Ambidexterity in Information Systems Research: Overview of Conceptualizations, Antecedents, and Outcomes

Karl Werder

Information Systems and Systems Development,
University of Cologne
werder@wiso.uni-koeln.de

Carl Simon Heckmann

Product Management,
hsag Heidelberger Services AG
c.heckmann@hsag.info

Abstract:

Organizations that are not efficient and innovative today quickly become irrelevant tomorrow. Ambidexterity (i.e., simultaneously conducting two seemingly contradicting activities, such as exploitation and exploration) helps organizations to overcome this challenge and, hence, has become increasingly popular with manifold applications in information systems (IS) research. However, we lack a systematic understanding of ambidexterity research, its research streams, and their future trajectory. Hence, we conduct a systematic literature review on ambidexterity in IS research and identify six distinct research streams that use an ambidexterity lens: IT-enabled organizational ambidexterity, ambidextrous IT capability, ambidexterity in IS development, ambidextrous IS strategy, ambidextrous inter-organizational relationships, and organizational ambidexterity in IS. We present the current state of research in each stream. More so, we comprehensively overview application areas, conceptualizations, antecedents for, and outcomes of ambidexterity. Hence, this study contributes to the emergent theme of ambidexterity in IS research.

Keywords: Ambidexterity, Exploitation, Exploration, Literature Review, Paradox.

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1 Introduction

In today's highly dynamic and competitive business environment, the need to accomplish two conflicting goals while fighting for survival often tears organizations apart (Gibson & Birkinshaw, 2004). For example, consider organizations that need to drive radical innovation in order to compete against agile and swift startups (e.g., FinTechs), while maintaining a continuous growth in order to provide dividends to their shareholders and investors. At their core, these objectives seem to contradict each other. On the one hand, radical innovation and start-ups typically represent high-risk investments with uncertain outcomes. On the other hand, continuous growth and shareholder trust requires a stable track record. When businesses neglect one or the other, they may lose significant market share as historic events suggest. Examples include Xerox, Kodak, or Nokia that focused too much on their current business and neglected the value of radical innovation. Therefore, they lost significant market share and relevance in today's competitive environment. Hence, we need to understand how organizations simultaneously achieve two seemingly conflicting goals, which the literature refers to as ambidexterity (Dewhurst, Heywood, & Rieckhoff, 2011; Reeves, Haanæs, Hollingsworth, & Pasini, 2013; Tushman & O'Reilly, 1996).

In recent years, scholars from various disciplines such as management (Raisch & Birkinshaw, 2008), organization science (O'Reilly & Tushman, 2008), information systems (IS) (Lee, Sambamurthy, Lim, & Wei, 2015), and software engineering (Werder, Li, Maedche, & Ramesh, 2019) have investigated the ambidexterity concept more closely. In general, the literature distinguishes between structural, temporal, and contextual ambidexterity. Structural ambidexterity accomplishes two conflicting goals using two spatially separated subunits, such as two different business units or work teams, that each pursue one conflicting goal (Tushman & O'Reilly, 1996). The higher-level unit achieves ambidexterity. Temporal ambidexterity suggests that a unit works on one of the conflicting goals at a time. Hence, that unit achieves ambidexterity over a longer period of time by switching goals and working on either one at a given time (Duncan, 1976; Turner, 2011). Contextual ambidexterity relies on the organizational context to help an organization achieve two seemingly conflicting goals (Gibson & Birkinshaw, 2004).

Given the interdisciplinary nature of IS research, it investigates a variety of conflicting goals. For example, IS researchers investigated how organizations use internally oriented and externally oriented IT resources (Lee, Lim, Sambamurthy, & Wei, 2008), relational and contractual governance in IS outsourcing and supply chain management (SCM) (Cao, Mohan, Ramesh, & Sarkar, 2013; Xie, Ran, & Xiao, 2014), or process agility and process alignment in IS development (Tiwana, 2010). When addressing such trade-offs, scholars frequently build on the theoretical foundations of the exploitation and exploration framework in order to derive utility from their research. Given the vast progress IS research has made in relation to ambidexterity and the diverse orientation of research projects, scholars need a comprehensive overview. Such an overview would help scholars to understand the current state of research on ambidexterity in IS research and to suggest future research directions. Hence, in this study, we: 1) summarize existing literature on ambidexterity in IS research, 2) synthesize the broad range of literature in IS research that uses the ambidexterity concept, 3) identify potential research opportunities, and 4) propose a framework that categorizes existing research gaps in order to guide future research. We address these goals through a systematic literature review (SLR) (vom Brocke et al., 2009) and formulate the following research questions (RQs):

RQ1: How does information systems research apply the concept of ambidexterity?

RQ2: What are the antecedents and outcomes of ambidexterity?

Contribution:

In this study, we synthesize the existing literature on ambidexterity in IS research and, therefore, help practitioners and scholars to better understand current ambidexterity trends. With the study, we provide three theoretical contributions. First, we identify and synthesize existing literature to comprehensively review how researchers have conceptualized ambidexterity in a multitude of contexts and analytical levels. For these conceptualizations, we identify the antecedents of and outcomes that result from ambidexterity in its distinct contexts. Second, we identify six domains of ambidexterity in IS research and develop a framework for research. Third, we identify clear research gaps and suggest future research opportunities along our proposed framework. Hence, we build a common understanding that helps ambidexterity research to continue its trajectory towards rigorous and relevant research.

2   Background

Duncan (1976) introduced ambidexterity in his seminal work on organizational learning. Based on his work, Tushman and O'Reilly (1996, p. 24) defined organizational ambidexterity as "the ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory structures, processes, and cultures within the same firm". Since this seminal work, the concept has spurred new interest in the research community mainly due to increasing environmental dynamics (Tushman & O'Reilly, 1996) and the rapid acceleration of digitization. In order to highlight the long-term firm survival that organizations seek to achieve by becoming ambidextrous, Gibson and Birkinshaw (2004, p. 209) define ambidextrous organizations as "aligned and efficient in their management of today's business demands, while also adaptive enough to changes in the environment that they will still be around tomorrow". The definition points to ambidexterity's exploitative and explorative elements. Exploitation is associated with continuous improvement, efficiency, automation, and stability, while exploration is associated with radical improvement, flexibility, innovation, and agility (March, 1991). Table 1 summarizes key definitions for ambidexterity.

Table 1. An Overview of Definitions for Ambidexterity

Author(s)	Definition
Tushman & O'Reilly (1996, p. 24)	"The ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory structures, processes, and cultures within the same firm."
Gibson & Birkinshaw (2004, p. 209)	"[An entity] aligned [with] and efficient in their management of today's business demands, while also adaptive enough to changes in the environment that they will still be around tomorrow."
Rothaermel & Alexandre (2009, p. 759)	"[The] ability to simultaneously balance different activities in a trade-off situation."

Many empirical studies suggest that organizational ambidexterity affects performance (e.g., Gibson & Birkinshaw, 2004; Lin, Yang, & Demirkan, 2007). Most studies suggest a positive effect (Junni, Sarala, Taras, & Tarba, 2013; O'Reilly & Tushman, 2013). However, this effect varies depending on the chosen method, performance measure, and unit of analysis (Junni et al., 2013). Furthermore, the effect is stronger for larger firms with more resources (e.g., Cao, Gedajlovic, & Zhang, 2009) and for firms under high environmental and technological uncertainty (e.g., Jansen, Volberda, & Van Den Bosch, 2003). Some research has identified different antecedents for organizational ambidexterity, such as IT capability (Pavlou & El Sawy, 2010), factors that moderate the organizational impacts (e.g., environmental dynamics) (Jansen, Van Den Bosch, & Volberda, 2006), and structural differentiation (Jansen, Tempelaar, van den Bosch, & Volberda, 2009). Other research has extended these contributions by adapting ambidexterity to the organizational technology sourcing context and defining it more generally as the "ability to simultaneously balance different activities in a trade-off situation" (Rothaermel & Alexandre, 2009). This definition forms the basis for how we conceptualize and apply ambidexterity in this study.

When describing strategies to resolve the trade-off, the literature differentiates between structural, temporal, and contextual ambidexterity. Structural ambidexterity achieves the trade-off between two activities or goals by assigning two different subunits to each activity or goal (Gibson & Birkinshaw, 2004; Tushman & O'Reilly, 1996). Temporal ambidexterity achieves the trade-off by conducting the two activities or goals at different points in time and switching between them periodically (Duncan, 1976; Gibson & Birkinshaw, 2004; Turner, 2011). Contextual ambidexterity relies on the organizational context to provide the capabilities to achieve the two activities or goals simultaneously (Gibson & Birkinshaw, 2004). While researchers have often analyzed temporal and structural ambidexterity at an organizational, subunit, or group level, they have also investigated contextual ambidexterity at the individual level (Papachroni, Heracleous, & Paroutis, 2015). Despite these distinctions, researchers continue to debate about ways to resolve such trade-offs because some assume that ambidexterity involves a conflict, while others argue that the opposing elements form part of the same continuum (e.g., Cao et al., 2009).

2.1   Ambidexterity and Paradoxes

Ambidexterity refers to a trade-off situation that tends to result in tension. Often, scholars use tension as a narrative tool to communicate their theory building research in management and organization research (Poole & Van de Ven, 1989). Building a tension field 1) makes it prominent to readers that a phenomenon

requires research efforts (e.g., Naidoo, 2016), 2) helps authors articulate their theoretical contribution, and 3) suggests that authors comprehensively investigate a problem by taking a dual perspective. Tension fields often fertilize paradox research. Management research defines paradoxes as "persistent contradiction between interdependent elements" (Schad, Lewis, Raisch, & Smith, 2016, p. 10). This contradiction serves as the source for the paradoxical tension. For example, organizations manage the trade-offs between exploitation and exploration in order to increase ambidexterity and, as a result, increase their chances of survival (Andriopoulos & Lewis, 2009). In contrast to some ambidextrous views, paradoxical research also refers to the interdependence of two opposing poles (Schad et al., 2016), such as in the case of opposing poles in an electromagnetic field (Papachroni et al., 2015).

The literature on paradoxes contains a plethora of different tension fields, such as autonomy versus control, collective action versus individual interests, continuity versus change, closed systems versus open systems, deliberate management versus emergent management, old knowledge versus new knowledge, organizational control versus organizational flexibility, self-belonging versus belonging to others, and satisfying internal stakeholders versus satisfying external stakeholders (Bouchikhi, 1998; Lewis & Smith, 2014; Smith & Lewis, 2011). However, the literature offers no clear explanations for these different types of paradoxes and the relationship between the opposing elements (see Table 2). In their early work, Poole and Van de Ven (1989) suggest a distinction between social and logical paradoxes. While social paradoxes depend on the time and place, which means one can manage them, one may never solve logical paradoxes. Hence, with their work, Ford and Backoff (1988) seek to understand the relation between the opposing elements in greater depth. They suggest three paradoxical perspectives. First, the perspective of formal logic suggests paradoxes as an either/or choice or as a compromise between the opposing elements. The literature on structural and temporal ambidexterity supports this view (Papachroni et al., 2015). Second, the dialectics perspective suggests dualities (i.e., both goals are needed for an organization to survive as they are intertwined). More recent advancements in contextual ambidexterity support this perspective. Third, the trialectic perspective proposes that the conflict results from our socially constructed reality and, hence, suggests that the tension is surreal.

In their study on innovation paradoxes, Andriopoulos and Lewis (2009) suggest three cross-sectional resolutions for three nested paradoxical tensions: strategic intent (profit-breakthroughs), personal drivers (discipline-passion), and customer orientation (tight-loose coupling). The authors suggest three factors that address existing tensions and, therefore, help organizations achieve ambidexterity. First, management can follow integration or differentiation tactics in order to respond to and solve these nested paradoxes. Second, researchers and practitioners need to employ multilevel approaches to respond to existing tension fields. Third, organizations need to benefit from learning processes in order to identify the right balance between the trade-offs and to respond to raising tensions.

Table 2. An Overview of Existing Expressions for the Relationship between Oppositional Elements

Authors	Ford & Backoff (1988)	Schad et al. (2016)	O'Reilly & Tushman (2013)
Stream	Paradox		Ambidexterity
Types expressing relationship between opposing elements	Formal logic: suggests either/or choice or balance	Concept of balance: suggests balance as a dynamic and ongoing process	Temporal ambidexterity: suggests switching goals periodically
	Dialectics: suggests a both/and relationship	Unity of opposites: suggests interconnectedness and integration	Structural ambidexterity: suggests two subunits that individually achieve one of the conflicting goals each
	Trialectics: suggests the opposition results from our socially constructed reality	Principle of holism: suggests inseparability, particularly considering nested paradoxes	Contextual ambidexterity: suggests developing and using capabilities for simultaneous achievement

2.2 Exploitation and Exploration

While not referring to ambidexterity, March (1991) built on Duncan's (1976) notion of building dual structures in organizations to introduce the concepts exploitation and exploration as dual structures in organizational learning. Exploitation describes activities that focus on leveraging existing knowledge. Typically, doing so involves continuously improving products and processes and standardizing products and processes to increase efficiency. Exploration, on the other hand, focuses on new knowledge to an

organization. The organization can use such knowledge to develop new products, enter new markets, or apply disruptive technology to improve its business processes. Further, March showed that organizations need to pursue both learning strategies simultaneously. Consequently, we see March's exploitation/exploration framework as one part of the ambidexterity literature.

Since March (1991) and Duncan (1976) introduced these concepts, researchers have used them in various contexts to describe seemingly opposing activities (see Table 3). Examples include alignment versus adaptability (Gibson & Birkinshaw, 2004), exploitative versus explorative innovation (He & Wong, 2004), efficiency versus innovation (Gregory, Keil, Muntermann, & Mähring, 2015; Xue, Ray, & Sambamurthy, 2012), and stability versus agility (Piccinini, Hanelt, Gregory, & Kolbe, 2015).

Table 3. An Overview of Different Conceptualizations of Exploitation and Exploration

Authors	March (1991)	Gibson & Birkinshaw (2004)	He & Wong (2004)
Stream	Exploitation/exploration	Ambidexterity	Ambidexterity
Context	Organizational learning	Organizational structure	Technology innovation
Exploitation	Exploitation: Exploitation is about efficiency, increasing productivity, control, certainty, and variance reduction	Alignment: coherence among all patterns of activities within a business unit.	Exploitative innovation: technological innovation aimed at improving existing product-market positions
Exploration	Exploration: Exploration is about search, discovery, autonomy, innovation and embracing variation	Adaptability: capacity to quickly reconfigure activities in the business unit quickly.	Explorative innovation: technological innovation activities aimed at entering new product-market-domains
Interrelationship	Ambidexterity is about doing both	Ambidexterity as tension between alignment/adaptability	Fit-perspective on ambidexterity

2.3 Conceptual Model

We developed a conceptual model based on prior literature to analyze the ambidexterity construct and the interrelationships between key concepts of interest. Ambidexterity formed the basic concept of interest, which comprises the two dimensions that form a tension field. In our model, we relied on the often instantiated dimensions exploitation and exploration. Both the literature on ambidexterity and research on paradoxes propose different explanations for the interaction effects between these two dimensions. Building on the ambidexterity literature, one can analyze this interrelationship using three lenses: temporal, structural, and contextual ambidexterity (O'Reilly & Tushman, 2013). Therefore, organizations can achieve ambidexterity by separating exploitative and explorative activities into different entities (structural ambidexterity), performing them sequentially (temporal ambidexterity), or performing them in parallel (contextual ambidexterity).

In order to understand ambidexterity better, we needed to understand the mechanisms behind ambidexterity in greater depth. Prior studies provide different examples of antecedents that explain how organizations develop ambidexterity on the one hand (e.g., Napier, Mathiassen, & Robey, 2011), while others investigate variables that ambidexterity influences, such as performance improvements or competitiveness (e.g., Mithas & Rust, 2016). Given the plethora of research related to ambidexterity and its wider adoption in different research communities, we distinguished between antecedents and between outcome variables based on their unit of analysis. Further, we distinguished between three analytical levels: the organization, the project/team, and the individual. We used the conceptual model that we present in Figure 1 to guide our research on how the IS community applies the ambidexterity concept to IS-specific phenomena and contexts.
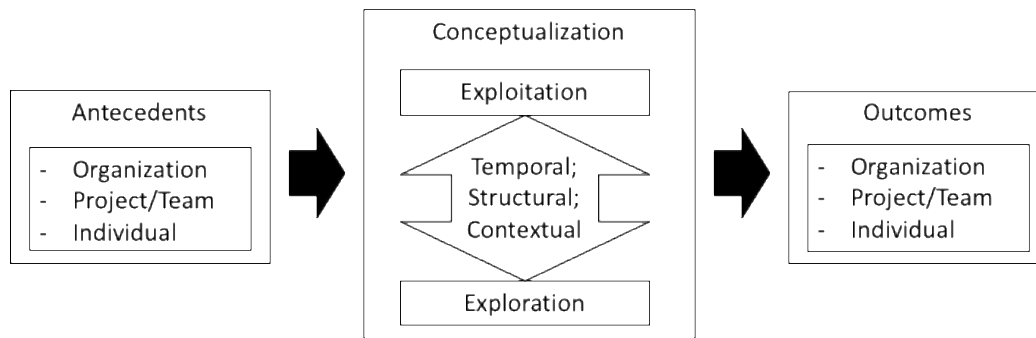
Figure 1. Conceptual Model that We Used to Guide the Literature Review

3   Research Method

In this section, we provide methodological details on our SLR on ambidexterity in IS research. Given the importance of properly documenting the review process (Brocke et al., 2009), a review protocol helps researchers select, assess, and synthesize papers in order to increase transparency and reduce biases (Kitchenham & Charters, 2007; Okoli & Schabram, 2009). First, we outline how we planned the review, which includes how we developed research questions, defined the search process, and identified selection and exclusion criteria for the study. Second, we provide further information for conducting the review (i.e., information on the data-collection and -analysis approach we followed). Since we focus on reviewing research about ambidexterity, we do not include grey literature contrary to some researchers' suggestions (Boell & Cecez-Kecmanovic, 2015).

3.1   Search Process and Selection Criteria

In our search process, we focused on studies in IS research and leveraged EBSCO and the AIS electronic library (AISeL) as our main databases. These databases cover the most relevant IS outlets, such as AIS Senior Scholar's basket of eight and top IS conferences (e.g., ICIS, ECIS, and PACIS) (see Table 4). We defined a simple search string in order to avoid artificially limiting the results (Jennex, 2015). To create the search string, we relied on Duncan's (1976) and March's (1991) seminal works. We used the following search string to search the title, abstract, and keywords fields: "ambidexterity OR ambidextrous OR ((exploitation OR exploitative) AND (exploration OR explorative))".

We found 88 papers from the search (66 papers from AISeL and 22 papers from EBSCO). In the next step, we extracted data from the papers, which included reviewing their titles and keywords in order to exclude papers that did not investigate ambidexterity. For instance, we excluded papers that mentioned ambidexterity but did not conceptualize or use it (e.g., Datta & Roumani, 2015). When uncertain about a paper, we reviewed it in depth. Thereafter, we began analyzing the data whereby we reviewed relevant papers' text in full. We excluded papers that 1) discussed ambidexterity in a non-business related domain (e.g., Tang, Kishore, & Parameswaran, 2015), 2) did not investigate ambidexterity as the central phenomenon (e.g., Datta & Roumani, 2015), and 3) discussed exploitation and exploration as distinct activities but did not conceptualize them as ambidexterity (e.g., Vidgen & Wang, 2009). After we applied the selection criteria, 45 remained to analyze further.

In addition, we conducted a backward and forward search. In the backward search, we reviewed selected papers' references in order to identify additional papers from other outlets that we may not have covered in our initial search. While the backward search investigates papers that outlets have published prior to when the selected set of 45 papers appeared, we applied a forward search using Google Scholar to identify more recent papers. As a result, we added five papers, which resulted in a final list with 50 relevant papers. Given the limited number of additional papers we found through the forward and backward search, we gained confidence in the scope of our initial search strategy. The additional papers either came from another community, such as operations research, or used rather context-specific synonyms for exploitation and exploration. Our final paper list included both empirical and conceptual papers related to the ambidexterity phenomenon in IS research.

Table 4. Overview of Search Results per Outlet

Outlet	Source	Search string results	Relevant*
Business Information Systems & Engineering	*	0	1
Business Process Management Journal	*	0	1
ECIS	AISeL	20	7
European Journal of Information Systems	EBSCO	4	3
European Journal of Operational Research	*	0	1
HICCS	*	0	1
ICIS	AISeL	30	14
Information Systems Journal	EBSCO	0	0
Information Systems Research	EBSCO	8	6
International Conference on Business Management and Business Management and Electronic Information	*	0	1
Journal of Information Technology	EBSCO	3	0
Journal of Management Information Systems	EBSCO	3	4
Journal of Strategic Information Systems	EBSCO	0	1
Journal of the Association for Information Systems	EBSCO	1	1
MIS Quarterly	EBSCO	3	3
PACIS	AISeL	16	6
			∑ = 50

* The forward and backward search led to our adding additional papers from sources that the initial search string did not consider(e.g., Tang & Rai, 2014)

3.2 Data Collection and Analysis

In the data-collection step, we extracted the following information for each paper:

- Bibliographic information (title, authors, year, journal/conference, full reference, rating)
- Paper type (empirical vs. conceptual)
- Research stream and unit of analysis
- Research approach and specific method (e.g. quantitative research, survey-based method)
- Deliverable type (e.g., process model, variance model, typology, lessons learned, etc.)
- Independent and dependent variables applied
- Suggested conceptualization of ambidexterity
- Exploitative elements and explorative elements

One author extracted the data while another author reviewed the extraction (Brereton, Kitchenham, Budgen, Turner, & Khalil, 2007). Moreover, the author extracting the data also determined each paper's research stream. As a result, we developed an initial coding scheme and continuously refined it in multiple iterations via discussion until we reached a final consensus (see Section 4.1). Subsequently, both authors used it to evaluate the research streams appropriateness and consistency. To ensure we obtained reliable results, both authors coded all publications independently, and we calculated the inter-coder reliability thereafter. The initial round resulted in an inter-coder reliability value of 0.75, above the suggested 0.70 threshold (Boyatzis, 1998). Both authors further discussed differences until they reached full agreement. By discussing differences, we could resolve conflicts and adjust the coding matrix accordingly.

We visualized and presented the data in various ways to help answer our research questions. We created descriptive statistics for the research method and units of analysis in each study and the number of studies over the years. In response to our research questions, we identified factors that lead to ambidexterity and its outcomes. In addition, we extracted the forms of ambidexterity by identifying the

conflicting goals that papers used to describe it, such as how Gregory et al. (2015) used efficiency versus innovation when investigating IT-enabled organizational ambidexterity.

4 Results

4.1 Research Streams

In line with the ambidexterity concept (i.e., balancing activities in trade-off situations (e.g., Rothaermel & Alexandre, 2009)), various trade-offs serve as candidates for applying ambidexterity as a research lens in IS research. Based on open coding, we identified six distinct research streams that have used the ambidexterity concept. Our classification reflects the status quo of ambidexterity research in the IS community. Thus, the IS community needs to revisit and adapt these streams over time as it makes advances. We present the number of publications in each stream in Table 5. While IT-enabled organizational ambidexterity and ambidextrous organizational IT capability included the most publications, the streams on ambidextrous IS strategy, ambidextrous inter-organizational relationships, and organizational ambidexterity in IS have appeared more recently according to their earliest publications.

Table 5. Overview of Research Streams that Use the Ambidexterity Concept

| Research stream	Earliest publication	Latest publication	Number of publications
IT-enabled organizational ambidexterity	2004	2015	18
Ambidextrous organizational IT capability	2007	2015	12
Ambidexterity in information system development (ISD) projects	2006	2015	7
Ambidextrous IS strategy	2014	2015	5
Ambidextrous inter-organizational relationships	2012	2016	4
Organizational ambidexterity in IS	2012	2013	4
			∑= 50
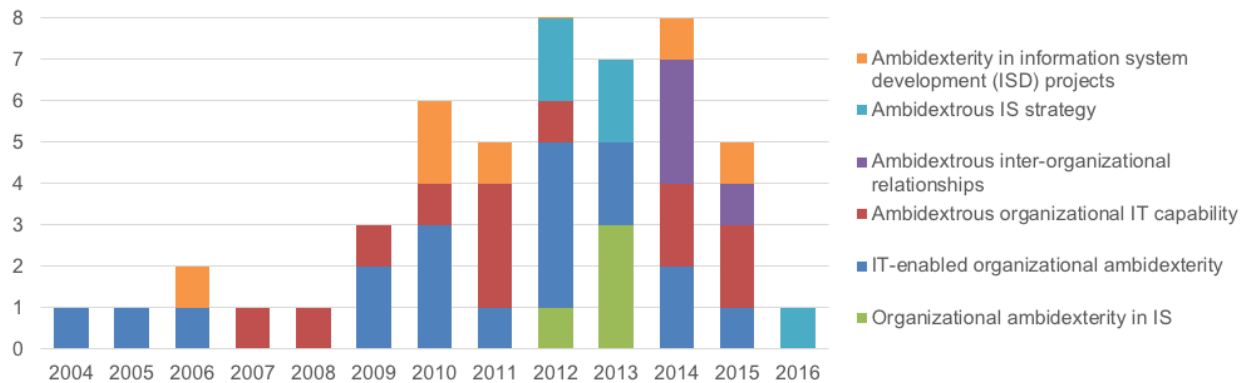
Figure 2. Overview of Number of Studies per Year and Research Stream

The IS research community started to use the ambidexterity concept rather spuriously from 2004 to 2009. Thereafter, the number of papers increased with up to eight relevant publications in 2012 and 2014 (see Figure 2). Initially, papers focused on how IT contributed to the organizational ambidexterity literature (Subramani, 2004). Only subsequently did research apply the exploitation and exploration framework to other areas, such as ambidextrous IT capabilities, which deal with the inherent dualism in simultaneously supporting business with agility and with efficient operations (Lee et al., 2008). Furthermore, the literature on SCM started to adopt the ambidexterity perspective as well. That research focused on the trade-offs between partnering flexibility and partnering alignment (Tang & Rai, 2014) on the one hand and the trade-offs between relational and contractual governance on the other hand (Xie et al., 2014). The latter had certain overlaps with research on ambidexterity in IS strategy and IT governance (Cao et al., 2013).

However, research on IS strategy focused on combining strategies on innovation with strategies to reduce costs (e.g., Mithas & Rust, 2016). Subsequently, we discuss each research stream in more detail.

Research in the **IT-enabled organizational ambidexterity** stream (e.g., Ling, Zhao, & Wang, 2009; Maghrabi, Oakley, Thambusamy, & Iyer, 2011; Xue et al., 2012) focused on using IT in general and the IS function in particular to achieve two seemingly conflicting organizational capabilities. The unit of analysis varied from organizations (Ling et al., 2009; Xue et al., 2012) or their business units (Pavlou & El Sawy, 2010) to different systems (Durcikova, Fadel, Butler, & Galletta, 2011; Raeth, Kügler, & Smolnik, 2011) and IT architectures (Gottschlich, 2013). When investigating organizations or their units, researchers highlighted IT capability (Kathuria & Konsynski, 2012) and the IT-leveraging capability of smaller organizational units (Ahuja & Chan, 2014; Pavlou & El Sawy, 2010) as important drivers of organizational ambidexterity. Similarly, researchers identified IT-initiatives that enable strategic and business learning (Yan, Yu, & Dong, 2013), business environment, and IT investments as antecedents of organizational ambidexterity (Xue et al., 2012).

In addition, researchers investigated different information systems that influence organizational ambidexterity through the development of knowledge and through radical and incremental innovation. Examples include business intelligence (Even & Shankaranarayanan, 2006; Oh, 2009), social websites (Raeth et al., 2011), knowledge management systems (Durcikova et al., 2011), and electronic data interchange (Nazir & Pinsonneault, 2012). As an exception, Piccinini et al. (2015) proposed the term digital ambidexterity using a technological and organizational dimension in order to drive a digital transformation process. From a methodological viewpoint, we found a lack of longitudinal studies. In this stream, only one study (Yan et al., 2013) applied a longitudinal approach.

Research in the **ambidextrous organizational IT capability** stream (e.g., Cao et al., 2013; Lee et al., 2008, 2015) investigated the impact and development of seemingly conflicting IT capabilities. The first paper we sorted into this research streamed appeared in 2004 (Melville, Kraemer, & Gurbaxani, 2004). Generally, we distinguished between studies that focused on outcomes and studies that focused on antecedents. Much research focused on combining efficiency with flexibility, such as analyzing the impact that applying IT for exploitation and exploration has on firm performance. For instance, Subramani (2004) focused on exploitation and exploration as distinct appropriation patterns of IT use and their impact on competitive performance through intermediate benefits for SCM-related activities. Other studies investigated the impact that ambidextrous IT capabilities have on process innovation (Tarafdar & Gordon, 2007), competitive performance (Xie, Ling, & Zhang, 2011), and operational ambidexterity (Lee et al., 2015). The latter study also identified that operational ambidexterity has an effect on organizational agility and addresses different combinatorial approaches for ambidexterity (Lee et al., 2015).

When investigating antecedents, scholars identified that internally oriented IT resources (i.e., service infrastructure, development skills, and internal relationships) impact exploitative and explorative IT capability (Lee et al., 2008). In contrast, they found that externally oriented resources (i.e., specialized applications, procurement skills, and external relationships) only had an impact on explorative IT capability (Lee et al., 2008). Additional antecedents of ambidextrous IT capability include alignment of processes and IT and IT-enabled modular business processes (Ling et al., 2009). For CIO ambidexterity, research suggested human capital (Chen, Preston, & Xia, 2010b), structural power (Chen et al., 2010b), organizational support for IT (Chen et al., 2010b), and connectedness (internally and externally) (Vidgen, Allen, & Finnegan, 2011) as antecedents. This stream adopted diverse applied research methods that cover conceptual and empirical approaches, such as qualitative, quantitative, and design research.

Research in the **ambidexterity in ISD projects** stream (e.g., Tiwana, 2010) addressed the tensions that arise from combining traditional and agile development methods. Initially, scholars investigated the trade-off between development speed and innovative content in agile ISD projects (Lyytinen & Rose, 2006). Later, they investigated the trade-off between formal and informal controls in the management style (Gregory & Keil, 2014; Tiwana, 2010), standardization and adaptability of software development processes (Lee, DeLone, & Espinosa, 2010; Napier et al., 2011; Ramesh, Mohan, & Cao, 2012), and incremental refinement through path development and radical innovation (Temizkan & Kumar, 2015). Five out of seven studies applied a qualitative approach. In addition, we found a quantitative and a mixed-methods study.

Research in the **ambidextrous IS strategy** stream (e.g., Ask, Magnusson, & Nilsson, 2015; Lo & Leidner, 2012) primarily dealt with organizational impacts from applying ambidextrous IS strategies and organizational attitudes about using IS and its intended activities (Lo & Leidner, 2012). The literature

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proposed a typology of IS strategies and suggested IS innovator, IS reserved, and a strategy void as the three strategy types (Chen, Mocker, Preston, & Teubner, 2010a). Based on this typology, scholars suggested a fourth type of ambidextrous IS strategy that refers to the simultaneously implementing IS innovator and IS reserved strategy (Lo & Leidner, 2012). Lo and Leidner (2012) found that the IT unit's absorptive capacity and agility mediates the influence that selected strategy has on an organization's performance. In predicting profitability and market valuation, Mithas and Rust (2016) suggested an interaction effect between the selected IS strategy and IT investment. In order to achieve ambidextrous IS strategy, the organization has to adopt one of three distinct forms (Gregory, Keil, & Muntermann, 2012; Raisch, Birkinshaw, Probst, & Tushman, 2009): single focus (structural approach), sequential focus (temporal approach), or parallel focus (contextual approach). This research stream showed the highest consistency in how it conceptualized ambidexterity and, therefore, benefitted from knowledge accumulation over time. From a methodical point of view, we found two qualitative and three quantitative studies in this stream.

Research in the **ambidextrous inter-organizational relationships** stream (e.g., Im & Rai, 2014; Tang & Rai, 2014) focused on resolving two trade-offs: one between alignment and adaptability and one between contractual and relational governance structures. Given the close link between the domains of SCM and inter-organizational relationship (IOR), we present results from both in this section. IOR contextual ambidexterity mediates the effect that different IT systems, such as operational support systems and interpretational support systems, have on performance (Im & Rai, 2014). In SCM, researchers have conceptualized different combination strategies for exploitation as partner process alignment and exploration as partner process flexibility (Tang & Rai, 2014). The use of balancing and complementing patterns in SCM ambidexterity positively influences SCM performance (Tang & Rai, 2014). Furthermore, Xie et al. (2014) suggested that information systems enable an organization to pursue relational and contractual governance. Information systems' induced transparency, which leads higher levels of trust, explains this effect. Consequently, IS allow an organization to identify non-trustworthy partners that require strict contracts. When investigating contextual ambidexterity in inter-organizational relationships, scholars identified shared knowledge creation, the development of a common understanding about the collaborative business process, and the development of further coordination mechanism as essential drivers (Lavikka, Smeds, & Jaatinen, 2015). While the research in this stream applied common approaches, we found one notable exception in Lavikka et al.'s (2015) applying action research.

Research in the **organizational ambidexterity** stream (e.g., Wang, Huang, & Tan, 2012; Zheng & Abbott, 2013) investigated the ambidexterity phenomenon in IS-related contexts, such as e-commerce. Various studies did not investigate IS-specific ambidexterity but rather analyzed organizational ambidexterity in the IS context. Examples include the strategic management of an e-commerce platform (Wang et al., 2012) or ERP adoption's organizational learning mechanisms (Shao, Feng, & Hu, 2013). In this stream, three studies adopted a qualitative research approach, while one study adopted a quantitative research approach.

4.2 Unit of Analysis and Research Method

We found that most studies investigated the organization as their unit of analysis (see Table 6). While this unit of analysis eases data collection, it excludes many important details in day-to-day business operations, such as actual IS implementations and business processes (Melville et al., 2004). For example, the business-process level allows one to capture details to thoroughly understand IT ambidexterity development and the interplay between ambidextrous IT capability and business processes. In addition, researchers have conducted little research on IT artifacts. While researchers have indicated the need to distinguish between organizational and technological ambidexterity (Piccinini et al., 2015), only a single study focused on integrating ambidexterity into IT artefacts (Gottschlich, 2013).

Existing research used both quantitative and qualitative methods alike though slightly more used the qualitative approach. We found three studies that applied a mixed-methods approach (Lee et al., 2010; Raeth et al., 2011; Subramani, 2004). However, we found few conceptual studies or interventions either in form of action research (see Lavikka et al., 2015) or design science research (see Hevner, March, Park, & Ram, 2004). Most qualitative studies produced a typology, such as IS competencies that enable process innovation (Tarafdar & Gordon, 2007) or the trade-off between short- and long-term goals in IT transformation projects (Gregory et al., 2015). To the contrary, quantitative research often tested theory by producing variance-theoretical outcomes and investigated specific effects in the form of antecedents or ambidexterity's outcomes (e.g., Mithas & Rust, 2016; Subramani, 2004).

Table 6. An Overview of the Papers by Unit of Analysis and Research Method[1]

Unit of analysis	Articles	Method	Papers
Organization	39	Qualitative	24
Individual	6	Quantitative	23
Project	5	Conceptual	3
Artifact	3	Design science research	2
		Action research	1
	∑= 53		∑ = 53

4.3 Conceptualizations, Antecedents, and Outcomes of Ambidexterity in IS Research

We found that researchers conceptualized ambidexterity in six different ways throughout the literature (see Table 7). This variance concurs with the number of conceptualizations that management research has applied (e.g., O'Reilly & Tushman, 2013). The two literatures share similarities for two potential reasons. First, we note in Section 2, one can apply ambidexterity as a meta-concept to a wide variety of trade-off situations; thus, one needs to adapt it the specific research context. Second, research lacks a common understanding about whether one needs to conceptualize ambidexterity needs to be conceptualized as balance or fit between exploitation and exploration (Raisch et al. 2009).

Only few studies benefitted from the balance and combined dimensions of ambidexterity, which has received significant attention from management research community (Cao et al., 2009; He & Wong, 2004) and represented a promising direction for ambidexterity research. On the one hand, IS research used these dimensions as a structuring element for typologies, such as when identifying barriers of chief information officer (CIO) ambidexterity (Kalgovas, van Toorn, & Conboy, 2014). On the other hand, IS researchers used the dimensions to develop variance theoretical models, such as to explain the impact that IT ambidexterity has on organizational agility (Lee et al., 2015) or the influence that SCM ambidexterity has on supply chain process performance (Tang & Rai, 2014).

Table 8 summarizes the antecedents applicable to the different forms of ambidexterity. We identified a strong focus on organizational ambidexterity when we analyzed what antecedents of ambidexterity the IS community has identified.

We present different outcomes that researchers have investigated in the ambidexterity context in Table 9. We make three important observations:

- At the organizational level, more studies used firm performance as their dependent variable than any other variable (five out of 14 studies used it). Similarly, researchers focused on individual performance in studies at the individual level (Raeth et al., 2011; Vidgen et al., 2011).

- Various studies addressed the interrelationship between different forms of ambidexterity, such as IT ambidexterity on operational ambidexterity (Lee et al., 2015) and business process ambidexterity (Xie et al., 2011). Furthermore, Chen et al. (2014) investigated the influence that CIO ambidexterity has on organizational IT ambidexterity.

We found few studies that focused on the impact that ambidexterity has on the team and the individual level.

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[1] Numbers add up to more than 50 due to studies with multiple levels of analysis (e.g., Cao et al., 2013). The same applies to the count of research methods per paper where we found three studies that applied mixed-methods research.

Table 7. Conceptualizations of Ambidexterity

Exploitation (exploit.)	Exploration (explor.)	References
IT-enabled organizational ambidexterity		
Alignment	Adaptability	Ling et al., (2009)
Efficiency	Innovation	Gregory et al. (2015), Xue et al. (2012)
Operational capabilities	Dynamic capabilities	Pavlou & El Sawy (2010)
Stability	Agility	Piccinini et al. (2015)
Short-term IT investments	Long-term strategic planning	Piccinini et al. (2015)
Manufacturing philosophy	Digital innovation philosophy	Piccinini et al. (2015)
Solution reuse	Solution innovation	Durcikova et al. (2011)
Internal Integration	External integration	Nazir & Pinsonneault (2012)
Business Learning	Strategic Learning	Yan et al. (2013)
Social website usage for exploit.	Social website usage for explor.	Raeth et al. (2011)
Exploit. data-warehouse usage	Explor. data-warehouse usage	Even & Shankaranarayanan (2006)
Exploit. innovation competence	Explor. innovation competence	Oh (2009)
ISD ambidexterity		
Patch development	Feature-request development	Temizkan & Kumar (2015)
Formal controls	Informal controls	Gregory & Keil (2014), Tiwana (2010)
Process alignment	Process adaptability	Lee et al. (2010), Napier et al. (2011), Ramesh et al. (2012)
Development speed	Innovative content	Lyytinen & Rose (2006)
Performance management	Social support	Napier et al. (2011)
Process rigor and standardization	Process agility	Gregory & Keil (2014)
Ambidextrous IS strategy		
Contractual governance	Relational governance	LCao et al. (2013)
Cost reduction	Revenue expansion	Mithas & Rust (2016)
IS conservative	IS innovative	Gregory et al. (2012), Karpovsky & Galliers (2013), Lo & Leidner (2012)
Ambidextrous IT capability		
IT use for exploitation	IT use for exploration	Subramani (2004), Tarafdar & Gordon (2007)
Exploitative IT capability	Explorative IT capability	Lee et al. (2008, 2015), Xie et al. (2011)
Business process efficiency	Business process flexibility	Xie et al. (2011)
Operational exploit. capability	Operational explor. capability	Lee et al. (2015)
CIO supply-side leadership	CIO demand-side leadership	Chen et al. (2010b)
Individual exploitation	Individual exploration	Vidgen et al. (2011)
Exploiting technology	Exploring technology	Montealegre, Iyengar, & Sweeney (2014)
Operational BI capabilities	Strategic BI capabilities	Yogev, Fink, & Even (2012)
Ambidextrous inter-organizational relationships		
Process alignment	Partnering flexibility	Im & Rai (2014), Tang & Rai (2014)
Idea exploitation	Idea exploration	Lavikka et al. (2015)
Contractual governance	Relational governance	Xie et al. (2014)
Inter-organizational system use for exploitation	Inter-organizational system use for exploration	Won, Zhang, Bock, Park, & Kang (2012)

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Table 8. Antecedents of Ambidexterity

Effects	Antecedents	References
Organizational level		
Organizational ambidexterity	IT-process alignment, process modularization enabled by IT	Ling et al. (2009)
	IT-leveraging in new product development	Pavlou & El Sawy (2010)
	IT-leveraging capability	Ahuja & Chan (2014)
	Climate for innovation, climate for autonomy, knowledge management system access	Durcikova et al. (2011)
	External electronic integration, internal electronic integration	Nazir & Pinsonneault (2012)
	IT-enabled strategic learning, IT-enabled business learning	Yan et al. (2013)
	IT automate capability, IT inform capability, IT transform capability	Kathuria & Konsynski (2012)
	IT-enabled BI competence, business network structure strength	Oh (2009)
	Exploitation IT investments, exploration IT investments	Xue et al. (2012)
Ambidextrous inter-organizational relationships	Market responsiveness, managerial IS knowledge, IS infrastructure	Won et al. (2012)
Ambidextrous IT capability	Dynamic capabilities	Montealegre et al. (2014)
Ambidextrous IS strategy	Types of power sources: bureaucratic, network, critical contingencies	Karpovsky & Galliers (2013)
ISD Ambidexterity	Diagnosing, visioning, intervening, practicing	Napier et al. (2011)
	Market pull, market push	Lyytinen & Rose (2006)
Project level		
ISD ambidexterity	Control mechanisms (outcome control, clan control, and behavior control)	Tiwana (2010)
	Social network structure (internal cohesion, external connectivity, network location, network decomposition)	Temizkan & Kumar (2015)
	Performance management, social context	Ramesh et al. (2012)
	Management style (bureaucratic and collaborative management style)	Gregory & Keil (2014)
Individual level		
Ambidextrous IT capability	Barriers	Kalgovas et al. (2014
	Internal connectedness, external connectedness	Vidgen et al. (2011)
	CIO human capital, CIO structural power, organizational support	Chen et al. (2010b)

Table 9. Ambidexterity Outcomes

Source	Outcome	References
Organizational-level outcomes		
Organizational ambidexterity	Firm performance	Kathuria & Konsynski (2012), Ling et al. (2009), Oh (2009)
	Frugal innovation	Ahuja & Chan (2014)
Business process ambidexterity	Firm performance	Xie et al. (2011)
Operational ambidexterity	Organizational agility	Lee et al. (2015)
SCM ambidexterity	Firm performance	Lee Won et al. (2012), Tang & Rai (2014)
	Relationship outcomes	Im & Rai (2014)
IT ambidexterity	Firm performance	Subramani (2004)
	Organizational agility	Lee et al. (2008)
	Operational ambidexterity	Lee et al. (2015)
	Business process ambidexterity	Xie et al. (2011)
	Transition between exploratory and exploitative activities	Yan et al. (2013)
	Process innovation	Tarafdar & Gordon (2007)
Ambidextrous use	IT business value	Yogev et al. (2012)
IS strategy ambidexterity	Firm performance	Lo & Leidner (2012), Mithas & Rust (2016)
ISD ambidexterity	Firm-level coordination	Napier et al. (2011)
	Product goals (innovative, content, speed, quality, risk, cost)	Lyytinen & Rose (2006)
Team-level outcomes		
ISD ambidexterity	Project's success	Temizkan & Kumar (2015)
	System performance	Lee et al. (2010)
Individual-level outcomes		
CIO ambidexterity	IT ambidexterity	Chen et al. (2010b)
	Individual performance	Vidgen et al. (2011)
Ambidextrous use	Individual performance	Raeth et al. (2011)

5 Discussion

In this paper, we review conceptualizations, antecedents, and outcomes of ambidexterity in its various forms. Further, we present a framework with six research streams on ambidexterity in IS. When combining two dimensions (research streams vs. unit of analysis) in a systematic map, we identify potential research areas. Reflecting on the literature we identified and analyzed, we suggest four research gaps that require IS scholars' attention. Further, we present two main research directions that will help IS researchers to better understand ambidexterity.

In the IS discipline, researchers have progressed in how they conduct systematic literature reviews. In the past, scholars used a concept matrix to structure how they collected and analyzed data (Webster & Watson, 2002). Thereafter, they began to focus on the entire research process and transparently communicating how they conducted it (Brocke et al., 2009). In order to develop high-quality reviews, we have to avoid common pitfalls, such as weak and artificial search criteria or convenient sampling approaches (Jennex, 2015), as more critical voices suggest (e.g., Boell & Cecez-Kecmanovic, 2015). Our study serves as an example review that contributes systematically identified research streams, research gaps, and suggestions for future research. More so, we systematically map prior research conceptualizations, antecedents, and outcomes of ambidexterity along previously identified research streams. In doing so, we provide a starting point for researchers to identify research gaps. Analyzing the

dependent and independent variables can help to spot unexplored relationships. Such relationships might be interesting for future studies. Figure 3 shows a systematic map for the number of studies on ambidexterity in IS research in relation to the six research streams we identified and the analytical framework of antecedents, conceptualizations, and outcomes along the individual, project/team, and organizational levels. The systematic map allows one to spot gaps in the existing body of knowledge.

When analyzing the results, we found that much research relates to IT-enabled ambidexterity and the organizational level. Figure 3 suggests that we need more research on projects, teams, and individuals. While projects and teams help organizations to solve complex problems and manage complex tasks, prior scholars suggest individuals to be the source of contextual ambidexterity (Gibson & Birkinshaw, 2004). Consequently, we can learn more about the different research streams by investigating a different unit of analysis. For example, we need more research to examine how IT can help individuals to manage and achieve ambidexterity. In addition, large-scale projects may benefit from ambidextrous inter-team relationships in helping a team to accomplish its goals flexibly while still adhering to organizational standards. We found more studies that focused on individual-level antecedents (three) than studies that focused on the organizational-level (one) in the ambidextrous organizational IT capability stream. We did not find any study on ambidexterity outcomes that applied an artifact-centric perspective.

While much research has focused on the organizational level, little has investigated ambidexterity at the project/team, individual, or artifact level. We need more research to clarify 1) whether ambidexterity in ISD may help developers to perform better and 2) whether IT-enabled ambidexterity and ambidextrous inter-team relationship increase project performance. In addition, IS strategy documents and contractual documents may spur further artifact-centric research in ambidexterity.
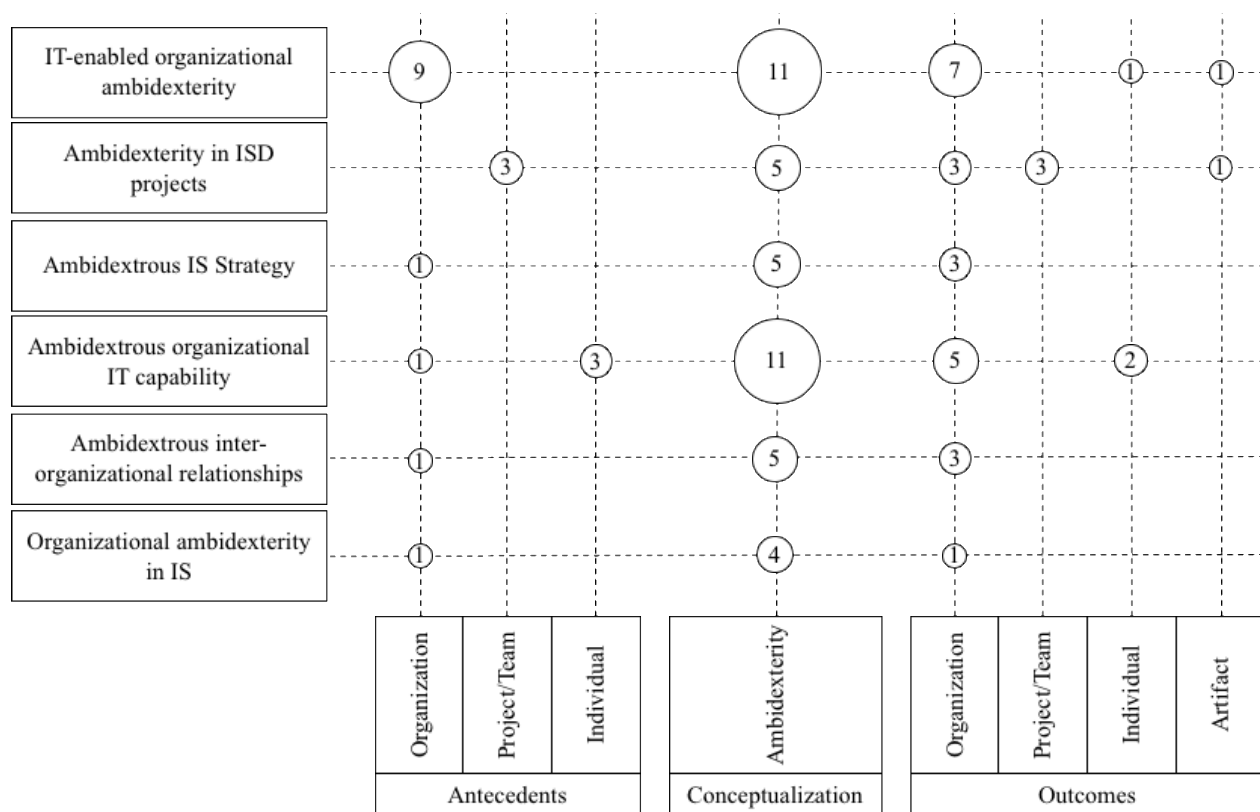
Figure 3. Systematic Map of the Research Streams and Units of Analysis

5.1   Potential Avenues for Ambidexterity Research

We identified four research gaps in the literature. We suggest that researchers conduct work that addresses these gaps in order to advance our knowledge about ambidexterity. First, when analyzing the data by unit of analysis, we identified little research on the process level. The ambidexterity concept can provide valuable insights into business process management. Hence, we suggest future studies to investigate various trade-offs at the process level. Two examples include the achievement of incremental

and radical innovation in business processes (Benner & Tushman, 2003) and the need for process standardization and differentiation in enterprise systems (Strong & Volkoff, 2010).

Second, some researchers have suggested the nature of ambidexterity (i.e., whether exploitation and exploration substitute for or complement each other) (Huber, Fischer, Dibbern, & Hirschheim, 2013), to depend on the research context (Turner, Swart, & Maylor, 2013; Werder et al., 2019). Given the importance of context in management research in general and IS in particular (Johns, 2006), we suggest researchers further investigate the role that context plays in ambidexterity research.

Third, previous research has often focused on a single unit of analysis. While we found some exceptions (e.g., Vidgen et al., 2011), we need more research to understand what effects ambidexterity has at different levels. In particular, developing organizational and functional capabilities involves multiple levels to achieve a desired outcome (Raisch et al., 2009). Therefore, future studies should investigate the interdependencies of ambidexterity in its various forms at different analytical levels (Raisch et al., 2009; Turner et al., 2013). For instance, the relationship between ambidextrous IT capabilities at the team and organizational level remains unclear. Similarly, the relationship between ambidextrous software developer and ambidextrous ISD requires further investigation.

Fourth, several studies (e.g., Gregory et al., 2012; Yan et al., 2013) followed a qualitative research approach, which suggests the need to investigate the evolutionary nature of ambidextrous capabilities. In particular, work needs to investigate and evaluate situational factors in quantitative research settings (Ployhart & Vandenberg, 2010; Werder, 2018). Therefore, we suggest that researchers conduct longitudinal quantitative studies to explore the evolution of ambidextrous capabilities over time.

In sum, future research can identify boundary conditions, take time into consideration, and apply multi-level analyses. Our identified research gaps suggest that we need more research in this regard. While the management literature provides prior calls for more longitudinal research and multi-level research (Raisch et al., 2009), researchers have not sufficiently addressed them. However, the continuous need for more multi-level and time-dependent research in ambidexterity might partially result from a dominance of single-unit and time-independent studies in management and IS research. Applying multi-level research can also help to connect the many studies in management and organization science with IS research on ambidexterity—an important goal since prior research proposes IT to enable contextual and structural ambidexterity (e.g., Pavlou & El Sawy, 2010). Furthermore, empirical evidence in previous studies indicates that ambidexterity in IS- and IT-related contexts serve as antecedents for ambidexterity at other organizational levels (Lee et al., 2015). Thus, by understanding ambidexterity in IS contexts, we can better understand ambidexterity in management and organization science.

5.2   Ambidexterity through the Lens of Paradox Research

Ambidexterity expresses a trade-off situation in organizations. However, this trade-off causes tensions. Research on paradox in management and organization sciences offers different approaches to understanding the relationship between two opposing elements that cause such tension. While prior research on ambidexterity often focuses on the either/or relationship between these opposing elements or seeks to identify a balance between them, we suggest two research directions that help IS scholars to advance our understanding of ambidexterity.

First, future research can investigate the dialectics of ambidexterity when seeking to accomplish two seemingly conflicting goals. The symbiotic view of duality helps to synthesize opposing elements and to understand those tension fields that truly require the opposing elements in order to thrive. An example includes the cooperation and competition view in organizations that has lead scholars to coin the term coopetition (Tsai, 2002), which suggests the tension field's symbiotic nature. This symbiotic view requires one to more strongly consider the context. As research on contextual ambidexterity suggests, the context plays an important role in forming and evolving a symbiotic relationship. Yet, given the manifold structure and functions of context (Johns, 2006), better understanding the role context plays in forming ambidexterity poses a larger obstacle for researchers in the discipline. We suggest that researchers use the distinction between social and logical paradoxes (Poole & Van de Ven, 1989) when investigating the root cause of the tension field.

Second, future research on ambidexterity in IS research can benefit from the principle of holism (Schad et al., 2016) and an integrative approach to ambidexterity research. Organizations contain many tension fields that result from ambidexterity. However, we know little about the interrelations of different forms of ambidexterity and their effects. For example, ambidextrous strategies at different levels may build on each

other or hinder organizations from effectively developing ambidexterity. Hence, we need more research that uses a multi-level perspective on ambidexterity in IS.

6   Threats to Validity and Limitations

In this study, we follow established guidelines for conducting a SLR (Kitchenham & Charters, 2007). However, we briefly discuss the threats to internal and external validity and the study's reliability. Researchers themselves introduce the main threat to internal validity. In order to avoid this threat, we conducted a SLR in which we limited our influence (Kitchenham & Charters, 2007). Thus, while we focus on IS research, we discuss related topics (i.e., paradoxes and exploration/exploitation) from a broader view to include also other domains, such as management research.

Threats to *external validity* minimize the results' generalizability. We collected data from secondary sources and, therefore, benefitted from identifying more reliable meta-information in contrast to a single study. We introduce clear inclusion and exclusion criteria that identify relevant publications in our list of final articles (Kitchenham & Charters, 2007). Further, in order to identify relevant research streams, we each independently classified each paper. Thereafter, we discussed and resolved differences collaboratively.

Reliability becomes threatened when other scholars conduct the same study but come to different conclusions. We avoid threats to reliability by having two independent researchers code and analyze data. In addition, we provide high transparency when presenting our research method and results. While we define important terms for this study, we also benefit from continuously exchanging interim results and challenges encountered. Further, we challenged and discussed our interim results with other scholars.

We identify two limitations in this study. First, we focus on secondary data. While we do not contribute new empirical results, we advance the research on ambidexterity in IS research by synthesizing prior studies. The research results of the SLR provide scholars with an overview of prior research on ambidexterity in general and conceptualizations, antecedents, and outcomes of ambidexterity in IS research in particular. Second, we focus on ambidexterity and the exploitation/exploration conceptualization. While research on paradoxes helps researchers to understand and advance research on ambidexterity, we focus on ambidexterity research and its possible conceptualization via exploitation/exploration.

7   Conclusion

This study presents a systematic literature review to identify six distinct research streams in the IS literature on IT-enabled organizational ambidexterity, ambidextrous organizational IT capability, ambidexterity in ISD projects, ambidextrous IS strategy, ambidextrous inter-organizational relationships, and organizational ambidexterity in IS. Therefore, this study contributes to IS by comprehensively reviewing the ambidexterity literature and ambidexterity's conceptualizations, antecedents, and outcomes.

We identify important areas for future research. First, we lack research on ambidexterity at the business-process level. Second, we lack research on the nature of ambidexterity and the influence of context. Third, we need research that investigates the interaction effects between the various levels of analysis. Fourth, to date, we lack longitudinal quantitative studies that investigate the evolution of ambidexterity in the IS context. Hence, we suggest two future research directions: investigating ambidexterity that thrives as a result of tension and investigating the influence between different forms of ambidexterity.

References

Ahuja, S., & Chan, Y. E. (2014). The enabling role of IT in frugal innovation. In *Proceedings of the International Conference on Information Systems* (pp. 1-20).

Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science*, *20*(4), 696-717.

Ask, U., Magnusson, J., & Nilsson, A. (2015). Ambidexterity and paradexterity: A typology of IT governance contradictions. In *Proceedings of the Americas Conference on Information Systems*.

Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, *28*(2), 238-256.

Boell, S. K., & Cecez-Kecmanovic, D. (2015). On being "systematic" in literature reviews in IS. *Journal of Information Technology*, *30*(2), 161-173.

Bouchikhi, H. (1998). Living with and building on complexity: A constructivist perspective on organizations. *Organization*, *5*(2), 217-232.

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. Thousands Oaks, CA: Sage.

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain. *Journal of Systems and Software*, *80*(4), 571-583.

Cao, L., Mohan, K., Ramesh, B., & Sarkar, S. (2013). Evolution of governance: Achieving ambidexterity in IT outsourcing. *Journal of Management Information Systems*, *30*(3), 115-140.

Cao, Q., Gedajlovic, E., & Zhang, H. (2009). Unpacking organizational ambidexterity: Dimensions, contingencies, and synergistic effects. *Organization Science*, *20*(4), 781-796.

Chen, D. Q., Mocker, M., Preston, D. S., & Teubner, A. (2010a). Information systems strategy: Reconceptualization, measurement, and implications. *MIS Quarterly*, *34*(2), 233-259.

Chen, D. Q., Preston, D. S., & Xia, W. (2010b). Antecedents and effects of CIO supply-side and demand-side leadership: A staged maturity model. *Journal of Management Information Systems*, *27*(1), 231-272.

Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., & Chow, W. S. (2014). IT capability and organizational performance: The roles of business process agility and environmental factors. *European Journal of Information Systems*, *23*(3), 326-342.

Datta, P., & Roumani, Y. (2015). Knowledge-acquisitions and post-acquisition innovation performance: A comparative hazards model. *European Journal of Information Systems*, *24*(2), 202-226.

Dewhurst, M., Heywood, S., & Rieckhoff, K. (2011). Preparing your organization for growth. *McKinsey.* Retrieved from https://www.mckinsey.com/business-functions/organization/our-insights/preparing-your-organization-for-growth

Duncan, R. (1976). The ambidextrous organization: Designing dual structures for innovation. In R. H. Kilmann, L. R. Pondy, & D. Slevin (Eds.), T *The management of organization: Strategies and implementation* (pp. 167-188). New York, NY: North-Holland.

Durcikova, A., Fadel, K. J., Butler, B. S., & Galletta, D. F. (2011). Knowledge exploration and exploitation: The impacts of psychological climate and knowledge management system access. *Information Systems Research*, *22*(4), 855-866.

Even, A., & Shankaranarayanan, G. (2006). Data-warehouse as a dynamic capability: Utility/cost foundations and implications for economically-driven design. In *Proceedings of the International Conference on Information Systems*.

Ford, J. D., & Backoff, R. W. (1988). Organizational change in and out of dualities and paradox. In R. E. Quinn & K. S. Cameron (Eds.), *Toward a theory of change in organization and management* (pp. 81-121). New York, NY: Ballinger Publishing.

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

Gottschlich, J. (2013). An IT architecture enabling flexible adjustment of exploration/exploitation trade-off. In *Proceedings of the European Conference on Information Systems*.

Gregory, R. W., & Keil, M. (2014). Blending bureaucratic and collaborative management styles to achieve control ambidexterity in IS projects. *European Journal of Information Systems*, *23*(3), 343-356.

Gregory, R. W., Keil, M., & Muntermann, J. (2012). Ambidextrous IS strategy: The dynamic balancing act of developing a "transform & merge" strategy in the banking industry. In *Proceedings of the European Conference on Information Systems*.

Gregory, R. W., Keil, M., Muntermann, J., & Mähring, M. (2015). Paradoxes and the nature of ambidexterity in IT transformation programs. *Information Systems Research*, *26*(1), 57-80.

He, Z.-L., & Wong, P.-K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, *15*(4), 481-494.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quartely*, *28*(1), 75-105.

Huber, T. L., Fischer, T. A., Dibbern, J., & Hirschheim, R. (2013). A process model of complementarity and substitution of contractual and relational governance in IS outsourcing. *Journal of Management Information Systems*, *30*(3), 81-114.

Im, G., & Rai, A. (2014). IT-enabled coordination for ambidextrous interorganizational relationships. *Information Systems Research*, *25*(1), 72-92.

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

Jansen, J. J. P., Van Den Bosch, F. A. J., & Volberda, H. W. (2006). Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science*, *52*(11), 1661-1674.

Jansen, J. J. P., Volberda, H. W., & Van Den Bosch J., F. A. (2003). Exploratory innovation, exploitative innovation, and ambidexterity: The impact of environmental and organizational antecedents. *Schmalenbach Business Review*, *57*, 351-363.

Jennex, M. E. (2015). Literature reviews and the review process: An editor-in-chief's perspective. *Communications of the Association for Information Systems*, *36*, 139-146.

Johns, G. (2006). The essential impact of context on organizational behavior. *Academy of Management Review*, *31*(2), 386-408.

Junni, P., Sarala, R. M., Taras, V., & Tarba, S. Y. (2013). Organizational ambidexterity and performance: A meta-analysis. *Academy of Management Perspectives*, *27*(4), 299-312.

Kalgovas, B., van Toorn, C., & Conboy, K. (2014). Transcending the barriers to ambidexterity: An exploratory study of Australian CIO. In *Proceedings of the European Conference on Information Systems*.

Karpovsky, A., & Galliers, R. (2013). Sources of power and CIO influence and their impact: An explorative survey. In *Proceedings of the International Conference on Information Systems*.

Kathuria, A., & Konsynski, B. R. (2012). Juggling paradoxical strategies: The emergent role of IT capabilities. In *Proceedings of the International Conference on Information Systems.*

Kitchenham, B., & Charters, S. (2007). *Guidelines for performing systematic literature reviews in software engineering* (EBSE Technical Report EBSE-2007-01). Durham, UK: University of Durham.

Lavikka, R., Smeds, R., & Jaatinen, M. (2015). A process for building inter-organizational contextual ambidexterity. *Business Process Management Journal*, *21*(5), 1140-1161.

Lee, G., DeLone, W. H., & Espinosa, J. A. (2010). The main and interaction effects of process rigor, process standardization, and process agility on system performance in distributed IS development:

An ambidexterity perspective. In *Proceedings of the International Conference on Information Systems*.

Lee, G., Espinosa, J. A., & DeLone, W. H. (2013). Task environment complexity, global team dispersion, process capabilities, and coordination in software development. *IEEE Transactions on Software Engineering*, *39*(12), 1753-1771.

Lee, O.-K., Lim, K. H., Sambamurthy, V., & Wei, K. K. (2008). Information technology exploitation and exploration in a fast growing economy. In *Proceedings of the Pacific Asia Conference on Information Systems*.

Lee, O.-K., Sambamurthy, V., Lim, K. H., & Wei, K. K. (2015). How does IT ambidexterity impact organizational agility? *Information Systems Research*, *26*(2), 398-417.

Lewis, M. W., & Smith, W. K. (2014). Paradox as a metatheoretical perspective. *The Journal of Applied Behavioral Science*, *50*(2), 127-149.

Lin, Z., Yang, H., & Demirkan, I. (2007). The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing. *Management Science*, *53*(10), 1645-1658.

Ling, H., Zhao, F., & Wang, Y. (2009). Impact of synergy between IT and business process on organizational performance: A perspective of ambidexterity theory. In *Proceedings of the Pacific Asia Conference on Information Systems*.

Lo, J., & Leidner, D. E. (2012). Extending the IS strategy typology: An assessment of strategy impacts on capabilities development and performance. In *Proceedings of the International Conference on Information Systems*.

Lyytinen, K., & Rose, G. M. (2006). Information system development agility as organizational learning. *European Journal of Information Systems*, *15*(2), 183-199.

Maghrabi, R. O., Oakley, R. L., Thambusamy, R., & Iyer, L. (2011). The role of business intelligence (BI) in service innovation: An ambidexterity perspective. In *Proceedings of the Americas Conference on Information Systems*.

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

Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Information technology and organizational performance: An integrative model of IT business value. *MIS Quarterly*, *28*(2), 283-322.

Mithas, S., & Rust, R. T. (2016). How information technology strategy and investments influence firm performance: Conjecture and empirical evidence. *MIS Quarterly*, *40*(1), 223-245.

Montealegre, R., Iyengar, K., & Sweeney, J. (2014). Toward a process model of IT adoption ambidexterity: A revelatory case-study. In *Proceedings of the International Conference on Information Systems*.

Naidoo, R. (2016). A communicative-tension model of change-induced collective voluntary turnover in IT. *The Journal of Strategic Information Systems*, *25*(4), 277-298.

Napier, N. P., Mathiassen, L., & Robey, D. (2011). Building contextual ambidexterity in a software company to improve firm-level coordination. *European Journal of Information Systems*, *20*(6), 674-690.

Nazir, S., & Pinsonneault, A. (2012). IT and firm agility: An electronic integration perspective. *Journal of the Association for Information Systems*, *13*(3), 150-171.

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

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

Oh, L.-B. (2009). Managing external information sources in digital extended enterprises: The roles of IT enabled business intelligence competence and network structure strength. In *Proceedings of the International Conference on Information Systems*.

Okoli, C., & Schabram, K. (2009). Protocol for a systematic literature review of research on the Wikipedia. *Sprouts: Working Papers on Information Systems*, *9*(65), 1-10.

Papachroni, A., Heracleous, L., & Paroutis, S. (2015). organizational ambidexterity through the lens of paradox theory. *The Journal of Applied Behavioral Science*, *51*(1), 71-93.

Pavlou, P. A., & El Sawy, O. A. (2010). The "third hand": IT-enabled competitive advantage in turbulence through improvisational capabilities. *Information Systems Research*, *21*(3), 443-471.

Piccinini, E., Hanelt, A., Gregory, R. W., & Kolbe, L. M. (2015). Transforming industrial business: The impact of digital transformation on automotive organizations. In *Proceedings of the International Conference on Information Systems*.

Ployhart, R. E., & Vandenberg, R. J. (2010). Longitudinal research: The theory, design, and analysis of change. *Journal of Management*, *36*(1), 94-120.

Poole, M., & Van de Ven, A. (1989). Using paradox to build management and organization theories. *Academy of Management Review*, *14*(4), 562-578.

Raeth, P., Kügler, M., & Smolnik, S. (2011). Measuring the impact of organizational social web site usage on work performance: A multilevel model. In *Proceedings of the International Conference on Information Systems*.

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

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

Ramesh, B., Mohan, K., & Cao, L. (2012). Ambidexterity in agile distributed development: An empirical investigation. *Information Systems Research*, *23*(2), 323-339.

Reeves, M., Haanæs, K., Hollingsworth, J., & Pasini, F. L. S. (2013). Ambidexterity: The art of thriving in complex environments. *BCG*. Retrieved from https://www.bcgperspectives.com/content/articles/business_unit_strategy_growth_ambidexterity_art_of_thriving_in_complex_environments/

Rothaermel, F. T., & Alexandre, M. T. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science*, *20*(4), 759-780.

Schad, J., Lewis, M. W., Raisch, S., & Smith, W. K. (2016). Paradox Research in Management Science: Looking Back to Move Forward. *The Academy of Management Annals*, *10*(1), 5-64.

Shao, Z., Feng, Y., & Hu, Q. (2013). The impact mechanism of transformational leadership style on exploitative and exploratory learning of ERP systems. In *Proceedings of the Pacific Asia Conference on Information Systems*.

Smith, W. K., & Lewis, M. W. (2011). Toward a theory of paradox: A dynamic equilibrium model of organzining. *Academy of Management Review*, *36*(2), 381-403.

Strong, D. M., & Volkoff, O. (2010). Understanding organization-enterprise system fit: A path to theorizing the information technology artifact. *MIS Quarterly*, *34*(4), 731-756.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *MIS Quarterly*, *28*(1), 45-73.

Tang, X., & Rai, A. (2014). How should process capabilities be combined to leverage supplier relationships competitively? *European Journal of Operational Research*, *239*(1), 119-129.

Tang, X., Kishore, R., & Parameswaran, S. (2015). Dig deeper or diversify? The rewards and penalties of knowledge exploration and exploitation capabilities in the context of IS scholar publication productivity. In *Proceedings of the International Conference on Information Systems*.

Tarafdar, M., & Gordon, S. R. (2007). Understanding the influence of information systems competencies on process innovation: A resource-based view. *The Journal of Strategic Information Systems*, *16*(4), 353-392.

Temizkan, O., & Kumar, R. L. (2015). Exploitation and exploration networks in open source software development: An artifact-level analysis. *Journal of Management Information Systems*, *32*(1), 116-150.

Tiwana, A. (2010). Systems development ambidexterity: Explaining the complementary and substitutive roles of formal and informal controls. *Journal of Management Information Systems*, *27*(2), 87-126.

Tsai, W. (2002). Social structure of "coopetition" within a multiunit organization: Coordination, competition, and intraorganizational knowledge sharing. *Organization Science, 13*(2), 179-190.

Turner, N. (2011). *The management of ambidexterity—an intellectual capital perspective* (doctoral thesis). University of Bath, Somerset, England.

Turner, N., Swart, J., & Maylor, H. (2013). Mechanisms for managing ambidexterity: A review and research agenda. *International Journal of Management Reviews*, *15*(3), 317-332.

Tushman, M. L., & O'Reilly, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, *38*(4), 8-30.

Vidgen, R., & Wang, X. (2009). Coevolving systems and the organization of agile software development. *Information Systems Research*, *20*(3), 355-376.

Vidgen, R., Allen, P., & Finnegan, P. (2011). Towards "open" IS managers: An exploration of individual-level connectedness, ambidexterity, and performance. In *Proceedings of the 44th Hawaii International Conference on System Sciences*.

vom Brocke, J. V. Simons, A., Niehaves, B. B., Reimer, K., Plattfaut, R., & Cleven, A. (2009). Reconstructing the giant: On the importance of rigour in documenting the literature search process. In *Proceedings of the 17th European Conference on Information Systems* (pp. 2206-2217).

Wang, Z., Huang, J., & Tan, B. (2012). Managing organizational identity through ambidextrous capabilities: A Dual Level Analysis. In *Proceedings of the Pacific Asia Conference on Information Systems*.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, *26*(2), xiii-xxiii.

Werder, K. (2018). The evolution of emotional displays in open source software development teams: An individual growth curve analysis. In *Proceedings of the 3rd International Workshop on Emotion Awareness in Software Engineering.*

Werder, K., Li, Y., Maedche, A., & Ramesh, B. (2019). Software development process ambidexterity and project performance: A coordination cost-effectiveness view. *IEEE Transactions on Software Engineering.*

Won, J. L., Zhang, C., Bock, G. W., Park, S. C., & Kang, Y. J. (2012). Interorganizational system ambidexterity capability and its role in the information technology-performance relationship. In *Proceedings of the European Conference on Information Systems*.

Xie, K., Ran, J., & Xiao, J. (2014). Strike a subtle balance between being too lenient and too strict: The IT enabled ambidexterity of governance conversion. In *Proceedings of the Pacific Asia Conference on Information Systems.*

Xie, R., Ling, H., & Zhang, C. (2011). Effect of business process management on firm performance: An ambidexterity perspective. In *Proceedings of the International Conference on Business Management and Electronic Information* (pp. 341-345).

Xue, L., Ray, G., & Sambamurthy, V. (2012). Efficiency or innovation: How do industry environments moderate the effects of firms' IT asset portfolios? *MIS Quarterly*, *36*(2), 509-528.

Yan, M., Yu, A. Y., & Dong, X. (2013). Organizational ambidexterity building via IT-enabled strategic learning and business learning: A evolutionary journey of Huawei. In *Proceedings of the International Conference on Information Systems.*

Yogev, N., Fink, L., & Even, A. (2012). How business intelligence creates value. In *Proceedings of the European Conference on Information Systems*.

Zheng, Y., & Abbott, P. (2013). Moving Up the value chain or reconfiguring the value network? An organizational learning perspective on born global outsourcing vendors. In *Proceedings of the European Conference on Information Systems*.

About the Authors

Karl Werder is a Research Fellow at the University of Cologne, Germany. He received his Doctorate Degree in Information Systems from the Karlsruhe Institute of Technology, Germany. His research interests include information systems development and software-intensive businesses. His work has been published in journals such as *IEEE Transactions on Software Engineering, Information & Software Technology,* and *Information Technology & People* and conferences such as the *International Conference on Information Systems* and *European Conference on Information Systems.*

Carl Simon Heckmann is a Product Manager at Heidelberger Services AG, Germany. He received his Doctorate Degree in Information Systems from the University of Mannheim. His research interests include business process excellence, IT ambidexterity, and the energy research. His work has been published in journals such as *Business Process Management Journal* and conferences such as *European Conference on Information Systems* and *Energy Informatics and Management.*

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