance exploitative and explorative innovation activities, ultimately enhancing organisational performance.

Ambidexterity	Definition	Associated digital phenomena
IT ambidexterity	IT function's ability to simultaneously explore new IT resources and practices and exploit current IT resources and practices (Leonhardt et al., 2017)	Disruptive potential of digital technologies Overall digital transformation
Innovation ambidexterity	Balancing exploitative and explorative innovation activities so as to introduce incremental and radical innovation for a sustainably superior performance (Božič and Dimovski, 2019)	Disruptive potential of digital technologies Digital business models

Table 2.   Ambidexterity definitions in the digital era.

Similarly, Oberländer et al. (2021) base their study on the notion of innovation ambidexterity. They suggest that today's incumbents need to balance developing "new products, services, or business models 'that serve[s] new customer needs or create[s] new demands'" and providing "enhanced products, services, or business models to address the demands of existing customers or markets" (p. 4). In contrast to Božič and Dimovski (2019) who use the BI&A technology as their starting point, Oberländer et al. (2021) take a more product-centric view, where digital opportunities are about developing new or enhancing existing offerings. Combining both of these views Kranz et al. (2016) study the disruptive potential of cloud-computing software on incumbents' business models.

Moving on to our research questions, our attention was particularly drawn to two aspects that were shared among most of the papers included in our review. First, digitalisation challenges the traditional approaches of pursuing ambidexterity. More specifically, digitalisation introduces an aspect of dynamism which requires incumbents to blend structural and contextual ambidexterity approaches. Second, in line with previous literature, ambidexterity is consistently viewed as a prerequisite for organisational success and survival in the digital era. Further extensive empirical research is however needed to understand the circumstances in which certain ambidexterity approaches are more successful than others. We introduce both points in more detail in the next two sections.

4.2   Ambidexterity approaches in the digital era

In this section, we present our findings relating to ambidexterity approaches that exist in the digital era, corresponding with our first research question.

In line with previous findings (Dixon et al., 2017), the traditional approaches of structural and contextual ambidexterity were particularly well represented in the articles included in our review. The former was typically used in the context of organisational units or teams dedicated to digital innovation, such as digital innovation units (DIUs), and the latter in the context of contradicting demands placed on individuals working in organisations undergoing digital transformation. Our analysis also however revealed that recent IS articles question the division between the traditional structural and contextual ambidexterity strategies. Some authors associated this with increasingly dynamic nature of the external environment today's organisations are facing (Dixon et al., 2017), while others linked it to the increasingly concurrent nature of digital transformation initiatives (Jöhnk et al., 2020) and the specialised knowledge requirements for digital innovation (Holotiuk and Beimborn, 2019). Common to all three was however their view of structural and contextual ambidexterity not as competing but as complementing strategies. We describe the two traditional ambidexterity approaches (structural and contextual) first, followed by three ambidexterity approaches suggested for the digital era (dynamic, hybrid and temporal), also summarised in Table 3. The level of analysis for each approach is included to help clarify the domain of applicability of each approach (Templier and Paré, 2015).

Structural ambidexterity. IS scholars have increasingly studied organisational units dedicated to the exploration of digital technologies and opportunities. The terminology they use varies, with earlier studies referring to bimodal IT (Haffke et al., 2017; Jöhnk et al., 2017) and more recent ones referring to digital innovation labs (DILs) (Holotiuk, 2020; Holotiuk and Beimborn, 2019) and digital innovation units (DIUs) (Barthel et al., 2020; Fuchs et al., 2019). In bimodal IT organisations, the IT function is split into two (modes): an agile and a traditional IT unit (Horlach et al., 2017; Jöhnk et al., 2019). The agile IT unit is associated with exploration and innovation whereas the traditional IT unit is associated with exploitation and managing the existing IT assets. In turn, DILs and DIUs (referred to only as DIUs from hereon) are organisational units dedicated specifically to pursuing the exploration of new technologies and leveraging them for innovative solutions for internal or external use (Fuchs et al., 2019). While the DIU focuses on exploration, the existing IT function focuses on ensuring the continuity of existing operations and revenue sources. As such, DIUs allow organisations to differentiate and separate exploration and exploitation activities structurally to pursue ambidexterity at the organisational level. Most recently, Brauer and Schirmer (2021) add further nuances to our understand of such units by examining digital accelerators, such as external or internal incubators dedicated specifically to nurturing digital innovation ideas and ventures at their very early stages.

At their core, all of these structures (agile IT units, DIUs and digital accelerators) can be seen as organisational units whose primary activities are in line with how March (1991) characterised exploration: searching for new knowledge outside the organisation, experimenting with new technologies and developing value-adding solutions and innovations for the organisation. As noted for instance by (Jöhnk et al., 2017), agile IT units are "the explorative part of ambidexterity, fostering organisations' innovative capability" (p. 1523). IS scholars have highlighted that such units may exist on a continuum in terms of their integration with the main organisation. Some maintain close and regular ties with the main organisation while others operate almost entirely independently (Holotiuk and

Beimborn, 2019; Horlach et al., 2017; Jöhnk et al., 2017). In parallel however, they all recognise the necessity for some degree of differentiation and freedom from the main organisation to account for the uncertainty and risk involved in exploration activities. Such differentiation can be achieved for instance by allowing and encouraging such units to develop their own more risk-taking culture, implement their own reward structures for staff and use more flexible governance mechanisms and structures (Jöhnk et al., 2017).

Contextual ambidexterity. Cram and Marabelli (2015) deploy the ambidexterity concept to examine the tensions between agile and traditional methods in systems development projects. They highlight how individual users need to be ambidextrous in simultaneously using both development methods during a project to allow for effective knowledge sharing. In a similar vein, Gregory et al. (2015) study IT transformation programmes and how they are seen as a direct result of digitalisation and increased dynamism in the marketplace. They note that such programmes are riddled with contrasting demands and paradoxical tensions and highlight how ambidextrous approaches are required at managerial levels to alleviate them. Both studies imply that contextual ambidexterity is particularly relevant in the overall digital transformation of incumbent organisations. They suggest that individual staff members and managers need to be able to rapidly shift their mind set and ways of working depending on the context (e.g. project or project phase) they find themselves in at any given point in time. Furthermore, they need extensive behavioural and cognitive capabilities to cope with conflicting requirements and tensions on an ongoing basis (Tai et al., 2019).

Dynamic ambidexterity. In their conceptual review, Dixon et al. (2017) posit that the traditional division between structural and contextual ambidexterity is "inherently artificial" (p. 9). The authors suggest that structural ambidexterity on its own may result in organisational *rigidity* rather than *agility*, thus hindering rather than helping an organisation's ability to respond to environmental turbulence. This is due to the idea that traditional views of structural ambidexterity suggest a predetermined and clearly delineated allocation of resources to exploration and exploitation which results in a static capability. Instead, the authors put forward an approach for *dynamic ambidexterity* which is defined as "a dynamic capability central to the firm's ongoing ability to manage the constant rebalancing of resources and capabilities necessary to maintain dual strategies of resource exploration and exploitation" (p. 10). Rather than a static capability and mere separation and allocation of resources to exploration and exploitation – which could in itself result in organisational rigidity – ambidexterity in the digital era should be seen as a dynamic capability where resources and capabilities are shifted between the two activities on a continuous basis. This suggests that for instance organisational units such as DIUs or DILs, should be seen as temporary and fluid structures that can be reshaped or dismantled over time, rather than permanent. Dynamic ambidexterity is hence anchored in the view that rather than a static balance, ambidexterity is an ongoing balancing act an organisation needs to engage in (Magnusson et al., 2020). The authors suggest that their dynamic ambidexterity approach can help us understand "how existing firms can develop innovative digital business models while maintaining existing operations and cash flows" (p. 14). Their approach includes the reintegration of outputs that result from exploration activities back into the firm for exploitation, a crucial step for realising the value-adding potential of digital innovations that other authors often remain silent about.

Hybrid ambidexterity. Drawing on extant literature and empirical evidence from a single case study, Jöhnk et al. (2020) conceptualise the interplay of multiple concurrent digital transformation initiatives (DTIs). The authors leverage the concept of *hybrid ambidexterity*, initially put forward by Ossenbrink et al. (2019), to refer to scenarios where incumbents use both structural and contextual digital transformation initiatives to pursue ambidexterity. At its core, hybrid ambidexterity therefore suggests that structural and contextual ambidexterity are intimately intertangled and, rather than one or the other, it is their combination that can provide a suitable response to digitalisation challenges. Their case study shows that different types of DIU initiatives (structural ambidexterity) can be especially valuable to explore areas where existing knowledge within the organisation is scarce and, when accompanied by appropriate cultural change initiatives (contextual ambidexterity), can help the organisation achieve hybrid ambidexterity and ultimately digital transformation. In other words, the study concretises how a

digital transformation strategy can be pursued by concurrent DTIs, each of which is a manifestation of either structural or contextual ambidexterity.

Jöhnk et al.'s (2020)'s point of view is therefore similar to Dixon et al.'s (2017) in proposing that both structural and contextual ambidexterity approaches should play a role in incumbent organisations' digital transformation strategies. The authors suggest that DTIs can combine structural changes (e.g. programmes to set up DIUs) with contextual changes (e.g. cultural change programmes) all the while maintaining strategic alignment with the corporate strategy. In contrast to Dixon et al. (2017) however, Jöhnk et al. (2020) maintain the division between structural and contextual ambidexterity. They implicitly suggest that digital transformation initiatives can be classified into structural or contextual ambidexterity approaches, but that they can and should take place concurrently and integrate with each other to some degree to enable digital transformation.

Temporal ambidexterity. While the approaches of Dixon et al. (2017) and Jöhnk et al. (2020) are set at firm and programme level respectively, Holotiuk and Beimborn (2019) describe an ambidexterity approach at individual level. The authors studied nine case sites with different types of DIUs (structural ambidexterity). They observe that a shared practice among the DIUs is the temporary transfer of individual staff members between the DIU and the main organisation for extended periods of time. The authors label this as *temporal ambidexterity*. Temporal ambidexterity transcends structural and contextual ambidexterity as, on the one hand, it is set in a context where the organisation is structurally ambidextrous (by having a DIU) and as, on the other hand, individual staff members are contextually ambidextrous when they move between their base roles (exploitation) and the DIU (exploration) for given projects. Thus, while exploration and exploitation are structurally separated to be performed in the DIU and the main organisation respectively, the two activities are also implicitly connected as both are performed by the same people moving from one structure to the other. Moreover, knowledge gaps between exploration and exploitation are minimised as the same individuals are responsible for both subsequently and the transfer of a digital innovation is simplified as no hand-over is needed. The authors suggest that temporal ambidexterity differs from contextual ambidexterity in that individuals temporarily assigned to the DIU focus their full efforts to exploration activities while there, with assignments typically lasting several weeks or months. In contrast, in contextual ambidexterity, individuals (re)allocate time to the two activities more frequently, switching between exploration and exploitation multiple times during a working day or week. In other words, in temporal ambidexterity an individual performs only exploration or exploitation over longer periods of time, rather than fluidly switching between the two.

Ambidexterity approach	Definition	Proposed by	Digital phenomena associated with	Level of analysis
Dynamic	Firm's ongoing ability to manage the constant rebalancing of resources and capabilities necessary to maintain dual strategies of resource exploration and exploitation.	Dixon et al. (2017)	Business model transformation with digital innovation	Firm
Hybrid	Using structural and contextual (digital transformation) initiatives in combination to pursue ambidexterity.	Jöhnk et al. (2020)	Digital transformation initiatives	Programme, project
Temporal	Temporary transfer of people to manage the trade-off between exploration and exploitation.	Holotiuk and Beimborn (2019)	Digital innovation units (DIUs)	Individual

Table 3.   Ambidexterity approaches in the digital era.

Finally, Dixon et al. (2017) conceptualise *dynamic ambidexterity* with temporally distinct phases of innovation initiation and development (phase I) and innovation reintegration (phase II). The latter, where a digital innovation is reintegrated with the existing organisation, has received little attention so far. Similarly, Holotiuk and Beimborn (2019) concretise these phases showing how digital innovation can be initiated and developed in a DIU (phase I) and reintegrated into the organisation (phase II) with the help of individuals that are temporarily assigned to the DIU. Individuals move from their base role into the DIU to ideate and develop a digital innovation (phase I) and, once the innovation's potential has been validated and a minimum viable product has been developed, the individuals move back into their base role and help embed the innovation into the existing organisation (phase II). In this way, *temporal ambidexterity* agrees with *dynamic ambidexterity* in that while a DIU in itself may be a permanent structure, teams within the DIU are temporary as they change from one project to another.

4.3 Ambidexterity outcomes

In this section, we describe our findings relating to ambidexterity outcomes, corresponding with our second research question. We find that new digital technologies can play a central role in pursuing ambidexterity in terms of digital innovation and developing new business models, but also need careful consideration in terms of knowledge and skills involved. On the whole, however, our analysis showed that studies focusing on ambidexterity's implications on firm performance in the digital era are as yet scarce, causing ambidexterity outcomes for the moment to remain somewhat obscure.

A study by Božič and Dimovski (2019) shows how business intelligence and analytics (BI&A) use can help achieve innovation ambidexterity which in turn positively affects business performance. More specifically, they explicate the mechanics of how BI&A technologies can be advantageous in harnessing external knowledge and building an organisation's innovation capability. The authors attribute these outcomes to the increased diversity and richness of knowledge that BI&A can help acquire and the increased possibilities to experiment with and predict the value of new products and services.

Kranz et al.'s (2016) study also highlights the disruptive potential of digital technologies and the growing importance of being able to absorb and integrate external knowledge into existing business knowledge. Focusing on business model changes resulting from the emergence of digital technologies, the authors underscore how specifically "for disruptive innovations, the ability to identify and assimilate knowledge from distant and loosely coupled domains from various external sources is pivotal" (p. 503). They further show that rather than technology knowledge on its own, it is the integration of market and technology knowledge, that is likely to lead to successful business model change. In turn, the quantitative study of Chen et al. (2020) studies the impacts of exploration and exploitation on business model design. Their study highlights in particular the need to develop novel digital business models and that such development cannot be achieved with exploitation on its own. They suggest that in order to come up with genuinely novel business models that can enhance firm performance, radical departures from existing knowledge are required.

Taking a bottom-up view on ambidexterity and focusing on managerial capabilities, Tai et al. (2019) find that IS ambidexterity positively influences IS alignment (which is viewed as an ordinary capability) which in turn is associated with firm performance and competitive advantage. Similarly, Shao et al. (2021) show how individual employees' ambidextrous use of a specific technology (IoT) can lead to digital innovation and overall digital transformation of the organisation.

Putting these findings together thus showcases remarkably well the complexity today's incumbents are facing in terms of pursuing ambidexterity to enhance business performance through digital innovation and new business models. Digitalisation is forcing incumbents to radically depart from their existing knowledge base and to successfully integrate external knowledge within existing operations and business, ultimately leading to enhanced performance. Moreover, in order for such changes to materialise at organisational level, incumbents have to nurture the skills and competencies of individual staff members to enable them to perform exploratory activities and deal with increased dynamism in their everyday roles (Shao et al., 2021; Wolf, 2019).

5   Discussion and future research avenues

On the whole, our analysis revealed that IS scholars view ambidexterity as essential for organisations not only to survive but also to thrive in the digital era. This is consistent with a stream of organisational science literature arguing that exploration and exploitation are fundamental strategic activities to ensure an organisation's survival and success in the long term (March, 1991; O'Reilly III and Tushman, 2013). In the below, we outline four avenues for future research.

Ambidexterity outcomes. First, we observed that extant IS studies into ambidexterity skew towards understanding the kinds of approaches incumbents deploy to achieve ambidexterity (section 4.2) rather than ambidexterity outcomes in the digital context (section 4.0). For instance, while our sample included several articles on digital innovation units and their typical characteristics and configurations (e.g. Barthel et al., 2020; Fuchs et al., 2019), we came across no studies that would explicitly attempt to specify the value-adding potential of such units. On the contrary, digital innovation units have been found to encounter several challenges (Raabe et al., 2020) and risks (Bygstad and Øvrelid, 2021) and even their ability to produce genuinely value-adding digital innovations has been questioned (Barthel et al., 2020). Bimodal IT organising modes have also come under heavy criticism for their potential to create yet more silos rather than help dismantle them (Horlach et al., 2016). Recent research skewing towards ambidexterity antecedents is however unsurprising given the emergent nature of digitalisation. It builds a solid foundation for examining ambidexterity outcomes which we see as a key avenue for future IS research. In particular, we see value in understanding the kind of contexts in which particular ambidexterity approaches are more successful than others. Studies by for instance Barthel et al. (2020) and Göbeler et al. (2020) laying out structured DIU designs and modes can provide excellent framings for such research.

Furthermore, while the three ambidexterity approaches described above make noteworthy theoretical advances in understanding ambidexterity in the digital era, our analysis also revealed a paucity in extensive empirical studies into ambidexterity. Given the dynamic and continuous nature of ambidexterity in the digital era, as highlighted by all three approaches, we propose that longitudinal case studies could provide particularly valuable insights into understanding how incumbents leverage the different ambidexterity approaches. The approach proposed by Dixon et al. (2017) can for instance provide a starting point for designing and framing such studies. Extensive empirical data would also allow for the three ambidexterity approaches to be validated and refined further.

Clarifying the roles and responsibilities of ambidexterity. Second, over the course of our analysis, we were surprised of the IT function-centric view of IT ambidexterity. More specifically, the fact that the majority of the papers we analysed hold the IT function as the primary responsible for both exploration and exploitation activities surprised us as it seems to contrast recent research of IT and especially innovation activities increasingly taking place also outside the boundaries of the IT function (Legner et al., 2017; Peppard, 2018; Urbach et al., 2019). IS research has consistently shown business functions and individual staff members playing a more and more prominent role in IS development in particular on digital technology platforms (exploration) (Bygstad, 2017; Peppard, 2018, 2019), but this is of yet to be reflected in the IT ambidexterity definition. On the contrary, the most commonly adopted IT ambidexterity definition seems to suggest that the IT function would be the prime responsible for exploration. In this sense, the innovation ambidexterity definition seems to align better with the trend of IT functions' boundaries becoming less well-defined as digital technologies become more cost-efficient and user-friendly, allowing non-IT individuals to perform exploration activities on their own. Future research can thus focus on detailing where and by whom especially IT exploration activities are conducted in the organisation. Such detailing can contribute to reducing ambiguity around the roles and responsibilities of digital transformation strategies (Matt et al., 2015).

Negative aspects of ambidexterity. Third, our analysis also revealed that there has been little research into the potentially negative aspects of ambidexterity. This is particularly the case at individual level where the increased need for individuals to perform exploration alongside exploitation has as yet received no attention from IS scholars. While some studies have shed light into the challenges associated

with ambidexterity at the organisational and senior management levels (Jöhnk et al., 2019; Kalgovas et al., 2014) and researchers have recognised the impact digitalisation is having on the IT function (Urbach et al., 2019), we did not come across any studies that would have explicitly focused on how pursuing ambidexterity impacts the individuals doing so. We see this as another avenue for future research, given that several cognitive and behavioural challenges that individuals having to perform contextual ambidexterity might face are well established in the strategy literature (Stadler et al., 2014). During our analysis, we already saw some evidence of such challenges in the digital context for ambidexterity. For instance, the study by Cram and Marabelli (2015) highlights how individuals working in systems development projects are having to adopt more explorative ways of working and successfully combine these with exploitative ones during development projects. The study by Tai et al. (2019) concretises these demands further, showing how IT staff having certain cognitive and behavioural capabilities, such as understanding business situations, learning digital technology skills and interacting with users, is essential for achieving ambidexterity. Furthermore, Iho and Missonier (2021) start to conceptualise the distinct knowledge types and behaviours that are required from non-IT individuals as they switch between exploration and exploitation in organisations with DIUs, as described for instance in Holotiuk and Beimborn (2019). These studies start to shed light on the extensive cognitive demands placed on individuals that have previously focused primarily on exploitation tasks but are now also having to perform exploration. Understanding how both IT and non-IT staff cope with such cognitive and behavioural demands and what kind of support the organisation can provide them with to do so, would be highly valuable for practitioners going forward.

Incorporating exploitation. Finally, we would like to encourage IS scholars to incorporate exploitation into future studies for a more holistic view of ambidexterity. While the majority of the studies we reviewed focused on the exploration and innovation side of the ambidexterity coin, there is also evidence showing that organisations are more likely to use digital technologies to drive efficiency rather than innovation (Magnusson et al., 2019), namely exploitation. This evidence coupled with the paucity of studies concretising the outcomes of digital innovation might suggest that while digital innovation is a popular focus area among both practitioners and scholars, its impacts on organisational performance are as yet limited. Furthermore, especially given the blending of exploration and exploitation, future research should focus on studying both activities in a holistic manner to thoroughly understand how the synergetic pursuit of both can add value to an organisation.

6   Conclusion

Our work has revealed ambidexterity approaches that firms are deploying in the digital era and shed light on associated organisational performance outcomes. More specifically, our IS literature review on ambidexterity in the digital has made two main contributions.

First, we have synthesised three ambidexterity approaches from recent IS literature: dynamic (Dixon et al., 2017), hybrid (Jöhnk et al., 2020) and temporal (Holotiuk and Beimborn, 2019). At their core, all three have the traditional notions of structural and contextual ambidexterity as advanced earlier by strategy scholars (March, 1991; Tushman and O'Reilly III, 1996). All three also however challenge the idea of ambidexterity being as static and rigid as the earlier literature would suggest. Namely, they all highlight and reflect the dynamic nature of ambidexterity in the digital era at three distinct levels of analysis: organisational, programme and individual. In sum, our review has shown that while IS scholars consistently view ambidexterity as a useful concept to analyse how exploring digital technologies can be combined with exploiting existing technology assets, they also suggest that the concept in itself is somewhat rigid and restrictive for thoroughly understanding today's incumbents' digitalisation efforts. For practitioners, our findings suggest that rather than strictly separating exploration and exploitation activities either structurally or contextually, incumbents should aim to dynamically pursue both activities and put in place structures and policies that enable projects, teams and individual employees to autonomously move from one activity to the other. For scholars, our synthesis of current knowledge

on ambidexterity can help them stay abreast of ambidexterity contributions in the IS field (Templier and Paré, 2015).

Second, we have underscored a paucity of research into ambidexterity outcomes in the digital era and drawn IS scholars' attention to three additional avenues for future research: clarifying the roles and responsibilities for ambidexterity across an organisation, examining any potential negative implications of pursuing ambidexterity and incorporating exploitation activities more holistically into future ambidexterity studies. Especially quantitative studies into ambidexterity outcomes would provide valuable input to the ongoing debate regarding popular methods of pursuing exploration, such as DIUs and bimodal IT (Barthel et al., 2020; Horlach et al., 2016). In turn, better understanding negative implications of ambidexterity and how they can be addresses, especially at an individual level, would be essential to help individual staff members cope with the changing nature of work. As we have shown above, while such negative effects are rooted in previous ambidexterity literature (Stadler et al., 2014) and can be implicitly observed in more recent literature (Cram and Marabelli, 2015; Tai et al., 2019), they are, as yet, to be explicitly addressed by research. We trust however that our highlighting of some potential negative implications can already provide firms and managers with food for thought, in terms of potential pitfalls to avoid when pursuing ambidexterity, especially at individual employee level.

As with any research, our work is subject to limitations. First, we chose to restrict our literature search to the IS Basket of Eight and AIS affiliated conferences only. Consequently, our analysis may lack advances made in other journals or conferences. Moreover, this choice excluded contributions made in other disciplines, such as management and strategy, where the concept of ambidexterity has traditionally been used extensively. While we do not intend to disregard advances made in other fields nor to discourage cross-disciplinary dialogue, we saw value in focusing solely on IS literature for this review. Namely, we saw this choice as in line with our specific aim to understand how incumbents are leveraging digital technologies, while also maintaining efficiency and reliability of existing operations. Also, our final sample included papers that viewed ambidexterity from an organisational and strategic angle (e.g. Dixon et al., 2017) as well as from a more technology-centric angle (e.g. Božič and Dimovski, 2019), thus providing us with a well-rounded view of the phenomenon of interest. Nevertheless, we have not ruled out extending our work with literature from the management and strategy fields in the future. Second, while this paper has synthesised and analysed three ambidexterity approaches for incumbents, their efficacy is yet to be quantified. In addition, we lack understanding of the kinds of circumstances each approach might be particularly valuable in, for instance in terms of industries or markets. We trust however that presenting a synthesised view of the three approaches can already provide practitioners a starting point for their considerations of how to pursue ambidexterity and digital transformation at distinct levels of their own organisation. Especially, the hybrid and temporal ambidexterity approaches can provide managers with practical guidance on how to 'do' ambidexterity during digital transformation programmes and in DIU set-ups.

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