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Managing Emerging Technologies - A Socio-Technical Analysis of Opportunities and Tensions for Incumbents

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“[…] technological change […] lies at the heart of economic growth.”

(Romer, 1990)

Mit dem Abschluss dieser Dissertation blicke ich auf eine sehr lehrreiche, vielseitige und prägende universitäre Laufbahn zurück. Während dieser Laufbahn durfte ich Teil eines Umfelds sein, das mir Türen geöffnet und mir die Möglichkeiten geboten hat, mich fortlaufend weiterzuentwickeln und Neues zu lernen. Ich möchte diese Gelegenheit nutzen, um Danke zu sagen:

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Copyright Statement

The following sections comprise partly of content taken from the research papers embedded in this thesis. To improve the readability of the text, I have omitted the standard labeling of these citations.

Abstract

Emerging technologies are changing today's economic environment with unprecedented speed and in unpredictable ways. These dynamics threaten incumbent organizations, which are caught between continuing to effectively deliver their outcomes to existing customers and leaving established paths to leverage the opportunities afforded by emerging technologies that are still changing and developing. To address these tensions, incumbents often must implement a variety of structural and contextual changes. However, these changes strongly depend on the respective environment the incumbents are embedded in. In managing emerging technologies, incumbents thus need to understand and address a broad range of interrelated techno-organizational factors. At the same time, the increasing autonomy and intelligence of emerging technologies challenges the effectiveness of established concepts of information systems research for managing traditional information technology.

To address this gap, this thesis presents a socio-technical perspective on the management of emerging technologies that is informed by the ideas of critical realism and considers opportunities and tensions for incumbent organizations as well as their contextual embedding. First, it delves into a deeper understanding of the potentials of emerging technologies in relation to their respective context and organizational actors. In particular, the thesis focuses on two such technologies: blockchain and artificial intelligence. Second, it elaborates on how incumbents can prepare emerging technologies for effective use that lack established use cases and patterns. It explores how the techno-organizational context gives rise to a variety of interrelated mechanisms that can stimulate or constrain experimentation activities with these technologies. Moreover, this thesis investigates how incumbents prepare for effective technology use by building necessary digital capabilities and managing tensions between leveraging digital opportunities and effectively delivering outcomes despite disruption. Resolving these tensions often leads to an accumulation of digital debt, technical and informational obligations that will need to be addressed in the future. Incumbents must manage this digital debt carefully to avoid negative in the long-term.

This thesis contextualizes the contribution of seven embedded research papers and provides a holistic perspective on managing emerging technologies, contributing to a better understanding of opportunities and tensions for incumbents.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

A-A	Affordance-Actualization
A-E-A	Affordance-Experimentation-Actualization
AI	Artificial Intelligence
(co)ESB	(Cross-organizational) Enterprise Service Buse
ETF	Exchange-Traded Fund
FLORA	Federal Blockchain Infrastructure Asylum
GDPR	General Data Protection Regulation
IS	Information Systems
IT	Information Technology
PdM	Predictive Maintenance

1 Introduction

1.1 Motivation

While technological change has always been an important part of entrepreneurial action (Romer, 1990), digital technologies today are changing at an unprecedented pace and in unpredictable ways (Bailey et al., 2022). Emerging technologies such as artificial intelligence (AI), blockchain, digital platforms, quantum computing, robotics, and social media are increasingly permeating our society, impacting businesses, governments, and individuals alike. These technologies are characterized by their reprogrammability, homogenization of data, and self-referential nature (Yoo, 2010). Moreover, they can be designed for different purposes, such as platform provision, sensor-based data collection, actor-based data execution, self-dependent material agency, or augmented interactions (Baier et al., 2023). The increasing amounts of data that these technologies produce can substantially change the knowledge processes and organizational core operations (Alaimo & Kallinikos, 2022). Emerging technologies act autonomously and intelligently to an increasing extent, afford new ways of collaborating and coordinating, and, thus, drive new ideas, products, and processes (Bailey et al., 2022; Lanzolla et al., 2020; Majchrzak et al., 2021). In this way, these technologies disrupt existing business models, market structures, and industries, collapse organizational boundaries, shift the focus from value capturing to (co-)creation, and intensify competition due to lower market-entry barriers (Fichman et al., 2014; Menz et al., 2021; Yoo et al., 2012). For instance, mobile brokers such as Trade Republic or Robinhood are entering lines of business that have formerly been controlled by banks. Utilizing modern platform architectures together with automation techniques provides these mobile brokers with the opportunity to simplify investing in stocks or exchange-traded funds (ETF) while at the same time only charging small fees (Hemmersmeier, 2020). However, emerging technologies are not yet stable and are still evolving over time (Bailey et al., 2022). This evolving nature also carries significant tensions that, for instance, became apparent in Robinhood's losses from lawsuits and regulatory issues following stock rallies on struggling companies such as GameStop (Livni, 2022) or, more recently, in the collapse of FTX, one of the largest cryptocurrency exchanges (Huang, 2022).

With the increasing impact of emerging technologies, organizations must reorient their business-level strategies toward digital business strategies and create a better alignment between business and IT (Bharadwaj et al., 2013; Drnevich & Croson, 2013; Queiroz et al., 2020; Yeow et al., 2018). Organizations must continuously identify new ideas and leverage digital opportunities in their respective contexts to sustain a competitive advantage (Ciriello et al., 2018; Fichman et al., 2014; Henfridsson & Yoo, 2014; Menz et al., 2021). However, many incumbents are still struggling with these changes, as they need to leave established paths and often manage competing concerns (Henfridsson & Yoo, 2014; Svahn et al., 2017). Yet incumbents' existing resources can also provide them with opportunities in relation to emerging technologies (Keller et al., 2022; Oberländer et al., 2021). Banks, for instance, have rich datasets of customer transactions, including spending habits, contract fees, and income. This data can give them a competitive advantage over new market entrants and considerable potential to lower operational costs and add business value through a better customer experience (Königstorfer & Thalmann, 2020).

To remain competitive and avoid discontinuities, incumbents thus need to both exploit existing products and IT resources and explore new opportunities—an ability that is commonly referred to as organizational ambidexterity (Andriopoulos & Lewis, 2009; O.-K. Lee et al., 2015; Ossenbrink et al., 2019; Tushman & O'Reilly, 1996). This ambidexterity enhances organizational agility, allowing organizations to be able to quickly detect and exploit emerging market opportunities—a key capability that can help incumbents sustain a competitive advantage (Overby et al., 2006; Sambamurthy et al., 2003; Tallon & Pinsonneault, 2011). However, the established organizations also need to demonstrate organizational reliability, that is, being able to continue operating and delivering outcomes despite external disruptions, issues, and challenges (Butler & Gray, 2006; Research Paper 7). The necessity to demonstrate both organizational agility and reliability can create tensions that can be alleviated through organizational ambidexterity (Jöhnk et al., 2022; O.-K. Lee et al., 2015). To achieve this, organizations must manage both structural (e.g., the setup of teams or units) and contextual changes (e.g., establishing organization-wide behavior patterns) (Jöhnk et al., 2022; Ossenbrink et al., 2019; Vial, 2019). These changes often entail decoupling some elements of the organization from others, resulting in what can be described as loosely coupled systems (Berente & Yoo, 2012; Orton & Weick, 1990; Perrow, 1984). However, decoupling can also lead to a fragmented IT landscape that fosters the accumulation of digital debt, that is, technical and informational obligations that an organization needs to address in the future (Brown et al., 2010; Ramasubbu & Kemerer, 2016; Rolland et al., 2018). This means that strategically accumulating digital debt can help incumbents quickly seize opportunities. However, it also has negative impacts in the long-term when it is not repaid, such as the higher effort required for maintenance and responding to new market opportunities (Z. Li et al., 2015; Rolland et al., 2018; Woodard et al., 2013). Therefore, managing emerging technologies requires incumbents to address tensions between organizational agility and reliability while monitoring their digital debt (Research Paper 7). However, the aforementioned changes, structural and contextual, and tensions between these changes as well as between organizational agility and reliability are often themselves dependent on the techno-organizational context, that is, the organizational environment (Ossenbrink et al., 2019).

Essentially, this thesis follows the philosophical assumption that emerging technologies, the action possibilities they afford, and necessary organizational changes are all relational, that is, dependent on the connections they are embedded in (Bailey et al., 2022; Bradbury & Lichtenstein, 2000; Feldman et al., 2016). Managing emerging technologies thus requires a broader understanding of both social and technical factors (Research Paper 5; Sarker et al., 2019). These are the fundamental ideas underlying critical realism. Critical realism is a philosophy that conceptualizes the world in three layers (Bhaskar, 1998): the *real*, the *actual*, and the *empirical*. The layer of the *real* consists of physical and social structures associated with mechanisms that can generate events or outcomes. That means that these generative mechanisms arise from the relationship between different types of structures as causal triggers for events and outcomes (Bhaskar, 1998; Mingers, 2004). These mechanisms can be physical, chemical, biological, psychological, social, or economic, and at times they are even unobservable (Bunge, 2004). They can enable or constrain action (Volkoff & Strong, 2013). However, they do not act deterministically, as they are contingent on events or outcomes previously produced by other generative mechanisms (Elder-Vass, 2010; Henfridsson & Bygstad, 2013; Sayer, 1992; M. L. Smith, 2010). Some of these mechanisms may never be actualized, so their potential to cause certain events or outcomes can remain untapped (Fleetwood, 2011). The events and outcomes that are actually caused by the aforementioned mechanisms constitute the layer of the *actual* (Bhaskar, 1998; Mingers, 2004). Lastly, the layer of the *empirical* comprises the subset of observable events or outcomes that one can analyze. For the context of emerging technologies this, for instance, means that organizational actions not only depend on a technology's components but also factors such as the underlying data, existing policies and norms, people, and cultures that themselves are the result of interacting mechanisms (Bailey et al., 2022; Research Paper 5). Thus, managing emerging technologies requires understanding and addressing a multitude of interrelated technical and non-technical factors.

1.2 Research Aim

Incumbent organizations must understand how to effectively manage emerging technologies. These technologies promise great potential to both support and redefine the value creation paths of many established organizations (Bailey et al., 2022; Vial, 2019; Wessel et al., 2021). However, established methods and theories in information systems (IS) research may not suffice to understand technologies that act autonomously and intelligently to an increasing extent (Bailey et al., 2022; Rai et al., 2019). Managing emerging technologies for effective use requires a holistic approach that promotes an understanding of *technology potential* in relation to specific organizational actors (Markus & Silver, 2008; Volkoff & Strong, 2013) and *experimentation* due to lack of established use cases and patterns (Bailey et al., 2022; Du et al., 2019; Ølnes et al., 2017). Moreover, it should address the socio-technical factors of the broader *techno-organizational context* (Bygstad et al., 2016; Du et al., 2019). Figure 1 illustrates this holistic approach to the management of emerging technologies.

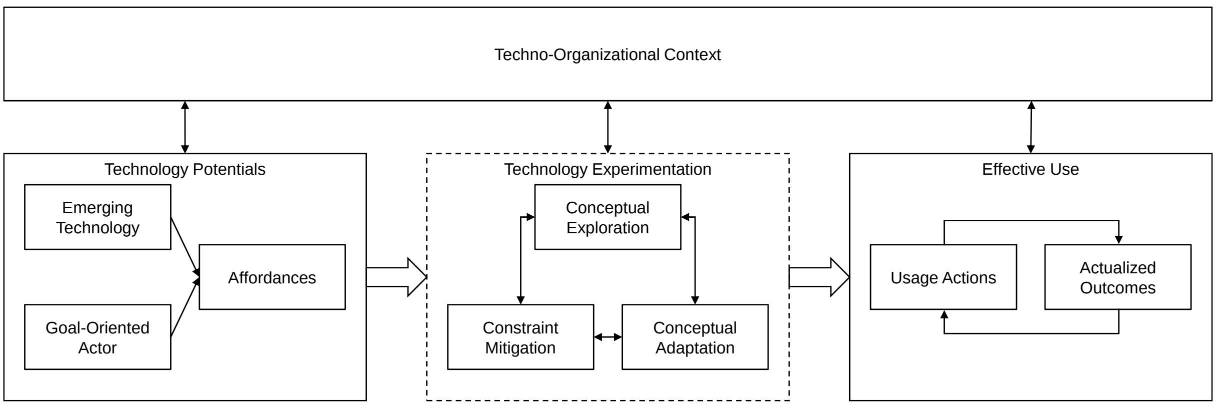

Figure 1. Managing Emerging Technologies for Effective Use (Based on Du et al. (2019) and Research Paper 4)

Technology potentials are relational. That is, the specific action possibilities that an emerging technology provides strongly depend on the respective organizational actors and their goals as well as capabilities (affordances) (Markus & Silver, 2008; Volkoff & Strong, 2013). Since emerging technologies often lack established use cases and are still evolving, their behavior upon introduction into a specific organizational context is unclear (Bailey et al., 2022; Du et al., 2019). To be able to effectively use an emerging technology, incumbents thus need to *experiment* with the technology to develop a conceptual understanding, mitigate constraints, and adapt the concept to their specific context (Du et al., 2019; Research Paper 4). *Effective use* of an emerging technology then entails taking the actions afforded by the technology to achieve specific outcomes (Strong et al., 2014). The entire process occurs in relation to the techno-organizational context, which means it is influenced by factors such as culture, policies and norms, team structure, and existing IT capabilities (Bailey et al., 2022; Bygstad et al., 2016; Du et al., 2019; Research Paper 5; Research Paper 6; Strong et al., 2014).

In this context, the thesis aims to provide an overview of the complexities of managing emerging technologies. First, it aims to provide insights into the opportunities that emerging technologies can afford incumbent organizations in both the private and public sector with a focus on blockchain and AI. Second, it aims to provide an understanding of how incumbents prepare these technologies for effective use, considering contextual factors such as structure and culture but also the development of necessary IT capabilities and management of tensions between these factors.

This thesis and its embedded research papers aim to contribute to both a theoretical and a practical understanding of the management of emerging technologies toward effective use in incumbent organizations. It addresses the need for theory extensions at the intersection of IS and organizational research due to the fundamental novelty of emerging technologies such as AI, blockchain, or digital platforms (Bailey et al., 2022; Rai et al., 2019). Such theories can assume different forms that can provide important and valuable contributions. There are theories for *analyzing* (i.e., describing or classifying phenomena that little is known about), for e*xplaining* (i.e., understanding how and why certain phenomena unfolded), for *predicting* (i.e., predicting outcomes from a set of explanatory factors), for *explaining and predicting* (i.e., understanding causes, predicting, and establishing theoretical constructs and their relationships), and for *design and action* (i.e., developing IS for specific purposes) (Gregor, 2006). Since the management of emerging technologies constitutes a comparatively new phenomenon, this thesis and its embedded research papers are based on qualitative research approaches (Creswell, 2014) and comprise theories for analyzing and explaining (Gregor, 2006). Due to the strong practical embedding, this thesis and its embedded research papers also provide practical insights into the opportunities and challenges of emerging technologies. In summary, the thesis aims to provide a holistic understanding of the management of emerging technologies in incumbent organizations, considering both theoretical and practical aspects.

1.3 Structure of the Thesis and Overview of the Embedded Research Papers

The following section presents the structure of this thesis and provides an overview of the embedded research papers. This cumulative doctoral thesis comprises seven research papers that investigate the management of emerging technologies and provide a socio-technical perspective on opportunities and tensions for incumbent organizations. This thesis incorporates the findings gathered from all embedded research papers. As outlined in Figure 2, the research articles in this study focus on various aspects of the early stage adoption process of emerging technologies. The effective use of emerging technologies is not covered within the scope of this thesis.

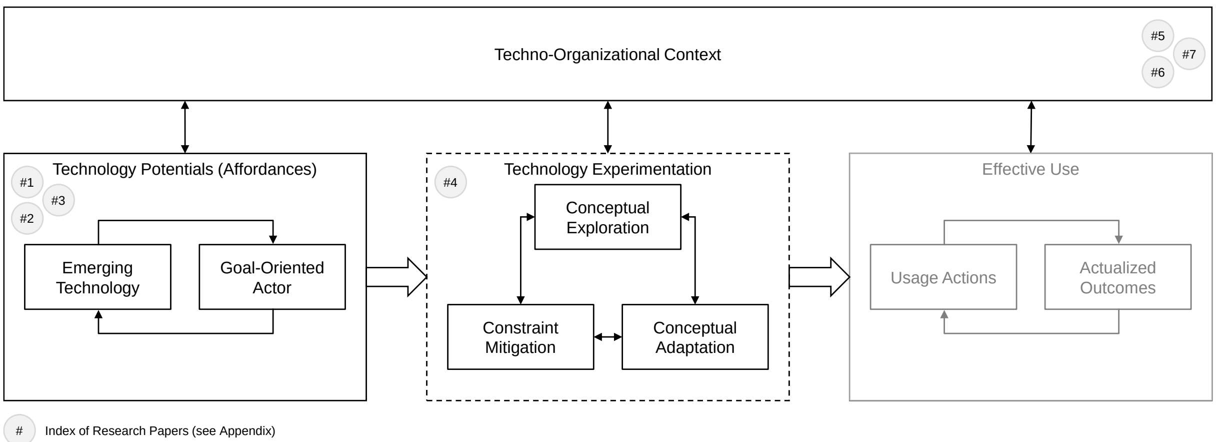

Figure 2. Structure of the Thesis

Each embedded research paper addresses a research question related to a specific aspect of the management of emerging technologies (see Table 1). The embedded research papers address these questions using different research approaches. However, the majority is based on single- or multiple-case studies that allow for a deeper understanding of a phenomenon in its socio-technical context and enable the inductive development of initial theoretical insights (Eisenhardt, 2021; Klein & Myers, 1999; Orlikowski & Iacono, 2001; Yin, 2014). These case studies are based on semi-structured interviews as a primary source of case evidence, which promises a comprehensive coverage of the subject area and rich insights into the phenomenon in question (Myers & Newman, 2007; Rubin & Rubin, 2012; Schultze & Avital, 2011).

Table 1. Overview of Research Questions in the Embedded Papers

Paper ID	Research Question
1	Why do organizations in federally structured government systems adopt blockchain?
2	How do organizations in federal public contexts use blockchain-based platforms to digitalize cross-organizational processes?
3	How can one conceptualize the collaborative interworking of human agents and AI-enabled systems?
4	(1) How do organizations actualize affordances in the context of AI-enabled predictive maintenance? (2) How does the organizational context affect the actualization process?
5	How does the techno-organizational context affect the experimentation phase of AI-enabled PdM systems?
6	How can banks successfully manage their investments in AI-related IT capabilities?
7	How do organizations responsible for IT infrastructure deal with the trade-off between organizational reliability and agility, and manage the accumulation of digital debt?

The remainder of this thesis is structured as follows. Section 2 illustrates the potentials of emerging technologies (i.e., technology affordances). These potentials, however, are not universal. They arise from the relationship between a technology and organizational actors (section 2.1). Since the field of emerging technologies is broad, this thesis focuses on two specific technologies: blockchain technology (section 2.2) and AI-enabled systems (section 2.3). Building upon these concepts, section 3 delves deeper into the adoption of emerging technologies. This section focuses on experimentation with these technologies and, in particular, the techno-organizational factors that influence this experimentation (section 3.1). Experimentation with emerging technologies can help incumbents in establishing IT-related capabilities that are necessary to eventually being able to effectively use an emerging technology. However, in doing so, incumbents need to carefully manage a trade-off between organizational agility and reliability that could lead to an accumulation of digital debt (section 3.2). Section 4 then provides a summary of the thesis and outlines its contributions, while section 5 acknowledges previous and related work. The thesis concludes with the references (section 6) and an appendix (section 7) that contains detailed information on the embedded research papers.

2 Understanding the Potentials of Emerging Technologies

Emerging technologies offer a broad range of possibilities to incumbents and new entrants alike and have the potential to fundamentally shape the business environment (Bailey et al., 2022). However, emerging technologies are only a collection of possible paths (Pentland et al., 2022) or a set of relations (Bailey et al., 2022). This means that these technologies are not stable but are evolving over time (Bailey et al., 2022). The specific action possibilities that a technology provides strongly depend on the respective organization and its actors (Markus & Silver, 2008; Volkoff & Strong, 2013). These actions and paths only constitute possibilities until they are harnessed through technology use (Pentland et al., 2022; Strong et al., 2014). This is the fundamental idea of affordance theory that can help researchers investigate phenomena on the sociotechnical continuum, particularly those concerned with the use of digital technologies (Markus & Silver, 2008).

2.1 Affordances of Emerging Technologies

The term “affordances” was originally coined by ecological psychologists to describe “what [the environment] offers the animal” (Gibson, 1979, p. 127). Affordances are based on the relationship between object and observer, and they can either be enabling or constraining (Gibson, 1979). For instance, a tree log can offer humans—and only adults if it is too tall—a place to sit, while it can be an obstacle for snakes. From these descriptions, we can identify properties that make the concept of affordances interesting for IS research as well. First, affordances are action possibilities whose mere existence does not guarantee any outcomes (Stoffregen, 2003). In other words, the concept differentiates between possibilities and outcomes. Second, the concept does not treat the object and the observer separately but instead emphasizes the relationship between them (Volkoff & Strong, 2013). Therefore, affordances can also contribute to a better understanding of the potentials of emerging technologies.

Affordance-Actualization (A-A) theory allows for an organizational perspective that takes separate accounts of affordances, their actualization, and their outcomes (Strong et al., 2014). In this context, affordances are the possibilities for action that are available to a goal-oriented actor when using or interacting with a certain IT object (Markus & Silver, 2008). In other words, affordances represent action possibilities that arise from technology use (Ostern et al., 2020) and are available to any goal-oriented actor. These actors can either be individuals (Leonardi, 2011; Majchrzak & Markus, 2013), entire organizations, or specific entities or groups within an organization (Burton-Jones & Volkoff, 2017; Du et al., 2019; Research Paper 4; Research Paper 5; Volkoff & Strong, 2017). Since affordances represent possibilities for action, A-A theory proposes that goal-oriented actors must actualize these possibilities for their effects to unfold (Strong et al., 2014). The resulting outcomes provide important feedback on which affordances are available and most conducive to the respective goal (Volkoff & Strong, 2013). The same applies to the actualization actions themselves. This means that actualizing basic affordances of a technology enhances an actor's technological understanding and enables them to use that technology in a more sophisticated manner (Bygstad et al., 2016; Ostern et al., 2020; Strong et al., 2014). Considering this chronology, we can conclude that organizational actors actualize an emergent series of affordances upon implementing a technology (Strong et al., 2014).

However, affordances and actualization actions are often unclear when it comes to emerging technologies, especially when the technology in question lacks established use cases to start the affordance recognition cycle (Du et al., 2019). Emerging technologies still evolve on the basis of complex constellations of relations and "have yet to stabilize around a recognizable set of patterns" (Bailey et al., 2022, p. 12). In such instances, organizations must gain a better understanding of an emerging technology's potential in their specific context. They often enter an experimentation phase that precedes the actualization of affordances with the intention to prepare the technology for effective use or, put differently, to identify how to actualize useful affordances (Du et al., 2019; Research Paper 4). For this purpose, incumbents can, for instance, start a demonstrator project and test a specific emerging technology in a sandbox environment—an environment that is isolated from the productive systems. The benefit of this experimentation phase, then, is that it facilitates a conceptual understanding of the emerging technology as well as its conceptual adaptation to the specific context and helps mitigate constraints and risks that can arise when the technology is introduced in this specific context (Du et al., 2019; Research Paper 4; Research Paper 5). Moreover, this experimentation phase can help incumbents assess the technology's transformative potential by assessing whether it affords them new actions that they can flexibly recombine to generate new pathways of actions and events (Pentland et al., 2022). While the following subsections focus on the potentials of two specific technologies, blockchain and AI, section 3 delves deeper into the experimentation phase.

2.2 Technology Deep-Dive: The Potentials of Blockchain

In the past few years, interest in blockchain technology has increased significantly due to its potential of impacting a broad range of application both in the private and the public sector (Beck & Müller-Bloch, 2017; Benbunan-Fich et al., 2020; Upadhyay, 2020; Ziolkowski et al., 2020). Blockchains are transactional, immutable, and append-only databases that keep data consistent in a distributed network (Carvalho et al., 2021; Glaser et al., 2019; Upadhyay, 2020). Blockchains group data into blocks that each reference the previous block, which creates a chain of chronologically ordered blocks (Christidis & Devetsikiotis, 2016; Schweizer et al., 2017). The technology provides a high level of resistance to manipulations, failures, and attacks by maintaining copies of these cryptographically secured chains of blocks on all instances of the distributed network—the so called nodes (Andoni et al., 2019; Upadhyay, 2020).

However, blockchains are as versatile as their applications, and the same can be said of their technological characteristics. Generally, one can distinguish between public blockchains, where everyone can participate in the blockchain network, and private blockchains, where only selected, pre-registered participants can join. Moreover, blockchains differ in whether they are permissioned, where only authorized nodes can add a new block, or permissionless, where all nodes can add new blocks (Beck et al., 2018; H. M. Kim et al., 2022; Ølnes et al., 2017; Peters & Panayi, 2016). Some blockchain frameworks, like Ethereum, support both public permissionless and private permissioned implementations (Buterin, 2016; H. M. Kim et al., 2022). While public blockchains have gained particular prominence in the context of cryptocurrencies, "business" as well as public sector applications are often based on private blockchains (Jensen et al., 2019; Mattke et al., 2019; Pedersen et al., 2019; Research Paper 1; Rieger et al., 2019). These private blockchain frameworks have four key properties (Research Paper 1): secure and distributed data storage, selective transparency, reliable information sharing and process automation, and adaptability. Secure and distributed data storage—as described above when introducing the technology—is one of the key properties of blockchain technology (Andoni et al., 2019; Sedlmeir et al., 2020; Upadhyay, 2020). Second, private blockchain frameworks enable selective transparency. That means that they enable granting organizations limited rights to input and access data, dependent on their role in the respective procedures (Ølnes et al., 2017; Pal et al., 2020; Rieger et al., 2019; Ziolkowski et al., 2020). This selective transparency reduces coordination complexities by providing a shared truth where appropriate without disclosing information that either should not or may not be accessed (Mattke et al., 2019; Rieger et al., 2019). Selective transparency is an important property in circumstances when competitors work on the same blockchain network or when certain regulatory aspects, such as the General Data Protection Regulation (GDPR), have to be met (Iansiti & Lakhani, 2017; Perrons & Cosby, 2020; Rieger et al., 2019; Risius & Spohrer, 2017). Third, private blockchain frameworks enable reliable information sharing and process automation (Dutta et al., 2020; Helo & Hao, 2019; Rossi et al., 2019; Sikorski et al., 2017; Ziolkowski et al., 2020). Reliable information sharing builds on the previous two properties (Research Paper 1). On the one hand, secure and distributed data storage guarantees the authenticity of shared information (Mattila et al., 2018; Perrons & Cosby, 2020; Sedlmeir et al., 2020). On the other hand, selective transparency provides the basis for reliably disseminating to all *relevant* participants (Iansiti & Lakhani, 2017; Pal et al., 2020; Rieger et al., 2019). Most blockchains additionally support smart contracts that enable *process automation* based on automated triggers for certain process steps as well as extensive monitoring capabilities (Kranz et al., 2019; Lauslahti et al., 2018; Noor et al., 2018; Ølnes et al., 2017; Rieger et al., 2019). Fourth, many private blockchain frameworks provide a certain degree of *adaptability*. That means that the design of the network and the rules for information processing are somewhat dynamic and can evolve over time to meet case specific particularities and changing requirements (Andersen & Ingram Bogusz, 2019). This *adaptability* is crucial in cross-organizational contexts where technological solutions need to suit various cooperation scenarios (Farshidi et al., 2020; Jensen et al., 2019; Ziolkowski et al., 2020).

Based on the above properties, blockchain technology offers a broad range of affordances depending on the respective context and its goal-oriented actors. For instance, the technology provides different actors in an aviation context the possibility to settle payments directly, to automate transactions, or to secure loans from financial institutions in cases where existing contracts and past transactions are important factors for proving solvency but whose verification has previously been cumbersome (Du et al., 2019). Other affordances are the possibility to establish unique and verifiable identities/credentials (Ostern et al., 2020; Sedlmeir et al., 2021) or to track the origin, location, and status of different assets (Dutta et al., 2020; Guggenberger et al., 2020; Mattke et al., 2019; Ostern et al., 2020). Besides these more technical affordances, blockchain technology can also provide possibilities to establish new modes of value creation (Ostern et al., 2020).

However, affordances of blockchain technology are not limited to private sector actors but can apply to the public sector as well. For instance, blockchain can also enable process coordination in federally structured public environments (Ølnes et al., 2017; Research Paper 1). The appeal of blockchain in these environments is that the technology offers a close task-technology fit with federally organized governmental procedures, that is, the task structures (Research Paper 1). These task structures are the result of shared organizing principles, which, in turn, appear to be manifestations of shared values (Research Paper 1). In federally organized contexts, these values and task structures are reflected in legal norms that ensure their implementation (Bozeman, 2007; Craig, 2010; Lindahl, 2000; Tobias, 1989). This means that organizing principles are not simple antecedents of tasks and task structures but mandatory prerequisites stipulated by law (Bozeman, 2007; Lindahl, 2000). Therefore, legal norms cannot only constitute barriers to technical innovation (G. Smith et al., 2019) but also promote such innovation (Goh & Arenas, 2020; Research Paper 1). Figure 3 summarizes this relationship between technological properties and task structures.

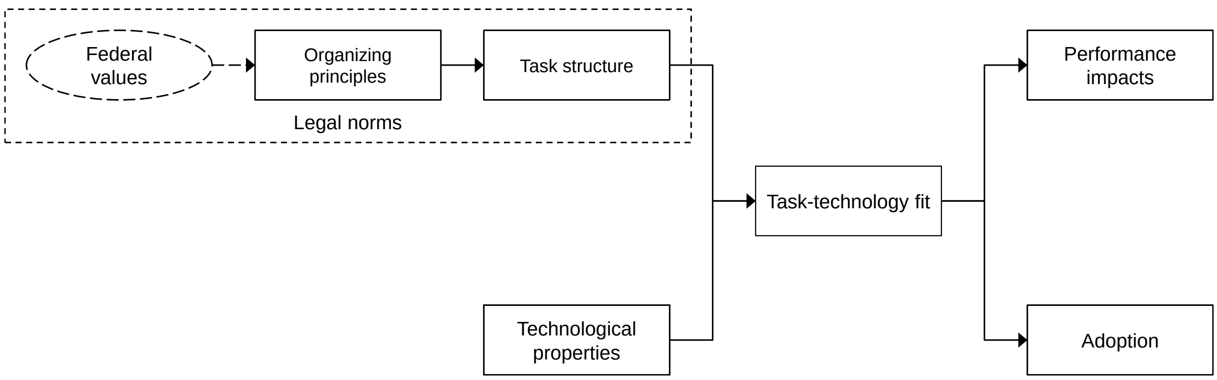

Figure 3. An Adapted and Extended Theory of Task-Technology Fit in Federally Organized Contexts (Research Paper 1)

A close task-technology fit does not only influence the adoption of a particular technology and the achievement of positive performances, but it can also reinforce federal organizing principles and values. Consequently, blockchain can function as a socio-technical agent that strengthens federal organizing principles and their underlying federal and cultural values (Research Paper 1).

At the same time, the digitalization of cross-organizational processes in federal contexts entails specific technical requirements. In a final stage of expansion, fragmented IT (legacy) systems need to be integrated both vertically (across different levels of governance) and horizontally (across different functions or agencies) (Layne & Lee, 2001). However, this integration is challenging, as a clear separation of competencies and subsidiarity can make it hard to delegate process governance to a central authority or system (Abels, 2019; Benson & Jordan, 2014; Research Paper 2). Blockchain may also be a promising alternative for these integration endeavors. For instance, the technology can act as a middleware platform that allows for an efficient and secure exchange of process data between fragmented IT systems and that acknowledges the peculiarities of federally organized contexts (Research Paper 2). In this way, blockchain could drive an end-to-end digitalization of cross-organizational processes in federal public contexts (Research Paper 2). Much like a traditional enterprise service bus (ESB), blockchain can function as a message broker in this context (Bhadoria et al., 2017; Chappell, 2004; Kshetri, 2018; Research Paper 2). However, blockchain-based platforms can make the ESB concept applicable to interorganizational IT integration (Research Paper 2) by addressing shortcomings such as the risk of a single point of failure (Chappell, 2004; Chaudhari et al.; Schmidt et al., 2005) and needs such as efficient integration flows and automated service updates (Górski, 2014) as well as process and information-coordination capabilities (Puschmann & Alt, 2004; Umar & Zordan, 2009). Moreover, the platform concept provides participating organization the architectural foundations to build other digital resources and the flexibility to adapt to changing requirements (Baldwin & Woodard, 2009; Millard, 2018). Thus, a blockchain-based platforms can evolve to a federal infrastructure for cross-organizational processes that attract an increasing number of participating authorities (Research Paper 2).

To realize the potentials of blockchain, however, private and public sector organizations alike need to first experiment with the technology due to its emerging nature (Du et al., 2019; Ølnes et al., 2017).

2.3 Technology Deep-Dive: The Potentials of AI-Enabled Systems

With its ability to learn, solve problems, and create, AI presents both new opportunities and notable challenges to incumbent organizations (Benbya et al., 2021). Computer scientists had already begun studying AI by the 1950s. At the time, they focused on exploring the nature of intelligence and attempted to construct systems that exhibited such intelligence (Simon, 1995). Specifically, they worked on systems that simulate human behavior and efficiently perform tasks that require general human-like intelligence, commonly referred to as "strong AI" (Kurzweil, 2005). These efforts led to the creation of various systems, but progress was slow, and interest in AI eventually began to wane (Russell & Norvig, 2016). Recently, however, public and academic interest in AI has been renewed. This increased interest is rooted in the availability of large amounts of data, the substantial increase in computational power, and the growing number of benefits AI promises in a variety of contexts, such as work environments, homes, and schools (Stone et al., 2016). With this renewed interest, researchers have also reconsidered their preconceptions of AI. The focus has shifted from "strong" to "weak" AI. That is, researchers now mostly focus on AI-enabled systems that master specific tasks (Russell & Norvig, 2016). Representative of current conceptions, Stone et al. (2016) understand AI as "a science and a set of computational technologies that are inspired by—but typically operate quite differently from—the ways people […] sense, learn, reason, and take action" (p. 4). AI and its related technologies are now commonly classified by the cognitive functions they replicate, such as perceiving, learning, reasoning, problem-solving, planning, decision-making, natural language processing, and interacting with their environment (Rai et al., 2019; Russell & Norvig, 2016). Such a perspective provides a common understanding of the broad range of possibilities afforded by AI-enabled technologies (Corea, 2019; Stohr & O'Rourke, 2021). In this context, it is worth noting that the umbrella term AI is not a ready-made technology but rather an evolving research field (Russell & Norvig, 2016). The frontiers of understanding AI are continually moving in tandem with advances in computing technologies (Berente et al., 2021). As such, AI itself cannot have capabilities or provide action possibilities. Only technologies related to AI (e.g., machine learning algorithms) can do so by functioning as an AI-enabled system within a technical subsystem (Chatterjee et al., 2021). Therefore, the term AI-enabled system is best understood and used as a subsumption of AI-enhanced (e.g., autonomous car navigation) as well as AI-based (e.g., natural language processing) systems (Rzepka & Berger, 2018).

To develop a deeper understanding of the potentials of AI-enabled systems, it is important to grasp both their strengths and limitations (Davenport & Ronanki, 2018). Limitations of such systems, for instance, include a lack of empathy, intuition, or the ability to quickly adapt to unforeseen circumstances (Bughin et al., 2018). These limitations are closely related to the intuitive actions of Kahneman's (2011) “System 1”. Kahneman (2011) differentiates between two modes of thought: “System 1” responds automatically, quickly, unconsciously, often emotional, and almost effortless, whereas “System 2” deals with more demanding mental activities. It works slower, more analytical, and logical (Kahneman, 2011). Failure to properly address the limitations of AI-enabled systems can significantly hinder the realization of their potential (Bughin et al., 2018). However, dynamically combining the individual capabilities of human agents and AI-enabled systems could help overcome these limitations (Rai et al., 2019; Research Paper 3), because those intuitive actions related to “System 1” have been an important foundation of human development (Kahneman, 2011; Seeber et al., 2020). While certain aspects of tasks are likely to align well with the capabilities of AI-enabled systems, others may correspond better with those of human agents (Daugherty & Wilson, 2018; Rai et al., 2019; Research Paper 3). Human agents and AI-enabled systems can perform different roles and interactions to facilitate collaborative work, eventually evolving into what can be called a "human-AI hybrid" (Research Paper 3).

In more abstract terms, one can understand human agents and AI-enabled systems as locally separate actors that intra-act on a higher-level to form sociomaterial practices (Leonardi, 2013; Niemimaa, 2016; Research Paper 3). That is to say, both AI-enabled systems and human agents are actors with respective attributes and capabilities that are combined in interactions to form something that potentially is greater than the sum of its parts (M. Jones, 2014; Leonardi, 2013; Research Paper 3). With progress in AI, social (human agent) and material (AI-enabled systems) agency is further converging (Research Paper 3). AI-enabled systems are no longer mere passive tools waiting to be used for repetitive tasks (Baird & Maruping, 2021). Instead, AI-enabled systems have developed the ability to initiate actions and accept rights and responsibilities on behalf of humans and organizations (Ågerfalk, 2020). Figure 4 illustrates these relationships as the foundation of the potentials that an AI-enabled system can provide specific organizational actors (affordances).

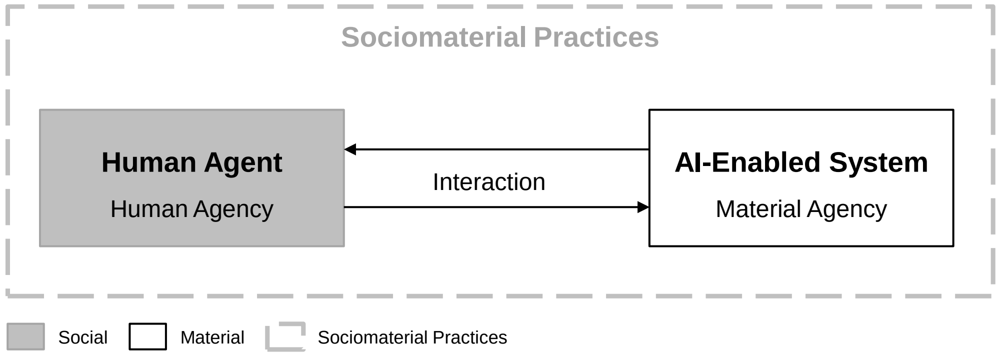

Figure 4. Sociomaterial Entanglement of Human-AI Hybrids (Research Paper 3)

The specific "configuration" of human-AI hybrids is diverse, and so are their potentials. Research Paper 3 adds structure to this field by establishing a taxonomy of human-AI hybrids (see Figure 5). In line with Figure 4, this taxonomy structures human-AI hybrids into three distinct entities: the human agent, the AI-enabled system, and the sociomaterial practices. Each entity is described in more detail using three dimensions. These dimensions and the corresponding characteristics provide information about the role of the human agent and the AI-enabled system in a human-AI hybrid (their focus and goal of interaction) and the capabilities that they contribute (the cognitive functions) as well as about the process of interworking and feedback.

For instance, AI-enabled predictive maintenance (PdM) systems can augment human inspectors in detecting machine errors and maintenance planning (Research Paper 4; Shin et al., 2021). The system can develop recommendations based on an ability to perceive the environment and draw conclusions (reasoning) from the collected data. The human inspector can then (sequentially) verify and use these recommendations to supplement their own assessment of a fault diagnosis and make the final decision on further actions (Shin et al., 2021). In this context, the relationship between AI-enabled systems and human agents provides grounds for different levels of action possibilities (affordances) ranging from basic real-time condition monitoring, to diagnosing states, and eventually planning future maintenance activities (Research Paper 4). When these potentials are realized (i.e., the affordances are actualized), manufacturers can optimize their process availability, safety, and quality, increase their productivity, and reduce their maintenance costs (Christer et al., 1997; Mobley, 2002).

<table>
<tr><th>Layer 1: Sociomaterial entities</th><th colspan="2">Layer 2: Dimensions</th><th colspan="19">Layer 3: Characteristics</th></tr>
<tr><td rowspan="3">Human (human agency)</td><td>Human cognitive functions</td><td>NE</td><td>Perceiving</td><td colspan="2">Reasoning</td><td colspan="3">Predicting</td><td colspan="2">Planning</td><td colspan="2">Decision-making</td><td colspan="2">Explaining</td><td colspan="3">Interacting</td><td colspan="3">Creating</td><td>Empathizing</td></tr>
<tr><td>Interaction human to AI</td><td>ME</td><td colspan="4">Facilitating</td><td colspan="7">Verifying</td><td colspan="8">Supplementing</td></tr>
<tr><td>Human focus</td><td>ME</td><td colspan="3">Sensemaking</td><td colspan="5">Creativity</td><td colspan="6">Compassion</td><td colspan="5">Flexibility</td></tr>
<tr><td rowspan="3">AI (material agency)</td><td>AI cognitive functions</td><td>NE</td><td>Perceiving</td><td colspan="2">Reasoning</td><td colspan="4">Predicting</td><td colspan="2">Planning</td><td colspan="4">Decision-making</td><td colspan="4">Interacting</td><td colspan="2">Creating</td></tr>
<tr><td>Interaction AI to human</td><td>ME</td><td colspan="4">Facilitating</td><td colspan="7">Verifying</td><td colspan="8">Supplementing</td></tr>
<tr><td>AI focus</td><td>ME</td><td colspan="8">Automation</td><td colspan="11">Augmentation</td></tr>
<tr><td rowspan="3">Sociomaterial practices</td><td>Form of interworking</td><td>ME</td><td colspan="4">Parallel</td><td colspan="7">Sequential</td><td colspan="8">Flexible</td></tr>
<tr><td>Mode of interworking</td><td>ME</td><td colspan="8">Singular</td><td colspan="11">Continuous</td></tr>
<tr><td>Learning</td><td>ME</td><td colspan="2">None</td><td colspan="3">AI learns</td><td colspan="5">Human learns</td><td colspan="6">Human and AI learn separately</td><td colspan="3">Co-evolution</td></tr>
</table>

ME = mutually exclusive, NE = non-exclusvie

Figure 5. Taxonomy of Human-AI Hybrids (Research Paper 3)

3 Preparing Emerging Technologies for Effective Use

Despite their potential benefits, emerging technologies such as blockchain and AI are still evolving and often lack established use cases (Bailey et al., 2022; Du et al., 2019; Research Paper 4). Therefore, organizations need to experiment with these technologies first before being able to effectively use them and thereby actualize beneficial affordances. This experimentation phase facilitates the recognition of lower- and higher-level affordances along with the identification of actualization actions (Du et al., 2019; Research Paper 4). Figure 1 illustrates this process of affordance-experimentation-actualization (A-E-A) in the context of emerging technologies.

Experimentation involves three main activities that are mutually constitutive: conceptual exploration, conceptual adaptation, and constraint mitigation (Du et al., 2019; Research Paper 4). Conceptual exploration precedes conceptual adaptation and constraint mitigation as it allows organizations to obtain the general understanding of a technology that is required to conduct these two activities (Research Paper 4). Conceptual adaption is the process by which the original framing of a technology is adapted to the specific context of an organization. Constraint mitigation refers to reducing the impact of oppositional forces that can arise when a technology is introduced in this specific context. Using a new technology can, for instance, entail unknown risks. Constraint mitigation can help reveal and mitigate these risks (Du et al., 2019). Because these experimentation activities rather are higher-level concepts, the specific organizational actions behind them can take different forms. For instance, organizations can use methods of agile requirements engineering such as prototyping (Ramesh et al., 2010) or action research (Baskerville & Wood-Harper, 1998; Davison et al., 2004) for constraint mitigation and conceptual adaptation. Moreover, organizations can enter the experimentation phase at different points, that is, they can start with different activities. If conceptual understanding concerning an emerging technology is not yet sufficient, an organization might begin with exploration activities to develop a basic understanding of the technology. If, however, the organization already has a stronger conceptual understanding of this technology, it can directly start with constraint mitigation and conceptual adaptation (Research Paper 4). For instance, some of the organizations participating in the project which Research Paper 4 examined had already developed a conceptual understanding regarding AI-enabled PdM by attending certain congresses and associations that addressed this technology or by hiring new employees. Therefore, these organizations could already start some tests with AI-enabled PdM before entering the project in question. Other participating organizations relied on developing such a conceptual understanding within the project through the exchange with researchers and the more advanced organizations.

All phases and activities of the A-E-A process are linked by recursive feedback loops. Throughout recurrent engagement with an emerging technology, actions and outcomes provide feedback concerning preceding activities and affordances. For instance, conceptual exploration can point toward constraints that need to be mitigated, while conceptual adaptation and constraint mitigation can increase the conceptual understanding of the technology in question (Du et al., 2019; Research Paper 4; Research Paper 5). Such feedback can also result from unexpected or unintended outcomes (Tim et al., 2018). Eventually, a recurrent engagement with an emerging technology can lead to the enhancement of an organization's capabilities, which allows for a more advanced use of the technology (Bygstad et al., 2016).

3.1 Managing Stimuli and Constraints in the Experimentation Process

Much like an emerging technology's potentials (cf. section 2), the recurrent engagement with the technology strongly depends on the respective context. This techno-organizational context can create both opportunities and tensions and can either stimulate or hamper experimentation (Du et al., 2019) and affordance actualization (Bygstad et al., 2016; Wang et al., 2020). Among the factors that can stimulate experimentation and actualization are structural factors such as cross-functional or interdisciplinary teams (Krancher et al., 2018; Research Paper 4) or cultural factors such as an openness to collaborate with external partners like startups, researchers, or organizations facing similar situations (Du et al., 2019; Research Paper 4). However, the techno-organizational context does not only influence experimentation and actualization. The outcomes of both phases can also lead to changes in the techno-organizational context itself (Bygstad et al., 2016; Demetriou, 2009; Fleetwood, 2011). In summary, the techno-organizational context "gives rise to a variety of mechanisms that may act as conditions that initially enable or constrain the actualization of the affordance, or that later stimulate its actualization" (Bygstad et al., 2016, p. 87) and its preceding experimentation activities (Research Paper 4; Research Paper 5).

These generative mechanisms can take several forms, be it physical, chemical, biological, psychological, social, or economical. At times, they are even unobservable (Bunge, 2004). These mechanisms act transfactually. This means that events or outcomes that a certain generative mechanism produces are not always the same but are instead contingent on the events or outcomes previously produced by other generative mechanisms (Elder-Vass, 2010; Fleetwood, 2009; Henfridsson & Bygstad, 2013; Sayer, 1992; M. L. Smith, 2010). Similar to affordances, some of these mechanisms may never be actualized even though they are available, so their potential to cause certain events can remain untapped (Fleetwood, 2011). Since there can exist a broad range of mechanisms, particularly in technology adoption projects, and since they affect and alter one another, it is impossible to identify each mechanism. Rather, researchers should focus on those mechanisms that best explain the observed outcomes (Gebre-Mariam & Bygstad, 2019). While understanding generative mechanisms does not provide grounds for predictions of future events or outcomes (Bygstad et al., 2016), analyzing these mechanisms can help researchers and practitioners gain a deeper understanding of how pre-existing technology, in conjunction with organizational factors like organizational culture and structure, can affect the adoption process of emerging technologies (Research Paper 5). Organizations need to be aware of these forces when trying to realize the potential of emerging technologies (i.e., achieve beneficial affordances). For instance, Research Paper 5 highlights four generative mechanisms that have substantial effects on experimenting with AI-enabled PdM: data, skillset, anxiety, and inspiration. These mechanisms are interrelated, and their effects influence each other (see Figure 6).

The data mechanism, for instance, can stimulate both experimentation (via training data) and actualization. It describes a process by which engagement with previously collected data generates relevant insights and encourages further data collection (R1). This process is mitigated by saturation (i.e., a reduction in the additional information that can be gained from growing data resources) (B1) (Research Paper 5). This mechanisms also corroborates the importance of data quality, data management, and data access to successfully adopt AI-enabled systems (Watson, 2017; Weber et al., 2022; Wiener et al., 2020).

Moreover, the data mechanism is closely connected to another mechanism, the skillset mechanism, because a broader organizational knowledge base—when properly integrated (Mitchell, 2006; Tiwana, 2004; Walz et al., 1993; Weber et al., 2022)—helps with generating insights from the data. The skillset mechanism itself can also have a stimulating effect on experimentation as well as actualization and allow organizations to make quicker progress toward actualizing affordances of AI-enabled PdM. The skillset mechanism describes a process by which resources to improve processes are invested in training existing and hiring new employees to foster interdisciplinary collaboration and cooperation (R3). This building and integration of organizational knowledge paves the way for a conceptual exploration of AI-enabled PdM and further experimental activities (R2) (Research Paper 5).

However, achieving process improvements by expanding organizational knowledge and experimentation is time-consuming, and positive outcomes may take time to become apparent (Repenning & Sterman, 2002). Yet, it can be worth investigating time and resources, as building up organizational knowledge and strengthening the conceptual exploration of AI-enabled PdM can mitigate the detrimental dynamics of another mechanism: the anxiety mechanism (B2) (Research Paper 5). This anxiety mechanism describes a process by which a lack of knowledge about AI-enabled PdM gradually nurtures insecurity and eventually leads to resistance against current and future projects (B2). The issues behind this mechanism can be manifold. For instance, trust is an important prerequisite for the interaction with AI-enabled systems (Foehr & Germelmann, 2020). Therefore, an inscrutability or untrustworthiness of AI-enabled systems may contribute to anxiety (Asatiani et al., 2021; Berente et al., 2021; Thiebes et al., 2021), just like conflicts in professional role identity (Strich et al., 2021) or the fear of losing one's job (Orlikowski, 1993).

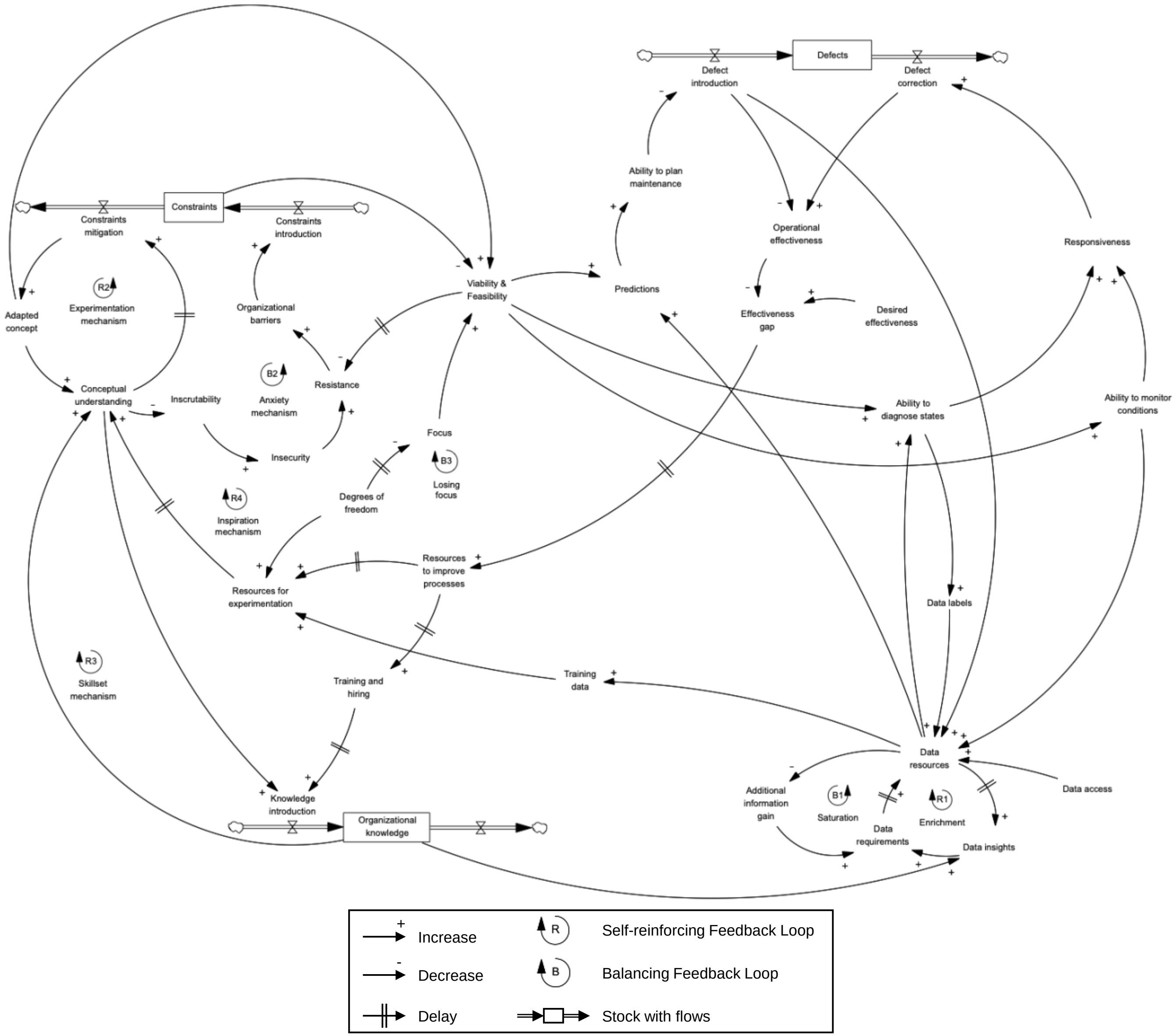

Figure 6. Mechanisms of AI-Enabled PdM (Research Paper 5)

Experimentation and demonstrating the benefits of AI-enabled PdM can mitigate these dynamics (Hertzum et al., 2012; Kim & Kankanhalli, 2009; Robey et al., 2002). The inspiration mechanism describes a process by which an organization's openness toward granting their employees freedom to, for instance, experiment with new technologies can help to generate positive results. These results provide the respective actors with the inspiration to reduce both inscrutability and resistance and progress toward actualization (R4). For instance, a team of employees at the German premium car manufacturer's production plant that informed the case study in Research Paper 5 was able to start a smaller experimentation project to predict cutter breakdowns. Due to the success of the project, these employees could increase awareness for AI-enabled PdM and motivated others to join their efforts. However, organizations may also risk losing focus if the degrees of freedom are overexploited (B3) (Research Paper 5) and if they exaggeratedly rely on pilot projects (Gebre-Mariam & Bygstad, 2019). This may be the case, for instance, when organizational units (independently) launch a multitude of experimentation projects that they eventually need to merge for effective use.

In summary, organizations need to be aware of various (interrelated) physical and social structures that significantly shape their path toward achieving technical feasibility and beneficial affordances of emerging technologies. They need to carefully manage factors, such as organizing structures, processes and culture (Jöhnk et al., 2021; Research Paper 5; Vial, 2019). Yet, since generative mechanisms are interdependent and act transfactually, managers need to balance their efforts. This is to say that it is not enough to simply focus on a particular physical or social structure. Instead, one has to appreciate the interrelatedness of such structures as well as potential delays in their effects (Research Paper 5).

3.2 Building Relevant Digital Capabilities and Managing Tensions

Managing emerging technologies and being able to effectively use them is not only about managing stimuli and constraints in the experimentation phase but also about building relevant (digital) capabilities (Bygstad et al., 2016), as organizational capabilities—high-level routines or a collection of routines—can provide organizations with "decision options for producing significant outputs" (Winter, 2003, p. 991). In this context, routines are learned, (quasi-)repetitive behaviors that follow recognizable patterns and are partly based on tacit knowledge (Winter, 2003). Organizations typically need a variety of organizational capabilities to operate and sustain competitive advantage. For instance, IT capabilities are a group of organizational capabilities that govern how well an organization uses its IT resources to support and enhance business strategies and processes (Sambamurthy & Zmund, 1997). These IT capabilities today are critical to the realization of business value and competitive advantage (Lu & Ramamurthy, 2011). Digital capabilities add a socio-technical perspective to IT capabilities and includes factors such as information management, entrepreneurship, and culture (Keller et al., 2022; Levallet & Chan, 2018; L. Li et al., 2018). These digital capabilities are a key enabler for incumbents to manage emerging technologies and can product innovations (Keller et al., 2022; Wiesböck et al., 2020).

At the same time, rapidly changing environments shorten organizational response times and enforce organizational flexibility (Tallon & Pinsonneault, 2011; Teece, 2007). These increased dynamics require organizations to revise inflexible and inert routines (Feldman & Pentland, 2003). Dynamic capabilities enable organizations to integrate, build, and reconfigure their resources and competencies in a way that allows them to address these rapid changes (Eisenhardt & Martin, 2000; Teece et al., 1997). Both dynamic and digital capabilities provide incumbents with the means to adapt and transform their services and modes of organizing to act on digital innovations and emerging technologies (Bailey et al., 2022; Chanias et al., 2019; Keller et al., 2022; Yoo et al., 2012). Organizational agility, which describes an organization's ability to detect and exploit emerging market opportunities, is one of the key dynamic capabilities required to achieve this (Overby et al., 2006; Sambamurthy et al., 2003; Tallon & Pinsonneault, 2011). Building and enhancing essential IT capabilities not only directly impacts an organization's ability to effectively use an emerging technology but can also enable organizational agility (Lu & Ramamurthy, 2011). For instance, organizations can increase organizational agility through an adaptable, modular, and scalable IT infrastructure (G. Kim et al., 2011). At the same time, it is critical for organizations to demonstrate organizational reliability. That means, that they need to be able to adapt as necessary to continue operating and delivering efficient and effective outcomes despite external challenges (Butler & Gray, 2006). Consequently, incumbent organizations must deal with potential trade-offs between organizational agility and reliability when managing emerging technologies (Research Paper 7). Moreover, dynamic capabilities are not to be confused with ad-hoc problem solving but are themselves organizational and strategic routines (Winter, 2003).

Therefore, these capabilities should be complemented by a culture of collective mindfulness. Mindfulness is particularly important in unexpected situations (which are likely to occur in the context of emerging technologies) that cannot be approached with rigid routines (Ndubisi, 2012; Weick & Sutcliffe, 2006). Mindfulness describes a cognitive state of alertness and dynamic awareness that forms a basis for acting upon these unexpected situations (Langer, 1989; Weick & Roberts, 1993). It involves establishing a reflective culture that is preoccupied with failure, reluctant to simplify interpretations, sensitive to operations, committed to resilience, and underspecifies structures (Weick et al., 1999). Therefore, mindfulness is also particularly important to organizational reliability (Denyer et al., 2011; Salovaara et al., 2019). Like digital capabilities, collective mindfulness embraces a socio-technical perspective that also reflects on the limits of technology (Salovaara et al., 2019). Yet, mindfulness is not a panacea since it is challenging to develop, requires a great deal of trust, clarity, and responsibility (Denyer et al., 2011).

The same applies to building dynamic and digital capabilities. This process is not a straightforward but rather a difficult, long-term process (Teece, 2007; Winter, 2003) that involves an accumulation of experience, reflective learning, and prospective capability building activities that may not directly contribute to value generation (Törmer & Henningsson, 2019). Thus, incumbent organizations must structurally evaluate their investments in capability building to seize opportunities from their existing resources (Oberländer et al., 2021) and eventually be able to actualize beneficial affordances of emerging technologies. Digital options theory provides a mental model for these proactive capability-building activities that may or may not be exploited in the future (Rolland et al., 2018; Sambamurthy et al., 2003; Sandberg et al., 2014; Svahn et al., 2015).

Digital options follow a "lifecycle". They first need to be available, which means that capability investment opportunities exist and are waiting to be identified (Sandberg et al., 2014). Particularly in complex environments characterized by many endogenous and exogenous dependencies (organizational, technological, and regulatory), it is important to perform a conscious and mindful analysis of which investments need to be made to generate digital option bundles (Research Paper 6). Once organizations have generated and identified these opportunities, they can iteratively evaluate and develop their desirability and feasibility through integrating IT, developing IT competence, and learning to make them actionable (Sambamurthy et al., 2003;

Sandberg et al., 2014). Selected actionable options can then be “realized” or “activated” through a larger investment in the required IT or digital capabilities (Sandberg et al., 2014). This lifecycle is also relational; it is embedded in the broader context of external factors, such as regulation, organizational factors, such as culture and existing know-how, and technological factors, such as the technological readiness of an organization (Research Paper 6). The impact of these specific factors can vary along the option lifecycle, resulting in different stimuli or tensions (Research Paper 6).

Due to these tensions, incumbents may incur digital debt upon realizing digital options (Rolland et al., 2018). The concept of digital debt is “a reflection of an organization’s cumulative build-up of technical and informational obligations related to the maintenance and evolvability of its platform and infrastructure” (Rolland et al., 2018, p. 420). That means that debt in this context refers to obligations that need to be addressed to achieve a hypothesized ideal state (Brown et al., 2010; Ramasubbu & Kemerer, 2016). For instance, organizations may decide to defer system updates, to take shortcuts in developing applications, or to postpone a proper documentation (Rolland et al., 2018). Accumulating digital debt is not negative per se. In fact, it might well be a strategic decision to do so (Brown et al., 2010). For instance, organizations that strive for a short time to market may consider digital debt as a strategic investment if the benefits exceed the costs (Kruchten et al., 2012; Z. Li et al., 2015). Particularly, organizations may decide to decouple their IT when adopting emerging technologies to address the tension between organizational agility and reliability (Perrow, 1984; Research Paper 7). Decoupling involves separating some elements of organizations and organizational systems, resulting in a form of loosely coupled or modular systems (Berente & Yoo, 2012; Orton & Weick, 1990; Yoo et al., 2010). In doing so, decoupling allows organizations to pursue emerging technologies without undermining the high security standards and governance in the reliable core system. However, decoupling leads to a fragmented IT landscape that fosters the accumulation of digital debt in the long-term, since it can lead to overlapping and incompatible infrastructures that result in significantly higher costs (Wimelius et al., 2021). On the other hand, digital debt may also result (unintentionally) from a technology gap when technology becomes obsolete or standards or practices change (Kruchten et al., 2012).

Since digital debt can have positive effects in the short-term, is not necessarily advisable to avoid digital debt altogether. Among these positive effects is the contribution to organizational agility as an important driver of the adoption of emerging technologies. However, digital debt can also contribute to organizational reliability in the short-term (Research Paper 7). This potentially positive impact on organizational reliability stems from its two constituents: stability and vulnerability. Leveraging digital debt enables organizations to maintain the status quo and therefore business continuity which fosters stability (Research Paper 7). However, while potentially having positive effects in the short-term, digital debt carries a high risk of negative consequences in the long-term if it is not repaid (Z. Li et al., 2015; Research Paper 7; Rolland et al., 2018). Among these negative consequences are partly recurring costs in the future owing to higher maintenance costs, additional efforts to exercise digital options, inefficiency costs, and the cost of implementing regulatory requirements (Brown et al., 2010; MacCormack & Sturtevant, 2016; Research Paper 7; Tom et al., 2013; Woodard et al., 2013). The latter efforts and costs also demonstrate that existing digital debt hinders an organization's ability to readily respond to future opportunities (i.e., organizational agility) in the long-term (Research Paper 7). Moreover, digital debt increases vulnerability over time since the systems become more error-prone when organizations defer updates. Thus, digital debt undermines organizational reliability in the long-term. These negative effects on vulnerability can offset the positive effects of continuity and stability (Research Paper 7). Figure 7 illustrates this relationship.

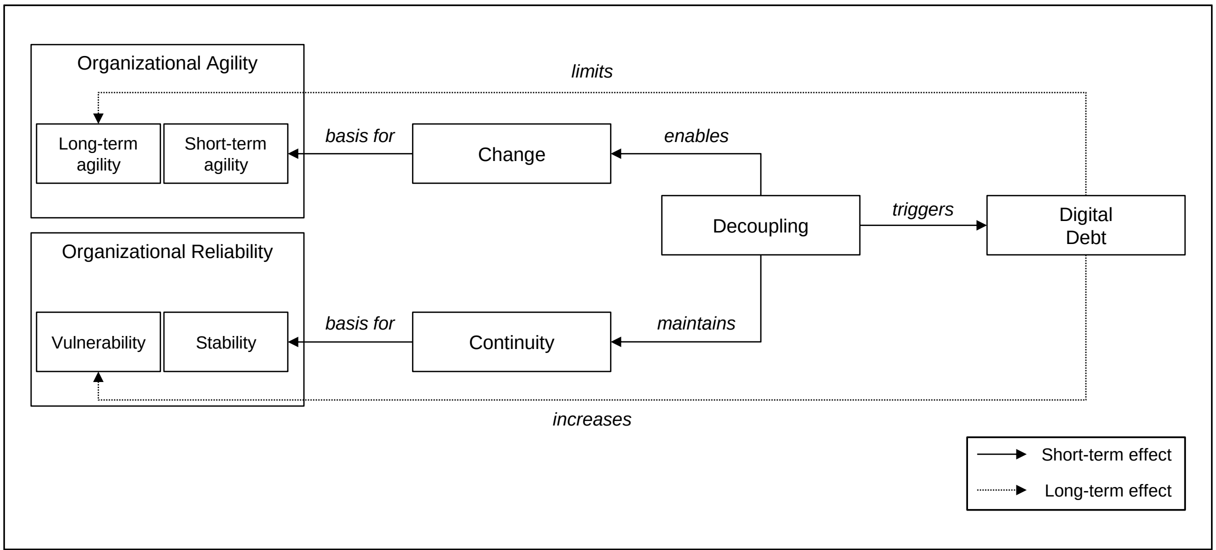

Figure 7. Implications of Leveraging Digital Debt (Research Paper 7)

In summary, incumbents must consider a broad range of factors to successfully build relevant capabilities for the adoption of emerging technologies and the management of digital debt (Research Paper 6; Research Paper 7).

4 Conclusion

To thrive in today's increasingly dynamic business environment, incumbent organizations must be able to persistently identify new ideas and leverage digital opportunities in their respective contexts to sustain a competitive advantage (Ciriello et al., 2018; Fichman et al., 2014; Henfridsson & Yoo, 2014; Menz et al., 2021). In this regard, incumbents need to be able to effectively manage emerging technologies that provide both considerable potential, such as offering new ways of collaborating or product improvements, and tensions that carry the potential to disrupt existing structures and collapse organizational boundaries (Bailey et al., 2022; Fichman et al., 2014; Lanzolla et al., 2020; Majchrzak et al., 2021; Menz et al., 2021; Yoo et al., 2012).

In light of the demand for research on the relationship between emerging technologies and organizing (Bailey et al., 2022), this thesis and its embedded research papers contribute to an understanding of the management of emerging technologies as well as the related opportunities and tensions for incumbent organizations. First, this thesis investigated the *potentials of emerging technologies*, focusing on two specific technologies: blockchain and AI, and their relationship to the respective goal-oriented actors. These potentials depend on both social (Research Paper 1) and technical aspects (Research Paper 2). Moreover, it is a close intra-action between the social and the technical that has the potential to provide substantial benefits (Research Paper 3). Second, this thesis delved deeper into *emerging technologies' preparation for effective use*. This process involves experimentation with the technology as well as capability building under consideration of the broader techno-organizational context. Depending on the pre-existing knowledge about an emerging technology, incumbent organizations need to consider different activities to start this experimentation and capability building process (Research Paper 4). Moreover, the techno-organizational context gives rise to a variety counteracting and reinforcing mechanisms that can stimulate or constrain experimentation. In this regard, incumbents need both patience and an orientation toward providing proper releasing conditions for these mechanisms in order to eventually be able to effectively use an emerging technology (Research Paper 5). However, preparing emerging technologies for effective use also requires building relevant (digital) capabilities, a process that involves generating, identifying, developing, and realizing digital options. These capabilities may or may not be exploited in the future and establishing them is again embedded in the broader techno-organizational context (Research Paper 6). In following the capability-building process, incumbents may face tensions between seizing opportunities and routines that ensure reliability. To resolve these tensions, established organizations may follow decoupling strategies and (intentionally or unintentionally) accumulate digital debt that needs to be managed carefully (Research Paper 7).

Like any research endeavor, this doctoral thesis is subject to certain limitations that provide grounds for further research. This paragraph provides an aggregated overview of the limitations of this thesis while the embedded research papers elaborate on the limitations underlying each individual paper. First, this thesis does not provide an exhaustive overview of the potentials of emerging technologies, or even of the two focus technologies: blockchain and AI. Rather, it provides researchers and practitioners with insights to facilitate a deeper understanding of these technologies but emphasizes the relational idea of affordance theory. The specific affordances strongly depend on the respective emerging technology and the organizational actors. Researchers can build on these ideas and the structure provided in Research Paper 3 to better understand the potential of a specific emerging technology and context. Second, this thesis focuses on aspects of preparing emerging technologies for effective use but not the effective use—the actualization of beneficial affordances—itself. Therefore, future research can build upon the insights in this thesis to investigate the progression of emerging technologies toward effective use based on proper contextual conditions for release.

In summary, this thesis provided a holistic perspective on the complexities of managing emerging technologies from the perspective of incumbent organizations and contributes to a better understanding of their opportunities and tensions. I hope that this thesis encourages further investigations into the management of emerging technologies and, thus, contributes to the vital, yet challenging, continuous transformation of incumbent organizations.

5 Acknowledgements of Previous and Related Work in the Research Group

In all the research projects and papers contained within this thesis, I collaborated with colleagues from the University of Bayreuth, the University of Augsburg, the Branch Business & Information Systems Engineering of the Fraunhofer Institute for Applied

Information Technology FIT, the Research Center Finance and Information Management (FIM), and the SnT - Interdisciplinary Centre for Security, Reliability and Trust, University of Luxemburg.

Therefore, the thesis and its embedded research papers were influenced by previous and related work conducted within these organizations. They are part of a lively research stream on emerging technologies, such as cloud computing (e.g., Keller & König, 2014) or the Internet of Things (e.g., Fähnle et al., 2018; Oberländer et al., 2018). More specifically, Research Papers 1 and 2 build on the organizations' work on blockchain-based platforms and cross-organizational process coordination (e.g., Fridgen et al., 2018; Guggenmos et al., 2020; Rieger et al., 2019; Schweizer et al., 2017). Research Paper 3 focuses on structuring the field of human-AI hybrids and complements previous research on AI-enabled systems (e.g., Hinsen et al., 2022; Hofmann et al., 2020). Moreover, it used the extended taxonomy design process of Kundisch et al. (2022) to develop a taxonomy of human-AI hybrids and was inspired by Oberländer et al. (2018) in using sociomateriality as justificatory knowledge. Research Papers 4 and 5 complement previous work on predictive maintenance (e.g., Fabri et al., 2019) and the organization-specificity of AI readiness (Jöhnk et al., 2021). Research Paper 6 focuses on a digital options theory that is closely connected to real option analysis and the evaluation of IT investments (e.g., Fridgen & Moser, 2013; Müller et al., 2016; Ullrich, 2013). Lastly, Research Paper 7 is based on the ideas of Keller et al. (2019) and considers previous work on digital capabilities (e.g., Jöhnk et al., 2022; Keller et al., 2022; Rövekamp et al., 2022).

6 References

Abels, G. (2019). Federalism and Democracy in the European Union. In S. S. Krause (Ed.), *Staatsverständnisse: Vol. 133. Theories of Modern Federalism* (1st ed., pp. 283–300). Nomos.

Ågerfalk, P. J. (2020). Artificial intelligence as digital agency. *European Journal of Information Systems*, *29*(1), 1–8. https://doi.org/10.1080/0960085X.2020.1721947

Alaimo, C., & Kallinikos, J. (2022). Organizations Decentered: Data Objects, Technology and Knowledge. *Organization Science*, *33*(1), 19–37. https://doi.org/10.1287/orsc.2021.1552

Andersen, J. V., & Ingram Bogusz, C. (2019). "Self-Organizing in Blockchain Infrastructures: Generativity Through Shifting Objectives and Forking". *Journal of the Association for Information Systems*, *20*(9), 1242–1273. https://doi.org/10.17705/1jais.00566

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., & Peacock, A. (2019). Blockchain technology in the energy sector: A systematic review of challenges and opportunities. *Renewable and Sustainable Energy Reviews*, *100*, 143–174. https://doi.org/10.1016/j.rser.2018.10.014

Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-Exploration Tensions and Organizational Ambidexterity: Managing Paradoxes of Innovation. *Organization Science*, *20*(4), 696–717. https://doi.org/10.1287/orsc.1080.0406

Asatiani, A., Malo, P., Nagbøl, P. R., Penttinen, E., Rinta-Kahila, T., & Salovaara, A. (2021). Sociotechnical Envelopment of Artificial Intelligence: An Approach to Organizational Deployment of Inscrutable Artificial Intelligence Systems. *Journal of the Association for Information Systems*, *22*(2), 325–352. https://doi.org/10.17705/1jais.00664

Baier, M.-S., Berger, S., Kreuzer, T., Oberländer, A. M., & Röglinger, M. (2023). What Makes Digital Technology? A Categorization Based on Purpose. *Communications of the Association for Information Systems*, *52*(1), Article 4. https://aisel.aisnet.org/cais/vol52/iss1/4

Bailey, D. E., Faraj, S., Hinds, P. J., Leonardi, P. M., & Krogh, G. von (2022). We Are All Theorists of Technology Now: A Relational Perspective on Emerging Technology and Organizing. *Organization Science*, *33*(1), 1–18. https://doi.org/10.1287/orsc.2021.1562

Baird, A., & Maruping, L. M. (2021). The Next Generation of Research on IS Use: A Theoretical Framework of Delegation to and from Agentic IS Artifacts. *MIS Quarterly*, *45*(1), 315–341. https://doi.org/10.25300/MISQ/2021/15882

Baldwin, C. Y., & Woodard, C. J. (2009). The Architecture of Platforms: A Unified View. In A. Gawer (Ed.), *Platforms, markets and innovation* (pp. 19–44). Edward Elgar Publishing. https://doi.org/10.4337/9781849803311.00008

Baskerville, R., & Wood-Harper, A. T. (1998). Diversity in information systems action research methods. *European Journal of Information Systems*, *7*(2), 90–107. https://doi.org/10.1057/palgrave.ejis.3000298

Beck, R., & Müller-Bloch, C. (2017). Blockchain as Radical Innovation: A Framework for Engaging with Distributed Ledgers as Incumbent Organization. In *Proceedings of the 50th Hawaii International Conference on System Sciences (HICSS),* Waikoloa Village, HI. http://hdl.handle.net/10125/41815

Beck, R., Müller-Bloch, C., & King, J. L. (2018). Governance in the Blockchain Economy: A Framework and Research Agenda. *Journal of the Association for Information Systems*, *19*(10), 1020–1034. https://doi.org/10.17705/1jais.00518

Benbunan-Fich, R., Desouza, K. C., & Andersen, K. N. (2020). IT-enabled innovation in the public sector: introduction to the special issue. *European Journal of Information Systems*, *29*(4), 323–328. https://doi.org/10.1080/0960085X.2020.1814989

Benbya, H., Pachidi, S., & Jarvenpaa, S. L. (2021). Special Issue Editorial: Artificial Intelligence in Organizations: Implications for Information Systems Research. *Journal of the Association for Information Systems*, *22*(2), 281–303. https://doi.org/10.17705/1jais.00662

Benson, D., & Jordan, A. (2014). Subsidiarity as a 'scaling device' in environmental governance: the case of the European Union. In I. Weibust & J. Meadowcroft (Eds.), *Multilevel Environmental Governance: Managing Water and Climate Change in Europe and North America* (pp. 39–57). Edward Elgar Publishing. https://doi.org/10.4337/9780857939258.00012

Berente, N., Gu, B., Recker, J., & Santhanam, R. (2021). Managing Artificial Intelligence. *MIS Quarterly*, *45*(3), 1433–1450. https://doi.org/10.25300/MISQ/2021/16274

Berente, N., & Yoo, Y. (2012). Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System. *Information Systems Research*, *23*(2), 376–396. https://doi.org/10.1287/isre.1110.0373

Bhadoria, R. S., Chaudhari, N. S., & Tomar, G. S. (2017). The Performance Metric for Enterprise Service Bus (ESB) in SOA system: Theoretical underpinnings and empirical illustrations for information processing. *Information Systems*, *65*, 158–171. https://doi.org/10.1016/j.is.2016.12.005

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, *37*(2), 471–482. https://doi.org/10.25300/MISQ/2013/37:2.3

Bhaskar, R. (1998). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*. Routledge.

Bozeman, B. (2007). *Public Values and Public Interest: Counterbalancing Economic Individualism*. Georgetown University Press.

Bradbury, H., & Lichtenstein, B. M. B. (2000). Relationality in Organizational Research: Exploring The Space Between. *Organization Science*, *11*(5), 551–564. https://doi.org/10.1287/orsc.11.5.551.15203

Brown, N., Ozkaya, I., Sangwan, R., Seaman, C., Sullivan, K., Zazworka, N., Cai, Y., Guo, Y., Kazman, R., Kim, M., Kruchten, P., Lim, E., MacCormack, A., & Nord, R. (2010). Managing technical debt in software-reliant systems. In *Proceedings of the FSE/SDP workshop on Future of software engineering research,* Santa Fe, NM.

Bughin, J., Seong, J., Manyika, J., Chui, M., & Joshi, R. (2018). *Notes from the AI frontier: Insights from hundreds of use cases*. McKinsey Global Institute. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-applications-and-value-of-deep-learning

Bunge, M. (2004). How Does It Work? The Search for Explanatory Mechanisms. *Philosophy of the Social Sciences*, *34*(2), 182–210. https://doi.org/10.1177/0048393103262550

Burton-Jones, A., & Volkoff, O. (2017). How Can We Develop Contextualized Theories of Effective Use? A Demonstration in the Context of Community-Care Electronic Health Records. *Information Systems Research*, *28*(3), 468–489. https://doi.org/10.1287/isre.2017.0702

Buterin, V. (2016). *Ethereum: Platform Review: Opportunities and Challenges for Private and Consortium Blockchains*. http://www.smallake.kr/wp-content/uploads/2016/06/314477721-Ethereum-Platform-Review-Opportunities-and-Challenges-for-Private-and-Consortium-Blockchains.pdf

Butler, B. S., & Gray, P. H. (2006). Reliability, Mindfulness, and Information Systems. *MIS Quarterly*, *30*(2), 211–224. https://doi.org/10.2307/25148728

Bygstad, B., Munkvold, B. E., & Volkoff, O. (2016). Identifying generative mechanisms through affordances a framework for critical realist data analysis. *Journal of Information Technology*, *31*(1), 83–96. https://doi.org/10.1057/jit.2015.13

Carvalho, A., Merhout, J. W., Kadiyala, Y., & Bentley, J., II (2021). When good blocks go bad: Managing unwanted blockchain data. *International Journal of Information Management*, *57*, 102263. https://doi.org/10.1016/j.ijinfomgt.2020.102263

Chanias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *The Journal of Strategic Information Systems*, *28*(1), 17–33. https://doi.org/10.1016/j.jsis.2018.11.003

Chappell, D. A. (2004). *Enterprise Service Bus*. *Theory in practice*. O'Reilly Media.

Chatterjee, S., Sarker, S [Suprateek], Lee, M. J., Xiao, X., & Elbanna, A. (2021). A possible conceptualization of the information systems (IS) artifact: A general systems theory perspective. *Information Systems Journal*, *31*(4), 550–578. https://doi.org/10.1111/isj.12320

Chaudhari, N., Bhadoria, R. S., & Prasad, S. Information Handling and Processing Using Enterprise Service Bus in Service-Oriented Architecture System. In *Proceedings of the 8th International Conference on Computational Intelligence and Communication Networks (CICN),* Tehri, India. https://doi.org/10.1109/CICN.2016.88

Christer, A. H., Wang, W., & Sharp, J. M. (1997). A state space condition monitoring model for furnace erosion prediction and replacement. *European Journal of Operational Research*, *101*(1), 1–14. https://doi.org/10.1016/S0377-2217(97)00132-X

Christidis, K., & Devetsikiotis, M. (2016). Blockchains and Smart Contracts for the Internet of Things. *IEEE Access*, *4*, 2292–2303. https://doi.org/10.1109/ACCESS.2016.2566339

Ciriello, R. F., Richter, A., & Schwabe, G. (2018). Digital Innovation. *Business & Information Systems Engineering*, *60*(6), 563–569. https://doi.org/10.1007/s12599-018-0559-8

Corea, F. (2019). *An introduction to data: Everything you need to know about AI, Big Data and Data Science*. *Studies in Big Data*. Springer International Publishing. https://doi.org/10.1007/978-3-030-04468-8

Craig, R. K. (2010). A Comparative Guide to the Western States' Public Trust Doctrines: Public Values, Private Rights, and the Evolution Toward an Ecological Public Trust. *Ecology Law Quarterly*, *37*(1), 53–197. https://www.jstor.org/stable/24114989

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

Daugherty, P. R., & Wilson, H. J. (2018). *Human + machine: Reimagining work in the age of AI*. Harvard Business Review Press.

Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, *96*(1), 108–116.

Davison, R., Martinsons, M. G., & Kock, N. (2004). Principles of canonical action research. *Information Systems Journal*, *14*(1), 65–86. https://doi.org/10.1111/j.1365-2575.2004.00162.x

Demetriou, C. (2009). The Realist Approach to Explanatory Mechanisms in Social Science. *Philosophy of the Social Sciences*, *39*(3), 440–462. https://doi.org/10.1177/0048393108329268

Denyer, D., Kutsch, E., Lee-Kelley, E., & Hall, M. (2011). Exploring reliability in information systems programmes. *International Journal of Project Management*, *29*(4), 442–454. https://doi.org/10.1016/j.ijproman.2011.02.002

Drnevich, P. L., & Croson, D. C. (2013). Information Technology and Business-Level Strategy: Toward an Integrated Theoretical Perspective. *MIS Quarterly*, *37*(2), 483–509. https://doi.org/10.25300/MISQ/2013/37.2.08

Du, W., Pan, S. L., Leidner, D. E., & Ying, W. (2019). Affordances, experimentation and actualization of FinTech: A blockchain implementation study. *The Journal of Strategic Information Systems*, *28*(1), 50–65. https://doi.org/10.1016/j.jsis.2018.10.002

Dutta, P., Choi, T.-M., Somani, S., & Butala, R. (2020). Blockchain technology in supply chain operations: Applications, challenges and research opportunities. *Transportation Research Part E: Logistics and Transportation Review*, *142*, Article 102067. https://doi.org/10.1016/j.tre.2020.102067

Eisenhardt, K. M. (2021). What is the Eisenhardt Method, really? *Strategic Organization*, *19*(1), 147–160. https://doi.org/10.1177/1476127020982866

Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, *21*(10-11), 1105–1121. https://doi.org/10.1002/1097-0266(200010/11)21:10/11<1105::AID-SMJ133>3.0.CO;2-E

Elder-Vass, D. (2010). *The Causal Power of Social Structures: Emergence, Structure and Agency*. Cambridge University Press. https://doi.org/10.1017/CBO9780511761720

Fabri, L., Häckel, B., Oberländer, A. M., Töppel, J., & Zanker, P. (2019). Economic Perspective on Algorithm Selection for Predictive Maintenance. In *Proceedings of the 27th European Conference on Information Systems (ECIS),* Stockholm, Sweden. https://aisel.aisnet.org/ecis2019_rp/21

Fähnle, A., Püschel, L., Röglinger, M., & Stohr, A. (2018). Business Value of the Internet of Things – A Project Portfolio Selection Approach. In *Proceedings of the 26th European Conference on Information Systems (ECIS),* Portsmouth, United Kingdom. https://aisel.aisnet.org/ecis2018_rp/160

Farshidi, S., Jansen, S., Espana, S., & Verkleij, J. (2020). Decision Support for Blockchain Platform Selection: Three Industry Case Studies. *IEEE Transactions on Engineering Management*, *67*(4), 1109–1128. https://doi.org/10.1109/TEM.2019.2956897

Feldman, M. S., & Pentland, B. T. (2003). Reconceptualizing Organizational Routines as a Source of Flexibility and Change. *Administrative Science Quarterly*, *48*(1), 94–118. https://doi.org/10.2307/3556620

Feldman, M. S., Pentland, B. T., D'Adderio, L., & Lazaric, N. (2016). Beyond Routines as Things: Introduction to the Special Issue on Routine Dynamics. *Organization Science*, *27*(3), 505–513. https://doi.org/10.1287/orsc.2016.1070

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. (2014). Digital Innovation as a Fundamental and Powerful Concept in the Information Systems Curriculum. *MIS Quarterly*, *38*(2), 329–343. https://doi.org/10.25300/MISQ/2014/38.2.01

Fleetwood, S. (2009). The Ontology of Things, Properties and Powers. *Journal of Critical Realism*, *8*(3), 343–366. https://doi.org/10.1558/jocr.v8i3.343

Fleetwood, S. (2011). Powers and Tendencies Revisited. *Journal of Critical Realism*, *10*(1), 80–99. https://doi.org/10.1558/jcr.v10i1.80

Foehr, J., & Germelmann, C. C. (2020). Alexa, Can I Trust You? Exploring Consumer Paths to Trust in Smart Voice-Interaction Technologies. *Journal of the Association for Consumer Research*, *5*(2), 181–205. https://doi.org/10.1086/707731

Fridgen, G., & Moser, F. (2013). Using IT fashion investments to optimize an IT innovation portfolio's risk and return. *Journal of Decision Systems*, *22*(4), 298–318. https://doi.org/10.1080/12460125.2013.835507

Fridgen, G., Radszuwill, S., Urbach, N., & Utz, L. (2018). Cross-Organizational Workflow Management Using Blockchain Technology - Towards Applicability, Auditability, and Automation. In *Proceedings of the 51st Hawaii International Conference on System Sciences (HICSS),* Waikoloa, HI. http://hdl.handle.net/10125/50332

Gebre-Mariam, M., & Bygstad, B. (2019). Digitalization mechanisms of health management information systems in developing countries. *Information and Organization*, *29*(1), 1–22. https://doi.org/10.1016/j.infoandorg.2018.12.002

Gibson, J. J. (1979). *The Ecological Approach to Visual Perception*. Houghton Mifflin.

Glaser, F., Hawlitschek, F., & Notheisen, B. (2019). Blockchain as a Platform. In H. Treiblmaier & R. Beck (Eds.), *Business transformation through Blockchain* (pp. 121–143). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-98911-2_4

Goh, J. M., & Arenas, A. E. (2020). IT value creation in public sector: how IT-enabled capabilities mitigate tradeoffs in public organisations. *European Journal of Information Systems*, *29*(1), 25–43. https://doi.org/10.1080/0960085X.2019.1708821

Górski, T. (2014). Using Enterprise Service Bus to transfer large volumes of data. *Journal of Theoretical and Applied Computer Science*, *8*(4), 72–81.

Gregor, S. (2006). The Nature of Theory in Information Systems. *MIS Quarterly*, *30*(3), 611–642. https://doi.org/10.2307/25148742

Guggenberger, T., Schweizer, A., & Urbach, N. (2020). Improving Interorganizational Information Sharing for Vendor Managed Inventory: Toward a Decentralized Information Hub Using Blockchain Technology. *IEEE Transactions on Engineering Management*, *67*(4), 1074–1085. https://doi.org/10.1109/TEM.2020.2978628

Guggenmos, F., Wenninger, A., Rieger, A., Fridgen, G., & Lockl, J. (2020). How to Develop a GDPR-Compliant Blockchain Solution for Cross-Organizational Workflow Management: Evidence from the German Asylum Procedure. In *Proceedings of the 53rd Hawaii International Conference on System Sciences (HICSS),* Wailea, HI. http://hdl.handle.net/10125/64234

Helo, P., & Hao, Y. (2019). Blockchains in operations and supply chains: A model and reference implementation. *Computers & Industrial Engineering*, *136*, 242–251. https://doi.org/10.1016/j.cie.2019.07.023

Hemmersmeier, J. (2020, October 16). Boom der App-Broker: Die jungen Zocker kommen. https://www.spiegel.de/wirtschaft/service/trade-republic-robinhood-und-co-app-boom-die-jungen-zocker-kommen-a-5f701590-5a19-43d7-a97f-03f10584c1b0

Henfridsson, O., & Bygstad, B. (2013). The Generative Mechanisms of Digital Infrastructure Evolution. *MIS Quarterly*, *37*(3), 907–931. https://doi.org/10.25300/MISQ/2013/37.3.11

Henfridsson, O., & Yoo, Y. (2014). The Liminality of Trajectory Shifts in Institutional Entrepreneurship. *Organization Science*, *25*(3), 932–950. https://doi.org/10.1287/orsc.2013.0883

Hertzum, M., Bansler, J. P., Havn, E. C., & Simonsen, J. (2012). Pilot Implementation: Learning from Field Tests in IS Development. *Communications of the Association for Information Systems*, *30*, Article 20, 313–328. https://doi.org/10.17705/1CAIS.03020

Hinsen, S., Hofmann, P., Jöhnk, J., & Urbach, N. (2022). How Can Organizations Design Purposeful Human-AI Interactions: A Practical Perspective From Existing Use Cases and Interviews. In *Proceedings of the 55th Hawaii International Conference on System Sciences (HICSS),* Maui, HI. http://hdl.handle.net/10125/79354

Hofmann, P., Jöhnk, J., Protschky, D., & Urbach, N. (2020). Developing Purposeful AI Use Cases – A Structured Method and Its Application in Project Management. In *Proceedings of the 15th International Conference on Wirtschaftsinformatik (WI),* Potsdam, Germany. https://doi.org/10.30844/wi_2020_a3-hofmann

Huang, K. (2022, November 10). Why Did FTX Collapse? Here's What to Know. *The New York Times*. https://www.nytimes.com/2022/11/10/technology/ftx-binance-crypto-explained.html

Iansiti, M., & Lakhani, K. R. (2017). The Truth about Blockchain. *Harvard Business Review*, *95*(1), 118–127.

Jensen, T., Hedman, J., & Henningsson, S. (2019). How TradeLens Delivers Business Value With Blockchain Technology. *MIS Quarterly Executive*, *18*(4), Article 5. https://doi.org/10.17705/2msqe.00018

Jöhnk, J., Ollig, P., Rövekamp, P., & Oesterle, S. (2022). Managing the complexity of digital transformation—How multiple concurrent initiatives foster hybrid ambidexterity. *Electronic Markets*, *32*(2), 547–569. https://doi.org/10.1007/s12525-021-00510-2

Jöhnk, J., Weißert, M., & Wyrtki, K. (2021). Ready or Not, AI Comes - An Interview Study of Organizational AI Readiness Factors. *Business & Information Systems Engineering*, *63*(1), 5–20. https://doi.org/10.1007/s12599-020-00676-7

Jones, M. (2014). A Matter of Life and Death: Exploring Conceptualizations of Sociomateriality in the Context of Critical Care. *MIS Quarterly*, *38*(3), 895–925. https://doi.org/10.25300/MISQ/2014/38.3.12

Kahneman, D. (2011). *Thinking, fast and slow* (1st ed.). *Psychology/economics*. Farrar, Straus and Giroux.

Keller, R., & König, C. (2014). A Reference Model to Support Risk Identification in Cloud Networks. In *Proceedings of the 35th International Conference on Information Systems (ICIS),* Auckland, New Zealand. https://aisel.aisnet.org/icis2014/proceedings/ISGovernance/1

Keller, R., Ollig, P., & Fridgen, G. (2019). Decoupling, Information Technology, and the Tradeoff between Organizational Reliability and Organizational Agility. In *Proceedings of the 27th European Conference on Information Systems (ECIS),* Stockholm, Sweden. https://aisel.aisnet.org/ecis2019_rp/118

Keller, R., Ollig, P., & Rövekamp, P. (2022). Pathways to Developing Digital Capabilities within Entrepreneurial Initiatives in Pre-Digital Organizations. *Business & Information Systems Engineering*, *64*(1), 33–46. https://doi.org/10.1007/s12599-021-00739-3

Kim, & Kankanhalli (2009). Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective. *MIS Quarterly*, *33*(3), 567–582. https://doi.org/10.2307/20650309

Kim, G., Shin, B., Kim, K., & Lee, H. (2011). IT Capabilities, Process-Oriented Dynamic Capabilities, and Firm Financial Performance. *Journal of the Association for Information Systems*, *12*(7), 487–517. https://doi.org/10.17705/1jais.00270

Kim, H. M., Turesson, H., Laskowski, M., & Bahreini, A. F. (2022). Permissionless and Permissioned, Technology-Focused and Business Needs-Driven: Understanding the Hybrid Opportunity in Blockchain Through a Case Study of Insolar. *IEEE Transactions on Engineering Management*, *69*(3), 776–791. https://doi.org/10.1109/TEM.2020.3003565

Klein, H. K., & Myers, M. D. (1999). A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems. *MIS Quarterly*, *23*(1), 67–93. https://doi.org/10.2307/249410

Königstorfer, F., & Thalmann, S. (2020). Applications of Artificial Intelligence in commercial banks – A research agenda for behavioral finance. *Journal of Behavioral and Experimental Finance*, *27*, Article 100352. https://doi.org/10.1016/j.jbef.2020.100352

Krancher, O., Luther, P., & Jost, M. (2018). Key Affordances of Platform-as-a-Service Self-Organization and Continuous Feedback. *Journal of Management Information Systems*, *35*(3), 776–812. https://doi.org/10.1080/07421222.2018.1481636

Kranz, J., Nagel, E., & Yoo, Y. (2019). Blockchain Token Sale. *Business & Information Systems Engineering*, *61*(6), 745–753. https://doi.org/10.1007/s12599-019-00598-z

Kruchten, P., Nord, R. L., & Ozkaya, I. (2012). Technical Debt: From Metaphor to Theory and Practice. *IEEE Software*, *29*(6), 18–21. https://doi.org/10.1109/MS.2012.167

Kshetri, N. (2018). 1 Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, *39*, 80–89. https://doi.org/10.1016/j.ijinfomgt.2017.12.005

Kundisch, D., Muntermann, J., Oberländer, A. M., Rau, D., Röglinger, M., Schoormann, T., & Szopinski, D. (2022). An Update for Taxonomy Designers. *Business & Information Systems Engineering*, *64*(4), 421–439. https://doi.org/10.1007/s12599-021-00723-x

Kurzweil, R. (2005). *The singularity is near: When humans transcend biology*. Viking.

Langer, E. J. (1989). *Mindfulness*. Addison-Wesley.

Lanzolla, G., Lorenz, A., Miron-Spektor, E., Schilling, M., Solinas, G., & Tucci, C. L. (2020). Digital Transformation: What is New if Anything? Emerging Patterns and Management Research. *Academy of Management Discoveries*, *6*(3), 341–350. https://doi.org/10.5465/amd.2020.0144

Lauslahti, K., Mattila, J., Hukkinen, T., & Seppälä, T. (2018). Expanding the Platform: Smart Contracts as Boundary Resources. In A. Smedlund, A. Lindblom, & L. Mitronen (Eds.), *Collaborative Value Co-creation in the Platform Economy* (pp. 65–90). Springer. https://doi.org/10.1007/978-981-10-8956-5_4

Layne, K., & Lee, J. (2001). Developing fully functional E-government: A four stage model. *Government Information Quarterly*, *18*(2), 122–136. https://doi.org/10.1016/S0740-624X(01)00066-1

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. https://doi.org/10.1287/isre.2015.0577

Leonardi, P. M. (2011). When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies. *MIS Quarterly*, *35*(1), 147–167. https://doi.org/10.2307/23043493

Leonardi, P. M. (2013). When Does Technology Use Enable Network Change in Organizations? A Comparative Study of Feature Use and Shared Affordances. *MIS Quarterly*, *37*(3), 749–775. https://doi.org/10.25300/MISQ/2013/37.3.04

Levallet, N., & Chan, Y. E. (2018). Role of Digital Capabilities in Unleashing the Power of Managerial Improvisation. *MIS Quarterly Executive*, *17*(1), Article 3. https://aisel.aisnet.org/misqe/vol17/iss1/3

Li, L., Su, F., Zhang, W., & Mao, J.-Y. (2018). Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal*, *28*(6), 1129–1157. https://doi.org/10.1111/isj.12153

Li, Z., Avgeriou, P., & Liang, P. (2015). A systematic mapping study on technical debt and its management. *Journal of Systems and Software*, *101*, 193–220. https://doi.org/10.1016/j.jss.2014.12.027

Lindahl, H. (2000). Authority and Representation. *Law and Philosophy*, *19*(2), 223–246. https://doi.org/10.1023/A:1006466126333

Livni, E. (2022, January 27). Robinhood Faces Lingering Issues a Year After Meme-Stock Mania. *The New York Times*. https://www.nytimes.com/2022/01/27/business/robinhood-meme-stocks.html

Lu, Y., & Ramamurthy, K. (2011). Understanding the Link Between Information Technology Capability and Organizational Agility: An Empirical Examination. *MIS Quarterly*, *35*(4), 931–954. https://doi.org/10.2307/41409967

MacCormack, A., & Sturtevant, D. J. (2016). Technical debt and system architecture: The impact of coupling on defect-related activity. *Journal of Systems and Software*, *120*, 170–182. https://doi.org/10.1016/j.jss.2016.06.007

Majchrzak, A., Malhotra, A., & Zaggl, M. A. (2021). How Open Crowds Self-Organize. *Academy of Management Discoveries*, *7*(1), 104–129. https://doi.org/10.5465/amd.2018.0087

Majchrzak, A., & Markus, M. L. (2013). Technology Affordances and Constraints Theory (of MIS). In E. H. Kessler (Ed.), *Encyclopedia of management theory*. SAGE Publications. https://doi.org/10.4135/9781452276090.n282

Markus, M. L., & Silver, M. S. (2008). A Foundation for the Study of IT Effects: A New Look at DeSanctis and Poole's Concepts of Structural Features and Spirit. *Journal of the Association for Information Systems*, *9*(10), 609–632. https://doi.org/10.17705/1jais.00176

Mattila, J., Seppälä, T., Smedlund, A., Lindblom, A., & Mitronen, L. (2018). Distributed Governance in Multi-sided Platforms: A Conceptual Framework from Case: Bitcoin. In A. Smedlund, A. Lindblom, & L. Mitronen (Eds.), *Collaborative Value Co-creation in the Platform Economy* (pp. 183–205). Springer. https://doi.org/10.1007/978-981-10-8956-5_10

Mattke, J., Maier, C., Hund, A., & Weitzel, T. (2019). How an Enterprise Blockchain Application in the U.S. Pharmaceuticals Supply Chain is Saving Lives. *MIS Quarterly Executive*, *18*(4), Article 6. https://doi.org/10.17705/2msqe.00019

Menz, M., Kunisch, S., Birkinshaw, J., Collis, D. J., Foss, N. J., Hoskisson, R. E., & Prescott, J. E. (2021). Corporate Strategy and the Theory of the Firm in the Digital Age. *Journal of Management Studies*, *58*(7), 1695–1720. https://doi.org/10.1111/joms.12760

Millard, J. (2018). Open governance systems: Doing more with more. *Government Information Quarterly*, *35*(4), 77-87. https://doi.org/10.1016/j.giq.2015.08.003

Mingers, J. (2004). Real-izing information systems: critical realism as an underpinning philosophy for information systems. *Information and Organization*, *14*(2), 372–406. https://doi.org/10.1016/j.infoandorg.2003.06.001

Mitchell, V. L. (2006). Knowledge Integration and Information Technology Project Performance. *MIS Quarterly*, *30*(4), 919–939. https://doi.org/10.2307/25148759

Mobley, R. K. (2002). *An Introduction to Predictive Maintenance* (2nd ed.). Butterworth-Heinemann.

Müller, M. P., Stöckl, S., Zimmermann, S., & Heinrich, B. (2016). Decision Support for IT Investment Projects. *Business & Information Systems Engineering*, *58*(6), 381–396. https://doi.org/10.1007/s12599-016-0423-7

Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and Organization*, *17*(1), 2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001

Ndubisi, N. O. (2012). Mindfulness, reliability, pre-emptive conflict handling, customer orientation and outcomes in Malaysia's healthcare sector. *Journal of Business Research*, *65*(4), 537–546. https://doi.org/10.1016/j.jbusres.2011.02.019

Niemimaa, M. (2016). Sociomateriality and Information Systems Research. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, *47*(4), 45–59. https://doi.org/10.1145/3025099.3025105

Noor, S., Yang, W., Guo, M., van Dam, K. H., & Wang, X. (2018). Energy Demand Side Management within micro-grid networks enhanced by blockchain. *Applied Energy*, *228*, 1385–1398. https://doi.org/10.1016/j.apenergy.2018.07.012

Oberländer, A. M., Röglinger, M., & Rosemann, M. (2021). Digital opportunities for incumbents – A resource-centric perspective. *The Journal of Strategic Information Systems*, *30*(3), Article 101670. https://doi.org/10.1016/j.jsis.2021.101670

Oberländer, A. M., Röglinger, M., Rosemann, M., & Kees, A. (2018). Conceptualizing business-to-thing interactions – A sociomaterial perspective on the Internet of Things. *European Journal of Information Systems*, *27*(4), 486–502. https://doi.org/10.1080/0960085X.2017.1387714

Ølnes, S., Ubacht, J., & Janssen, M. (2017). Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly*, *34*(3), 355–364. https://doi.org/10.1016/j.giq.2017.09.007

Orlikowski, W. J. (1993). CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in Systems Development. *MIS Quarterly*, *17*(3), 309–340. https://doi.org/10.2307/249774

Orlikowski, W. J., & Iacono, C. S. (2001). Research Commentary: Desperately Seeking the "IT" in IT Research—A Call to Theorizing the IT Artifact. *Information Systems Research*, *12*(2), 121–134. https://doi.org/10.1287/isre.12.2.121.9700

Orton, J. D., & Weick, K. E. (1990). Loosely Coupled Systems: A Reconceptualization. *Academy of Management Review*, *15*(2), 203–223. https://doi.org/10.5465/amr.1990.4308154

Ossenbrink, J., Hoppmann, J., & Hoffmann, V. H. (2019). Hybrid Ambidexterity: How the Environment Shapes Incumbents' Use of Structural and Contextual Approaches. *Organization Science*, *30*(6), 1319–1348. https://doi.org/10.1287/orsc.2019.1286

Ostern, N., Rosemann, M., & Moormann, J. (2020). Determining the Idiosyncrasy of Blockchain: An Affordances Perspective. In *Proceedings of the 41st International Conference on Information Systems (ICIS),* Hyderabad, India. https://aisel.aisnet.org/icis2020/blockchain_fintech/blockchain_fintech/4/

Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise Agility and the Enabling Role of Information Technology. *European Journal of Information Systems*, *15*(2), 120–131. https://doi.org/10.1057/palgrave.ejis.3000600

Pal, S., Rabehaja, T., Hill, A., Hitchens, M., & Varadharajan, V. (2020). On the Integration of Blockchain to the Internet of Things for Enabling Access Right Delegation. *IEEE Internet of Things Journal*, *7*(4), 2630–2639. https://doi.org/10.1109/JIOT.2019.2952141

Pedersen, A. B., Risius, M., & Beck, R. (2019). A Ten-Step Decision Path to Determine When to Use Blockchain Technologies. *MIS Quarterly Executive*, *18*(2), Article 3. https://aisel.aisnet.org/misqe/vol18/iss2/3

Pentland, B. T., Yoo, Y., Recker, J., & Kim, I. (2022). From Lock-In to Transformation: A Path-Centric Theory of Emerging Technology and Organizing. *Organization Science*, *33*(1), 194–211. https://doi.org/10.1287/orsc.2021.1543

Perrons, R. K., & Cosby, T. (2020). Applying blockchain in the geoenergy domain: The road to interoperability and standards. *Applied Energy*, *262*, Article 114545. https://doi.org/10.1016/j.apenergy.2020.114545

Perrow, C. (1984). *Normal Accidents: Living with High-Risk Technologies*. Basic Books.

Peters, G. W., & Panayi, E. (2016). Understanding Modern Banking Ledgers Through Blockchain Technologies: Future of transaction processing and smart contracts on the internet of money. In P. Tasca, T. Aste, L. Pelizzon, & N. Perony (Eds.), *Banking Beyond Banks and Money* (pp. 239–278). Springer International Publishing. https://doi.org/10.1007/978-3-319-42448-4_13

Puschmann, T., & Alt, R. (2004). Enterprise application integration systems and architecture – the case of the Robert Bosch Group. *Journal of Enterprise Information Management*, *17*(2), 105–116. https://doi.org/10.1108/17410390410518754

Queiroz, M., Tallon, P. P., Coltman, T., Sharma, R., & Reynolds, P. (2020). Aligning the IT portfolio with business strategy: Evidence for complementarity of corporate and business unit alignment. *The Journal of Strategic Information Systems*, *29*(3), 101623. https://doi.org/10.1016/j.jsis.2020.101623

Rai, A., Constantinides, P., & Sarker, S [Saonee] (2019). Editor's Comments: Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS Quarterly*, *43*(1), iii–ix.

Ramasubbu, N., & Kemerer, C. F. (2016). Technical Debt and the Reliability of Enterprise Software Systems: A Competing Risks Analysis. *Management Science*, *62*(5), 1487–1510. https://doi.org/10.1287/mnsc.2015.2196

Ramesh, B., Cao, L., & Baskerville, R. (2010). Agile requirements engineering practices and challenges: an empirical study. *Information Systems Journal*, *20*(5), 449–480. https://doi.org/10.1111/j.1365-2575.2007.00259.x

Repenning, N. P., & Sterman, J. D. (2002). Capability Traps and Self-Confirming Attribution Errors in the Dynamics of Process Improvement. *Administrative Science Quarterly*, *47*(2), 265–295. https://doi.org/10.2307/3094806

Rieger, A., Guggenmos, F., Lockl, J., Fridgen, G., & Urbach, N. (2019). Building a Blockchain Application that Complies with the EU General Data Protection Regulation. *MIS Quarterly Executive*, *18*(4), Article 7. https://aisel.aisnet.org/misqe/vol18/iss4/7

Risius, M., & Spohrer, K. (2017). A Blockchain Research Framework. *Business & Information Systems Engineering*, *59*(6), 385–409. https://doi.org/10.1007/s12599-017-0506-0

Robey, D., Ross, J. W., & Boudreau, M.-C. (2002). Learning to Implement Enterprise Systems: An Exploratory Study of the Dialectics of Change. *Journal of Management Information Systems*, *19*(1), 17–46. https://doi.org/10.1080/07421222.2002.11045713

Rolland, K. H., Mathiassen, L., & Rai, A. (2018). Managing Digital Platforms in User Organizations: The Interactions Between Digital Options and Digital Debt. *Information Systems Research*, *29*(2), 419–443. https://doi.org/10.1287/isre.2018.0788

Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy*, *98*(5, Part 2), 71-102. https://doi.org/10.1086/261725

Rossi, M., Mueller-Bloch, C., Thatcher, J. B., & Beck, R. (2019). Blockchain Research in Information Systems: Current Trends and an Inclusive Future Research Agenda. *Journal of the Association for Information Systems*, *20*(9), 1388–1403. https://doi.org/10.17705/1jais.00571

Rövekamp, P., Ollig, P., Ulrich Buhl, H., & and Keller, R. (2022). How Dr. Oetker's Digital Platform Strategy Evolved to Include Cross-Platform Orchestration. *MIS Quarterly Executive*, *21*(1), Article 5. https://doi.org/10.17705/2msqe.00057

Rubin, H. J., & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing data* (3rd ed.). SAGE Publications.

Russell, S. J., & Norvig, P. (2016). *Artificial Intelligence: A Modern Approach* (Global edition). Pearson Education Limited.

Rzepka, C., & Berger, B. (2018). User Interaction with AI-enabled Systems: A Systematic Review of IS Research. In *Proceedings of the 39th International Conference on Information Systems (ICIS),* San Francisco, CA. https://aisel.aisnet.org/icis2018/general/Presentations/7

Salovaara, A., Lyytinen, K., & Penttinen, E. (2019). High Reliability in Digital Organizing: Mindlessness, the Frame Problem, and Digital Operations. *MIS Quarterly*, *43*(2), 555–578. https://doi.org/10.25300/MISQ/2019/14577

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS Quarterly*, *27*(2), 237–263. https://doi.org/10.2307/30036530

Sambamurthy, V., & Zmund, R. W. (1997). At the Heart of Success: Organization-wide Management Competencies. In C. Sauer & P. W. Yetton (Eds.), *Steps to the Future: Fresh Thinking on the Management of IT-Based Organizational Transformation* (pp. 143–164). Jossey-Bass.

Sandberg, J., Mathiassen, L., & Napier, N. (2014). Digital Options Theory for IT Capability Investment. *Journal of the Association for Information Systems*, *15*(7), 422–453. https://doi.org/10.17705/1jais.00365

Sarker, S [Suprateek], Chatterjee, S., Xiao, X., & Elbanna, A. (2019). The Sociotechnical Axis of Cohesion for the IS Discipline: Its Historical Legacy and Its Continued Relevance. *MIS Quarterly*, *43*(3), 695–719. https://doi.org/10.25300/MISQ/2019/13747

Sayer, A. (1992). *Method in social science: A realistic approach* (2nd ed.). Routledge.

Schmidt, M.-T., Hutchison, B., Lambros, P., & Phippen, R. (2005). The Enterprise Service Bus: Making service-oriented architecture real. *IBM Systems Journal*, *44*(4), 781–797. https://doi.org/10.1147/sj.444.0781

Schultze, U., & Avital, M. (2011). Designing interviews to generate rich data for information systems research. *Information and Organization*, *21*(1), 1–16. https://doi.org/10.1016/j.infoandorg.2010.11.001

Schweizer, A., Schlatt, V., Urbach, N., & Fridgen, G. (2017). Unchaining Social Businesses - Blockchain as the Basic Technology of a Crowdlending Platform. In *Proceedings of the 38th International Conference on Information Systems (ICIS),* Seoul, South Korea. https://aisel.aisnet.org/icis2017/TransformingSociety/Presentations/8

Sedlmeir, J., Buhl, H. U., Fridgen, G., & Keller, R. (2020). The Energy Consumption of Blockchain Technology: Beyond Myth. *Business & Information Systems Engineering*, *62*(6), 599–608. https://doi.org/10.1007/s12599-020-00656-x

Sedlmeir, J., Smethurst, R., Rieger, A., & Fridgen, G. (2021). Digital Identities and Verifiable Credentials. *Business & Information Systems Engineering*, *63*(5), 603–613. https://doi.org/10.1007/s12599-021-00722-y

Seeber, I., Bittner, E., Briggs, R. O., Vreede, T. de, Vreede, G.-J. de, Elkins, A., Maier, R., Merz, A. B., Oeste-Reiß, S., Randrup, N., Schwabe, G., & Söllner, M. (2020). Machines as teammates: A research agenda on AI in team collaboration. *Information & Management*, *57*(2), 103174. https://doi.org/10.1016/j.im.2019.103174

Shin, W., Han, J., & Rhee, W. (2021). AI-assistance for predictive maintenance of renewable energy systems. *Energy*, *221*, Article 119775. https://doi.org/10.1016/j.energy.2021.119775

Sikorski, J. J., Haughton, J., & Kraft, M. (2017). Blockchain technology in the chemical industry: Machine-to-machine electricity market. *Applied Energy*, *195*, 234–246. https://doi.org/10.1016/j.apenergy.2017.03.039

Simon, H. A. (1995). Artificial Intelligence: An Empirical Science. *Artificial Intelligence*, *77*(1), 95–127. https://doi.org/10.1016/0004-3702(95)00039-H

Smith, G., Sochor, J., & Karlsson, I. M. (2019). Public–private innovation: barriers in the case of mobility as a service in West Sweden. *Public Management Review*, *21*(1), 116–137. https://doi.org/10.1080/14719037.2018.1462399

Smith, M. L. (2010). Testable Theory Development for Small-N Studies. *International Journal of Information Technologies and Systems Approach*, *3*(1), 41–56. https://doi.org/10.4018/jitsa.2010100203

Stoffregen, T. A. (2003). Affordances as Properties of the Animal-Environment System. *Ecological Psychology*, *15*(2), 115–134. https://doi.org/10.1207/S15326969ECO1502_2

Stohr, A., & O'Rourke, J. (2021). Through the Cognitive Functions Lens - A Socio-technical Analysis of Predictive Maintenance. In F. Ahlemann, R. Schütte, & S. Stieglitz (Eds.), *Lecture Notes in Information Systems and Organisation: Vol. 47. Innovation Through Information Systems: WI 2021* (pp. 182–197). Springer International Publishing. https://doi.org/10.1007/978-3-030-86797-3_13

Stone, P., Brooks, R., Brynjolfsson, E., Calo, R., Etzioni, O., Hager, G., Hirschberg, J., Kalyanakrishnan, S., Kamar, E., Kraus, S., Leyton-Brown, K., Parkes, D., Press, W., Saxenian, A., Shah, J., Tambe, M., & Teller, A. (2016). *Artificial Intelligence and Life in 2030* (One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel). Stanford, CA. Stanford University. http://ai100.stanford.edu/2016-report

Strich, F., Mayer, A.-S., & Fiedler, M. (2021). What Do I Do in a World of Artificial Intelligence? Investigating the Impact of Substitutive Decision-Making AI Systems on Employees' Professional Role Identity. *Journal of the Association for Information Systems*, *22*(2), 304–324. https://doi.org/10.17705/1jais.00663

Strong, D., Volkoff, O., Johnson, S., Pelletier, L., Tulu, B., Bar-On, I., Trudel, J., & Garber, L. (2014). A Theory of Organization-EHR Affordance Actualization. *Journal of the Association for Information Systems*, *15*(2), 53–85. https://doi.org/10.17705/1jais.00353

Svahn, F., Lindgren, R., & Mathiassen, L. (2015). Applying Options Thinking to Shape Generativity in Digital Innovation: An Action Research into Connected Cars. In *Proceedings of the 48th Hawaii International Conference on System Sciences (HICSS),* Kauai, HI. https://doi.org/10.1109/HICSS.2015.497

Svahn, F., Mathiassen, L., & Lindgren, R. (2017). Embracing Digital Innovation in Incumbent Firms: How Volvo Cars Managed Competing Concerns. *MIS Quarterly*, *41*(1), 239–253. https://doi.org/10.25300/MISQ/2017/41.1.12

Tallon, P. P., & Pinsonneault, A. (2011). Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model. *MIS Quarterly*, *35*(2), 463–486. https://doi.org/10.2307/23044052

Teece, D. J. (2007). Explicating dynamic capabilities: the nature and microfoundations of (sustainable) enterprise performance. *Strategic Management Journal*, *28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Thiebes, S., Lins, S., & Sunyaev, A. (2021). Trustworthy artificial intelligence. *Electronic Markets*, *31*(2), 447–464. https://doi.org/10.1007/s12525-020-00441-4

Tim, Y., Pan, S. L., Bahri, S., & Fauzi, A. (2018). Digitally enabled affordances for community-driven environmental movement in rural Malaysia. *Information Systems Journal*, *28*(1), 48–75. https://doi.org/10.1111/isj.12140

Tiwana, A. (2004). An empirical study of the effect of knowledge integration on software development performance. *Information and Software Technology*, *46*(13), 899–906. https://doi.org/10.1016/j.infsof.2004.03.006

Tobias, C. (1989). Public Law Litigation and the Federal Rules of Civil Procedure. *Cornell Law Review*, *74*(2), 270–346.

Tom, E., Aurum, A., & Vidgen, R. (2013). An exploration of technical debt. *Journal of Systems and Software*, *86*(6), 1498–1516. https://doi.org/10.1016/j.jss.2012.12.052

Törmer, R. L., & Henningsson, S. (2019). Dynamic Capability Building In The Lego Group - Prospective Activities Vs. Reflective Learning In Preparation For A Turbulent Digital Future. In *Proceedings of the 27th European Conference on Information Systems (ECIS),* Stockholm, Sweden. https://aisel.aisnet.org/ecis2019_rp/136

Tushman, M. L., & O'Reilly, C. A. (1996). Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change. *California Management Review*, *38*(4), 8–29. https://doi.org/10.2307/41165852

Ullrich, C. (2013). Valuation of IT Investments Using Real Options Theory. *Business & Information Systems Engineering*, *5*(5), 331–341. https://doi.org/10.1007/s12599-013-0286-0

Umar, A., & Zordan, A. (2009). Enterprise Ontologies for Planning and Integration of Business: A Pragmatic Approach. *IEEE Transactions on Engineering Management*, *56*(2), 352–371. https://doi.org/10.1109/TEM.2009.2013823

Upadhyay, N. (2020). Demystifying blockchain: A critical analysis of challenges, applications and opportunities. *International Journal of Information Management*, *54*, Article 102120. https://doi.org/10.1016/j.ijinfomgt.2020.102120

Vial, G. (2019). Understanding digital transformation: a review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Volkoff, O., & Strong, D. M. (2013). Critical Realism and Affordances: Theorizing IT-Associated Organizational Change Processes. *MIS Quarterly*, *37*(3), 819–834. https://doi.org/10.25300/MISQ/2013/37.3.07

Volkoff, O., & Strong, D. M. (2017). Affordance theory and how to use it in IS research. In R. D. Galliers & M.-K. Stein (Eds.), *The Routledge Companion to Management Information Systems* (1st ed., pp. 232–245). Routledge. https://doi.org/10.4324/9781315619361-18

Walz, D. B., Elam, J. J., & Curtis, B. (1993). Inside a software design team. *Communications of the ACM*, *36*(10), 63–77. https://doi.org/10.1145/163430.163447

Wang, N., Carte, T. A., & Bisel, R. S. (2020). Negativity decontaminating: Communication media affordances for emotion regulation strategies. *Information and Organization*, *30*(2), Article 100299. https://doi.org/10.1016/j.infoandorg.2020.100299

Watson, H. (2017). Preparing for the Cognitive Generation of Decision Support. *MIS Quarterly Executive*, *16*(3), Article 3. https://aisel.aisnet.org/misqe/vol16/iss3/3

Weber, M., Engert, M., Schaffer, N., Weking, J., & Krcmar, H. (2022). Organizational Capabilities for AI Implementation—Coping with Inscrutability and Data Dependency in AI. *Information Systems Frontiers*. Advance online publication. https://doi.org/10.1007/s10796-022-10297-y

Weick, K. E., & Roberts, K. H. (1993). Collective Mind in Organizations: Heedful Interrelating on Flight Decks. *Administrative Science Quarterly*, *38*(3), 357–381. https://doi.org/10.2307/2393372

Weick, K. E., & Sutcliffe, K. M. (2006). Mindfulness and the Quality of Organizational Attention. *Organization Science*, *17*(4), 514–524. https://doi.org/10.1287/orsc.1060.0196

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (1999). Organizing for High Reliability: Processes of Collective Mindfulness. In R. I. Sutton & B. M. Staw (Eds.), *Research in organizational behavior* (pp. 81–123). JAI Press.

Wessel, L. K., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. B. (2021). Unpacking the Difference between Digital Transformation and IT-enabled Organizational Transformation. *Journal of the Association for Information Systems*, *22*(1), 102–129. https://doi.org/10.17705/1jais.00655

Wiener, M., Saunders, C., & Marabelli, M. (2020). Big-data business models: A critical literature review and multiperspective research framework. *Journal of Information Technology*, *35*(1), 66–91. https://doi.org/10.1177/0268396219896811

Wiesböck, F., Hess, T., & Spanjol, J. (2020). The dual role of IT capabilities in the development of digital products and services. *Information & Management*, *57*(8), Article 103389. https://doi.org/10.1016/j.im.2020.103389

Wimelius, H., Mathiassen, L., Holmström, J., & Keil, M. (2021). A paradoxical perspective on technology renewal in digital transformation. *Information Systems Journal*, *31*(1), 198–225. https://doi.org/10.1111/isj.12307

Winter, S. G. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, *24*(10), 991–995. https://doi.org/10.1002/smj.318

Woodard, C. J., Ramasubbu, N., Tschang, F. T., & Sambamurthy, V. (2013). Design Capital and Design Moves: The Logic of Digital Business Strategy. *MIS Quarterly*, *37*(2), 537–564. https://doi.org/10.25300/MISQ/2013/37.2.10

Yeow, A., Soh, C., & Hansen, R. (2018). Aligning with new digital strategy: A dynamic capabilities approach. *The Journal of Strategic Information Systems*, *27*(1), 43–58. https://doi.org/10.1016/j.jsis.2017.09.001

Yin, R. K. (2014). *Case Study Research: Design and Methods* (5th ed.). SAGE Publications.

Yoo, Y. (2010). Computing in Everyday Life: A Call for Research on Experiential Computing. *MIS Quarterly*, *34*(2), 213–231. https://doi.org/10.2307/20721425

Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for Innovation in the Digitized World. *Organization Science*, *23*(5), 1398–1408. https://doi.org/10.1287/orsc.1120.0771

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research Commentary —The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research. *Information Systems Research*, *21*(4), 724–735. https://doi.org/10.1287/isre.1100.0322

Ziolkowski, R., Miscione, G., & Schwabe, G. (2020). Decision Problems in Blockchain Governance: Old Wine in New Bottles or Walking in Someone Else's Shoes? *Journal of Management Information Systems*, *37*(2), 316–348. https://doi.org/10.1080/07421222.2020.1759974

7 Appendix

7.1 Index of Research Papers[1]

Research Paper 1:

Roth, T., Stohr, A., Amend, J., Fridgen, G., & Rieger, A. (2023). Blockchain as a driving force for federalism: A theory of cross-organizational task-technology fit. *International Journal of Information Management*, *68*, Article 102476. https://doi.org/10.1016/j.ijinfomgt.2022.102476

(VHB-Jourqual 3: C, CiteScore 2021: 28.8, SJR 2021: 4.584, SNIP 2021: 5.416, Impact Factor 2021: 18.958)

Research Paper 2:

Arnold L., Fridgen G., Ollig P., Rieger A., Roth T., & Stohr A. Blockchain Platforms as Catalysts for an End-to-End Digitalization of the Public Sector? A Case Study of Germany's FLORA Platform. *Submitted*.

Research Paper 3:

Fabri L., Häckel B., Oberländer A.M., Rieg M., & Stohr A. Disentangling Human-AI Hybrids: Conceptualizing the Interworking of Humans and AI-enabled Systems. *Submitted* (major revision).

Research Paper 4:

Keller, R., Stohr, A., Fridgen, G., Lockl, J., & Rieger, A. (2019). Affordance-Experimentation-Actualization Theory in Artificial Intelligence Research - A Predictive Maintenance Story. In *Proceedings of the 40th International Conference on Information Systems (ICIS),* Munich, Germany. https://aisel.aisnet.org/icis2019/is_development/is_development/1/

(VHB-Jourqual 3: A)

[1] The following subsections contain a brief overview of Research Papers 1-7. For published papers this overview includes the publication outlet and an abstract, whereas for unpublished papers it includes a status and an extended abstract with references. A full version Research Papers 1-7 can be found in the supplement (not for publication). Kindly note that the text formatting and the reference style may differ from published papers, to allow for a consistent layout. There is a separate reference section, as well as a separate numbering of figures, tables, and footnotes for each paper.

Research Paper 5:

Stohr A., Ollig P., Keller R., & Rieger A. Generative mechanisms of AI experimentation: A critical realist perspective on predictive maintenance. *Submitted* (major revision).

Research Paper 6:

Fridgen G., Hartwich E., Rägo V., Rieger A., & Stohr A. (2022). Artificial Intelligence as a Call for Retail Banking: Applying Digital Options Thinking to Artificial Intelligence Adoption. In *Proceedings of the 30th European Conference on Information Systems (ECIS), Timişoara, Romania*. https://aisel.aisnet.org/ecis2022_rp/103

(VHB-Jourqual 3: B)

Research Paper 7:

Ollig, P., Berente, N., Fridgen, G. Keller, R., Rieger, A., & Stohr, A. When Procrastination Pays: Leveraging Digital Debt to Balance Organizational Reliability and Organizational Agility. *Working paper*.

During my PhD, I also contributed to other publications, which are listed below. These publications are not part of this dissertation.

- Amend, J., Fridgen, G., Rieger, A., Roth, T., & Stohr, A. (2021). The Evolution of an Architectural Paradigm - Using Blockchain to Build a Cross-Organizational Enterprise Service Bus. In *Proceedings of the 54th Hawaii International Conference on System Sciences (HICSS),* Honolulu, HI. http://hdl.handle.net/10125/71139
- Amend, J., van Dun, C., Fridgen, G., Köhler, F., Rieger, A., Stohr, A., & Wenninger, A. (2021). Using Blockchain to Coordinate Federal Processes: The Case of Germany's Federal Office for Migration and Refugees. In N. Urbach, M. Röglinger, K. Kautz, R. A. Alias, C. S. Saunders, & M. Wiener (Eds.), *Management for Professionals. Digitalization Cases Vol. 2* (pp. 85–100). Springer. https://doi.org/10.1007/978-3-030-80003-1_5
- Fähnle, A., Püschel, L., Röglinger, M., & Stohr, A. (2018). Business Value of the Internet of Things – A Project Portfolio Selection Approach. In *Proceedings of the 26th European Conference on Information Systems (ECIS),* Portsmouth, United Kingdom. https://aisel.aisnet.org/ecis2018_rp/160

- Fridgen, G., Körner, M.-F., Rägo, V., Steck, W., & Stohr, A. (2021). *Einsatz von KI im Retail Banking – Eine praxisorientierte Studie*. Augsburg, Eschborn, DE: Projektgruppe Wirtschaftsinformatik des Fraunhofer-Instituts für Angewandte Informationstechnik FIT und Senacor Technologies AG.
- Keller, R., Stohr, A., Weibelzahl, M., & Wolf, L. (2022). *Elektromobilität im ländlichen Raum – Handlungsempfehlungen für die Gestaltung der Mobilität von Morgen*. Augsburg, Bayreuth, Germany. Institutsteil Wirtschaftsinformatik, Fraunhofer-Institut für Angewandte Informationstechnik FIT.
- Rieger, A., Stohr, A., Wenninger, A., & Fridgen, G. (2021). Reconciling Blockchain with the GDPR: Insights from the German Asylum Procedure. In C. G. Reddick, M. P. Rodríguez-Bolívar, & H. J. Scholl (Eds.), *Blockchain and the Public Sector: Theories, Reforms, and Case Studies* (pp. 73–95). Springer International Publishing. https://doi.org/10.1007/978-3-030-55746-1_4
- Stohr, A., & O'Rourke, J. (2021). Through the Cognitive Functions Lens - A Socio-technical Analysis of Predictive Maintenance. In F. Ahlemann, R. Schütte, & S. Stieglitz (Eds.), *Lecture Notes in Information Systems and Organisation: Vol. 47. Innovation Through Information Systems: WI 2021* (Vol. 47, pp. 182–197). Springer International Publishing. https://doi.org/10.1007/978-3-030-86797-3_13

7.2 Declaration of Co-Authorship and Individual Contribution

This doctoral thesis is cumulative and comprises seven research papers. All of them were written in collaboration with multiple co-authors. In this section, I will describe my individual contribution to each of the six papers.

Research Paper 1:

I co-authored this research paper with Tamara Roth, Julia Amend, Gilbert Fridgen, and Alexander Rieger. Tamara Roth and I were main contributors to this paper. Specifically, I planned and conducted the interviews that informed our research. Moreover, I was responsible for the investigations and engaged in the further development of the idea of an extended theory of task-technology fit in federally organized contexts as well as the textual elaborations.

Research Paper 2:

I co-authored this research paper with Laurin Arnold, Gilbert Fridgen, Philipp Ollig, Alexander Rieger, and Tamara Roth. All authors contributed equally to this paper. Specifically, I contributed by co-initiating and co-developing the entire research project. I managed the research process and engaged in the further development of the research idea as well as textual elaborations.

Research Paper 3:

I co-authored this research paper with Björn Häckel, Lukas Fabri, Anna Maria Oberländer, and Marius Rieg. All authors contributed equally to this paper. Specifically, I provided the initial research idea and contributed by co-initiating and co-developing the theoretical and conceptional work. Moreover, I engaged in the further development of the research idea as well as textual elaborations.

Research Paper 4:

I co-authored this research paper with Robert Keller, Gilbert Fridgen, Jannik Lockl, and Alexander Rieger. Robert Keller and I were the main contributors to this paper. Specifically, I provided the initial research idea and contributed by co-initiating and co-developing the theoretical and conceptional work. Moreover, I was responsible for the methodology and planning as well as conducting the interviews that informed our research. I managed the research process and engaged in the further development of the research idea as well as textual elaboration.

Research Paper 5:

I co-authored this research paper with Robert Keller, Philipp Ollig, and Alexander Rieger. I was the lead author of this paper. In particular, I developed the initial idea, organized the research project and wrote the major part of the paper.

Research Paper 6:

I co-authored this research paper with Gilbert Fridgen, Eduard Hartwich, Vadim Rägo, and Alexander Rieger. Gilbert Fridgen, Vadim Rägo, Alexander Rieger and I were the main contributors to this paper. I provided the initial research idea and contributed by co-initiating and co-developing the theoretical and conceptional work. Moreover, I contributed to conducting the interviews that informed our research as well as the textual elaborations.

Research Paper 7:

I co-authored this research paper with Philipp Ollig, Nick Berente, Gilbert Fridgen, Robert Keller, and Alexander Rieger. Philipp Ollig is the lead author of this research paper. I contributed to the research paper by conducting interviews, supporting data analysis, and engaging in the further development of the research idea as well as textual elaborations.

7.3 Research Paper 1:
Blockchain as a Driving Force for Federalism: A Theory of Cross-Organizational Task-Technology Fit

Authors: Roth, Tamara; Stohr, Alexander; Amend, Julia; Fridgen, Gilbert; Rieger, Alexander

Published in: *International Journal of Information Management* (2023)

Abstract: Digital technologies play an important role for the delivery of many public services. However, selecting and adopting the 'right' digital technologies is often challenging, especially for federally structured governments. Universal factors for successful adoption are hard to establish, and the particularities of federalism, such as the separation of competencies, complicate technology selection. Nevertheless, blockchain technology seems to flourish in these environments. Through a single-case study on the blockchain project of Germany's Federal Office for Migration and Refugees, we unpack one essential factor for this success: the fit between (cross-)organizational task structure and technological properties. This fit earns the Federal Office's project considerable credit and traction with stakeholders and partner authorities – not least because it supports the argument that the digitalization of federal systems is possible without 'digital centralization' and redistribution of competencies. Our task-technology fit analysis contributes to a better understanding of the adoption of blockchain in the public sector. It also provides the foundation for an extended task-technology fit theory for federally structured, cross-organizational contexts.

Keywords: Blockchain, Public sector, Federalism, Organizing principles, Task-technology fit

7.4 Research Paper 2: Blockchain Platforms as Catalysts for an End-to-End Digitalization of the Public Sector? A Case Study of Germany's FLORA Platform

Authors: Arnold, Laurin; Fridgen, Gilbert; Ollig, Philipp; Rieger, Alexander; Roth, Tamara; Stohr, Alexander

Status: *Submitted*

Extended Abstract: The pressure to digitalize public services is mounting. However, the digitalization of public services is often encumbered by complex decision-making and accountability systems (Goh & Arenas, 2020; Scott et al., 2016). A particular challenge for the digitalization of many public services, especially in federal contexts, is the digital mapping of cross-organizational processes (Goh & Arenas, 2020; Ziemann et al., 2007). One of the reasons for this is the separation of competencies, which makes delegating governance to a central authority difficult and often undesirable (Egeberg, 2001; Jaeger, 2002). Such separation can also lead to various local differences in how processes are implemented (Ebinger & Richter, 2015; Fossum & Jachtenfuchs, 2017; Keating, 2017). A heterogeneous IT landscape and a variety of standards additionally complicate data exchange and the interactions of the IT systems involved (Klievink et al., 2016).

To mitigate this complexity, public administrations in Germany and other federal countries have typically focused on simpler and more lightweight "frontend digitization" efforts regarding public services. However, these efforts have often fallen short of creating an end-to-end digital infrastructure through the alignment of the involved (legacy) IT systems' backend operations and processes (Daub et al., 2020; Lizard Global, 2022). Consequently, public administrations in federal government systems require IT integration approaches that address both organizational and technical challenges.

Blockchain-based platforms may offer a promising approach to address these challenges through decentralized platform architectures (Alt, 2020; Trabucchi et al., 2020).

Therefore, this study explores how organizations in federal public contexts use blockchain-based platforms to digitalize cross-organizational processes. The study conducts a single-case study (Yin, 2014) on the federal blockchain infrastructure for asylum procedures (FLORA) platform of Germany's Federal Office for Migration and Refugees (BAMF). FLORA is a blockchain-based platform that supports the coordination of cross-authority processes in Germany's asylum procedure. The analysis spans a period from 2018 to 2022. The study finds that the FLORA platform is successful because it builds on a platform "core" that adopts and refines features of a long-know architectural concept, the enterprise service bus (ESB). An ESB connects multiple business applications to achieve collaboration and information exchange (Chappell, 2004; Menge, 2007). However, FLORA avoids primary shortcomings of a traditional ESB by emphasizing decentralization and adopting a "share-as-little-as-necessary" approach. Moreover, it adapts the ESB concept to a cross-organizational context. This improved and adapted cross-organizational ESB (coESB) enables process coordination and monitoring without infringing on the federal separation of competencies. As such, the FLORA platform provides an interesting architectural reference for the digitalization of cross-organizational processes in federal contexts. Therefore, the study contributes to research on IT integration and blockchain applications as well as on digitalization of cross-organizational processes in federal public contexts.

Keywords: Blockchain, Case Study, Digital Platforms, Enterprise Service Bus, IT Integration, Process Management, Public Sector

References:

Alt, R. (2020). Electronic Markets on blockchain markets. *Electronic Markets*, *30*(2), 181–188. https://doi.org/10.1007/s12525-020-00428-1

Chappell, D. A. (2004). *Enterprise Service Bus. Theory in practice*. O'Reilly Media.

Daub, M., Domeyer, A., Lamaa, A., & Renz, F. (2020). *Digital public services: How to achieve fast transformation at scale*. McKinsey & Company. https://www.mckinsey.com/industries/public-and-social-sector/our-insights/digital-public-services-how-to-achieve-fast-transformation-at-scale

Ebinger, F., & Richter, P. (2015). Decentralizing for performance? A quantitative assessment of functional reforms in the German Länder. *International Review of Administrative Sciences*, *82*(2), 291–314. https://doi.org/10.1177/0020852315586916

Egeberg, M. (2001). How federal? The organizational dimension of integration in the EU (and elsewhere). *Journal of European Public Policy*, *8*(5), 728–746. https://doi.org/10.1080/13501760110083482

Fossum, J. E., & Jachtenfuchs, M. (2017). Federal challenges and challenges to federalism. Insights from the EU and federal states. *Journal of European Public Policy*, *24*(4), 467–485. https://doi.org/10.1080/13501763.2016.1273965

Goh, J. M., & Arenas, A. E. (2020). IT value creation in public sector: how IT-enabled capabilities mitigate tradeoffs in public organisations. *European Journal of Information Systems*, *29*(1), 25–43. https://doi.org/10.1080/0960085X.2019.1708821

Jaeger, P. T. (2002). Constitutional principles and E-government: an opinion about possible effects of Federalism and the separation of powers on E-government policies. *Government Information Quarterly*, *19*(4), 357–368. https://doi.org/10.1016/S0740-624X(02)00119-3

Keating, M. (2017). Europe as a multilevel federation. *Journal of European Public Policy*, *24*(4), 615–632. https://doi.org/10.1080/13501763.2016.1273374

Klievink, B., Bharosa, N., & Tan, Y.-H. (2016). The collaborative realization of public values and business goals: Governance and infrastructure of public–private information platforms. *Government Information Quarterly*, *33*(1), 67–79. https://doi.org/10.1016/j.giq.2015.12.002

Lizard Global. (2022). *Digital Transformations in the Government and Public Sector*. https://lizard.global/blog/digital-transformations-in-the-government-and-public-sector

Menge, F. (2007). Enterprise Service Bus. In *Proceedings of the Free and Open Source Software Conference (FrOSCon),* Sankt Augustin, Germany. https://programm.froscon.org/2007/attachments/15-falko_menge_-_enterpise_service_bus.pdf

Scott, M., DeLone, W., & Golden, W. (2016). Measuring eGovernment success: a public value approach. *European Journal of Information Systems*, *25*(3), 187–208. https://doi.org/10.1057/ejis.2015.11

Trabucchi, D., Moretto, A., Buganza, T., & MacCormack, A. (2020). Disrupting the Disruptors or Enhancing Them? How Blockchain Reshapes Two-Sided Platforms. *Journal of Product Innovation Management*, *37*(6), 552–574. https://doi.org/10.1111/jpim.12557

Yin, R. K. (2014). *Case Study Research: Design and Methods* (5th ed.). SAGE Publications.

Ziemann, J., Matheis, T., & Freiheit, J. (2007). Modelling of Cross-Organizational Business Processes - Current Methods and Standards. *Enterprise Modelling and Information Systems Architectures*, *2*(2), 23–31. https://doi.org/10.18417/EMISA.2.2.3

7.5 Research Paper 3: Disentangling Human-AI Hybrids: Conceptualizing the Interworking of Humans and AI-enabled Systems

Authors: Fabri, Lukas; Häckel, Björn; Oberländer, Anna Maria; Rieg, Marius; Stohr, Alexander

Status: *Submitted* (major revision)

Extended Abstract: Rapid advancements in the field of artificial intelligence (AI) have led to increased expectations and some researchers viewing AI as the next general-purpose technology (Goldfarb et al., 2019; Jöhnk et al., 2021). As AI-related technologies become more mature, researchers and practitioners alike are recognizing an increasing number of AI use cases for different business fields (Bughin et al., 2018). However, many organizations still fail to generate value from using AI (Ransbotham et al., 2020). The path to seizing the potentials will likely involve human-AI interworking, where automation and augmentation are treated as equally important aspects (Dellermann et al., 2019; Rai et al., 2019; Raisch & Krakowski, 2021; Seeber et al., 2020). Therefore, a differentiated view of the precise ways in which human agents and AI-enabled systems can complement one another when performing tasks as so-called human-AI hybrids is necessary (Rai et al., 2019).

Against this backdrop, this study conceptualizes the collaborative interworking of human agents and AI-enabled systems by developing a taxonomy (Kundisch et al., 2022) of human-AI hybrids. Using weak sociomateriality as justificatory knowledge (M. Jones, 2014; D. Jones & Gregor, 2007; Orlikowski, 2007), the study presents AI-enabled systems and human agents as locally separate entities with distinct characteristics that intra-act globally to form sociomaterial practices. Thus, the taxonomy puts a clear structure to the collaborative interworking of human agents and AI-enabled systems. It not only enables a well-founded classification of individual human-AI hybrids but also sheds light on how human agents and AI-enabled systems could combine their strengths and achieve results that would be

impossible if they acted separately. Moreover, the taxonomy acknowledges the importance of both human and material agency in human-AI hybrids. In applying the taxonomy to a sample of 101 human-AI hybrids, the study also derives five archetypes that shed light on overarching interworking patterns in human-AI hybrids. That is, these archetypes illustrate which roles AI-enabled systems and human agents respectively can play in collaborative interworking scenarios.

As a theory for analyzing, the taxonomy and the derived archetypes together provide a solid foundation for future sensemaking and design research in the field of human-AI hybrids (Gregor, 2006). Moreover, the study can provide inspiration for practitioners to create and shape human-AI hybrids tapping their full potential.

Keywords: Human-AI Hybrids, Human-AI Collaboration, Taxonomy, Archetypes

References:

Bughin, J., Seong, J., Manyika, J., Chui, M., & Joshi, R. (2018). *Notes from the AI frontier: Insights from hundreds of use cases*. McKinsey Global Institute. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-applications-and-value-of-deep-learning

Dellermann, D., Ebel, P., Söllner, M., & Leimeister, J. M. (2019). Hybrid Intelligence. *Business & Information Systems Engineering*, *61*(5), 637–643. https://doi.org/10.1007/s12599-019-00595-2

Goldfarb, A., Gans, J., & Agrawal, A. (2019). *The Economics of Artificial Intelligence: An Agenda*. University of Chicago Press.

Gregor, S. (2006). The Nature of Theory in Information Systems. *MIS Quarterly*, *30*(3), 611–642. https://doi.org/10.2307/25148742

Jöhnk, J., Weißert, M., & Wyrtki, K. (2021). Ready or Not, AI Comes - An Interview Study of Organizational AI Readiness Factors. *Business & Information Systems Engineering*, *63*(1), 5–20. https://doi.org/10.1007/s12599-020-00676-7

Jones, D., & Gregor, S. (2007). The Anatomy of a Design Theory. *Journal of the Association for Information Systems, 8*(5), 312–335. https://doi.org/10.17705/1jais.00129

Jones, M. (2014). A Matter of Life and Death: Exploring Conceptualizations of Sociomateriality in the Context of Critical Care. *MIS Quarterly*, *38*(3), 895–925. https://doi.org/10.25300/MISQ/2014/38.3.12

Kundisch, D., Muntermann, J., Oberländer, A. M., Rau, D., Röglinger, M., Schoormann, T., & Szopinski, D. (2022). An Update for Taxonomy Designers. *Business & Information Systems Engineering*, *64*(4), 421–439. https://doi.org/10.1007/s12599-021-00723-x

Orlikowski, W. J. (2007). Sociomaterial Practices: Exploring Technology at Work. *Organization Studies*, *28*(9), 1435–1448. https://doi.org/10.1177/0170840607081138

Rai, A., Constantinides, P., & Sarker, S. (2019). Editor's Comments: Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS Quarterly*, *43*(1), iii–ix.

Raisch, S., & Krakowski, S. (2021). Artificial Intelligence and Management: The Automation–Augmentation Paradox. *Academy of Management Review*, *46*(1), 192–210. https://doi.org/10.5465/amr.2018.0072

Ransbotham, S., Khodabandeh, S., Kiron, D., Candelon, F., Chu, M., & LaFountain, B. (2020). *Expanding AI's Impact With Organizational Learning*. *MIT Sloan Management Review* and Boston Consulting Group. https://web-assets.bcg.com/f1/79/cf4f7dce459686cfee20edf3117c/mit-bcg-expanding-ai-impact-with-organizational-learning-oct-2020.pdf

Seeber, I., Bittner, E., Briggs, R. O., Vreede, T. de, Vreede, G.-J. de, Elkins, A., Maier, R., Merz, A. B., Oeste-Reiß, S., Randrup, N., Schwabe, G., & Söllner, M. (2020). Machines as teammates: A research agenda on AI in team collaboration. *Information & Management*, *57*(2), 103174. https://doi.org/10.1016/j.im.2019.103174

7.6 Research Paper 4: Affordance-Experimentation-Actualization Theory in Artificial Intelligence Research – A Predictive Maintenance Story

Authors: Keller, Robert; Stohr, Alexander; Fridgen, Gilbert; Lockl, Jannik; Rieger, Alexander

Published in: *Proceedings of the 40th International Conference on Information Systems (ICIS),* Munich, Germany (2019)

Abstract: Artificial intelligence currently counts among the most prominent digital technologies and promises to generate significant business value in the future. Despite a growing body of knowledge, research could further benefit from incorporating technological features, human actors, and organizational goals into the examination of artificial intelligence-enabled systems. This integrative perspective is crucial for effective implementation. Our study intends to fill this gap by introducing affordance-experimentation-actualization theory to artificial intelligence research. In doing so, we conduct a case study on the implementation of predictive maintenance using affordance-experimentation-actualization theory as our theoretical lens. From our study, we find further evidence for the existence of the experimentation phase during which organizations make new technologies ready for effective use. We propose extending the experimentation phase with the activity of 'conceptual exploration' in order to make affordance-experimentation-actualization theory applicable to a broader range of technologies and the domain of AI-enabled systems in particular.

Keywords: Affordance-Experimentation-Actualization Theory, Artificial Intelligence, Predictive Maintenance, Embedded Single-Case Study

7.7 Research Paper 5: Generative Mechanisms of AI Experimentation: A Critical Realist Perspective on Predictive Maintenance

Authors: Stohr, Alexander; Ollig, Philipp; Keller, Robert; Rieger, Alexander

Status: *Submitted* (major revision)

Extended Abstract: Artificial intelligence (AI) promises great potential and can both support and redefine the value creation paths of many organizations (Stone et al., 2016; Vial, 2019; Wessel et al., 2021). Some researchers are, therefore, calling AI the next general-purpose technology (Agrawal et al., 2019; Jöhnk et al., 2021). While IS research has been effective in guiding practitioners as they explore and manage traditional information technology (A. Lee, 1999; Sarker et al., 2019), the ability of AI-enabled systems to perform cognitive functions may require a re-examination of various IS concepts (Rai et al., 2019). It is unlikely that AI will simply fit into prevailing concepts for the management of traditional information technology (IT), nor is it self-evident how its wider use will affect innovativeness and competitive advantage (Benbya & Leidner, 2018; Yan et al., 2018). The adoption of AI-enabled systems is dynamic and requires the continuous examination and inclusion of both social and technical aspects (Sarker et al., 2019; Teodorescu et al., 2021). With this in mind, researchers focusing on the adoption of AI-enabled systems would do well to consider their technological features as they apply to the emergent capabilities and goals of human actors and organizations (Markus, 2017; Shmueli & Koppius, 2011).

To address this, the study draws on the critical realist concept of generative mechanisms, the causal structures that trigger events or outcomes (Bhaskar, 1998). Critical realism allows for situating the adoption of a particular AI-enabled system, AI-enabled predictive maintenance, in a broader context while focusing on the physical and social structures that influence the adoption process. Assuming this perspective not only sharpens the study's view of the techno-

organizational context as a mechanisms generator but also provides a more precise understanding of the adoption process itself. Based on a multiple-case study, the paper establishes three affordances of AI-enabled PdM and four interdependent generative mechanisms that either constrain or stimulate the experimentation phase in the context of AI-enabled PdM systems. The study uses system dynamics literature's causal loop diagramming method (Sterman, 2000) to provide a comprehensive picture of these interdependencies and the process from experimentation to actualization.

The purpose of this study is to contribute to the research on AI-enabled systems by providing insights into how techno-organizational context factors, such as organizational culture and structure as well as the pre-existing technology, affect the early-stage adoption process. More specifically, this study aims to provide a clearer understanding of how these factors affect an organization's experimentation with AI-enabled systems by looking at the generative mechanisms these factors produce and their interdependencies. The study's scientific contribution is multi-faceted in that it advances the research on AI-enabled PdM and contribute to Affordance-Experimentation-Actualization theory.

Keywords: Generative Mechanisms, Techno-Organizational Context, Artificial Intelligence, Predictive Maintenance, Affordance-Experimentation-Actualization Theory, Causal Loop Diagramming

References:

Agrawal, A., Gans, J., & Goldfarb, A. (2019). Economic Policy for Artificial Intelligence. *Innovation Policy and the Economy*, *19*, 139–159. https://doi.org/10.1086/699935

Benbya, H., & Leidner, D. (2018). How Allianz UK Used an Idea Management Platform to Harness Employee Innovation. *MIS Quarterly Executive*, *17*(2), Article 7. https://aisel.aisnet.org/misqe/vol17/iss2/7

Bhaskar, R. (1998). *The Possibility of Naturalism: A Philosophical Critique of the Contemporary Human Sciences*. Routledge.

Jöhnk, J., Weißert, M., & Wyrtki, K. (2021). Ready or Not, AI Comes - An Interview Study of Organizational AI Readiness Factors. *Business & Information Systems Engineering*, *63*(1), 5–20. https://doi.org/10.1007/s12599-020-00676-7

Lee, A. (1999). Inaugural Editor's Comments. *MIS Quarterly*, *23*(1), v–xi. http://www.jstor.org/stable/249400

Markus, M. L. (2017). Datification, Organizational Strategy, and IS Research: What's the Score? *The Journal of Strategic Information Systems*, *26*(3), 233–241. https://doi.org/10.1016/j.jsis.2017.08.003

Rai, A., Constantinides, P., & Sarker, S [Saonee] (2019). Editor's Comments: Next-Generation Digital Platforms: Toward Human–AI Hybrids. *MIS Quarterly*, *43*(1), iii–ix.

Sarker, S [Suprateek], Chatterjee, S., Xiao, X., & Elbanna, A. (2019). The Sociotechnical Axis of Cohesion for the IS Discipline: Its Historical Legacy and Its Continued Relevance. *MIS Quarterly*, *43*(3), 695–719. https://doi.org/10.25300/MISQ/2019/13747

Shmueli, G., & Koppius, O. R. (2011). Predictive Analytics in Information Systems Research. *MIS Quarterly*, *35*(3), 553–572. https://doi.org/10.2307/23042796

Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. Irwin/McGraw-Hill.

Stone, P., Brooks, R., Brynjolfsson, E., Calo, R., Etzioni, O., Hager, G., Hirschberg, J., Kalyanakrishnan, S., Kamar, E., Kraus, S., Leyton-Brown, K., Parkes, D., Press, W., Saxenian, A., Shah, J., Tambe, M., & Teller, A. (2016). *Artificial Intelligence and Life in 2030* (One Hundred Year Study on Artificial Intelligence: Report of the 2015-2016 Study Panel). Stanford, CA. Stanford University. http://ai100.stanford.edu/2016-report

Teodorescu, M., Morse, L., Awwad, Y., & Kane, G. (2021). Failures of Fairness in Automation Require a Deeper Understanding of Human-ML Augmentation. *MIS Quarterly*, *45*(3), 1483–1500. https://doi.org/10.25300/MISQ/2021/16535

Vial, G. (2019). Understanding digital transformation: a review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Wessel, L. K., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Jensen, T. B. (2021). Unpacking the Difference between Digital Transformation and IT-enabled Organizational Transformation. *Journal of the Association for Information Systems*, *22*(1), 102–129. https://doi.org/10.17705/1jais.00655

Yan, J., Leidner, D. E., & Benbya, H. (2018). Differential innovativeness outcomes of user and employee participation in an online user innovation community. *Journal of Management Information Systems*, *35*(3), 900–933. https://doi.org/10.1080/07421222.2018.1481669

7.8 Research Paper 6: Artificial Intelligence as a Call for Retail Banking: Applying Digital Options Thinking to Artificial Intelligence Adoption

Authors: Fridgen, Gilbert; Hartwich, Eduard; Rägo, Vadim; Rieger, Alexander; Stohr, Alexander

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Abstract: Technology-driven challenges, both existing and emerging, require banks to invest in IT capabilities, especially in artificial intelligence (AI). Digital options theory presents a valuable guide rail for these investments. However, the nature of AI as a moving frontier of computing requires certain extensions to established digital option thinking. Based on interviews with 23 experts in the retail banking industry, we highlight the importance of thinking broadly when laying the foundation for AI options and being mindful of the dynamic effects of contextual factors. Drawing from digital options theory and the Technology-Organization-Environment framework as dual lens, our study adds a structured approach to consciously balance resources and AI-related capability investments with a broader consideration of the banking industry's complex environment. In this way, our study complements recent research on the interplay between incumbents' resources and digital opportunities.

Keywords: Artificial Intelligence, Digital Options, Retail Banking, Technology-Organization-Environment Framework

7.9 Research Paper 7: When Procrastination Pays: Leveraging Digital Debt to Balance Organizational Reliability and Agility

Authors: Ollig, Philipp; Berente, Nicholas; Fridgen, Gilbert, Keller, Robert; Rieger, Alexander; Stohr, Alexander

Status: *Working paper*

Extended Abstract: Digital innovations continually change the market environment and require that organizations adapt and transform their offerings and modes of organizing (Bailey et al., 2022; Chanias et al., 2019; Keller et al., 2022; Yoo et al., 2012). To sustain performance and competitive advantage over time, organizations need to be able to detect and exploit emerging market opportunities (Overby et al., 2006; Sambamurthy et al., 2003; Tallon & Pinsonneault, 2011). Organizational agility, thus, becomes crucial. At the same time, organizations must demonstrate organizational reliability, that is, maintain and execute reliable processes and associated infrastructures to proactively execute on their imperatives and avoid external disruptions and threats (Butler & Gray, 2006). However, existing literature generally suggests a trade-off between organizational agility and reliability because standardization necessary for efficient and reliable operations can limit flexibility and innovativeness (Adler et al., 1999; Doz & Kosonen, 2010) and change often reduces reliability (Hannan & Freeman, 1984; Perrow, 1984). Limited IT spending further poses a major challenge to organizations who need to balance both imperatives (Tallon et al., 2019).

"Decoupling," the partial separation of elements of the infrastructure from each other, can be a possible solution to reconciling the imperatives of reliability and agility (Berente & Yoo, 2012; Orton & Weick, 1990; Perrow, 1984). In this way, vulnerabilities of one system do not influence the reliability of the other system. However, decoupling can also lead to a fragmented IT landscape that fosters the accumulation of digital debt, that is, technical and informational

obligations that an organization needs to address in the future (Brown et al., 2010; Ramasubbu & Kemerer, 2016; Rolland et al., 2018).

This study draws on 40 narratives (Pentland, 1999) from 28 interviews and unpacks the relationship between organizational reliability, agility, decoupling, and the resulting accumulation of digital debt. Based on these qualitative insights, the study derives a formal model that aims to extend the theory on the trade-off between organizational reliability and organizational agility. Applying this model through simulation, the study establishes several research propositions that can build the basis for further theorizing in this important area.

Overall, the study finds that organizations can benefit from postponing the repayment of digital debt and using decoupling to resolve the tension between organizational agility and reliability. These benefits stem from being able to both respond more quickly to new opportunities and maintain the status to increase stability in the short-term. However, decoupling can also lead to an accumulation of additional digital debt due to a fragmentation of IT systems. Organizations must carefully monitor the development of this digital debt since it can have substantial negative effects in the long term. These negative effects are an increase of the costs of digital debt, including maintenance costs and a loss of organizational agility (opportunity costs), as well as an increase in vulnerability risks, that can potentially offset stability benefits.

Keywords: Digital Debt, Organizational Reliability, Organizational Agility, Decoupling, Narratives, Simulation

References:

Adler, P. S., Goldoftas, B., & Levine, D. I. (1999). Flexibility Versus Efficiency? A Case Study of Model Changeovers in the Toyota Production System. Organization Science, 10(1), 43–68. https://doi.org/10.1287/orsc.10.1.43

Bailey, D. E., Faraj, S., Hinds, P. J., Leonardi, P. M., & Krogh, G. von (2022). We Are All Theorists of Technology Now: A Relational Perspective on Emerging Technology and Organizing. Organization Science, 33(1), 1–18. https://doi.org/10.1287/orsc.2021.1562

Berente, N., & Yoo, Y. (2012). Institutional Contradictions and Loose Coupling: Postimplementation of NASA's Enterprise Information System. Information Systems Research, 23(2), 376–396. https://doi.org/10.1287/isre.1110.0373

Brown, N., Ozkaya, I., Sangwan, R., Seaman, C., Sullivan, K., Zazworka, N., Cai, Y., Guo, Y., Kazman, R., Kim, M., Kruchten, P., Lim, E., MacCormack, A., & Nord, R. (2010). Managing technical debt in software-reliant systems. In Proceedings of the FSE/SDP workshop on Future of software engineering research, Santa Fe, NM.

Butler, B. S., & Gray, P. H. (2006). Reliability, Mindfulness, and Information Systems. MIS Quarterly, 30(2), 211–224. https://doi.org/10.2307/25148728

Chanias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. The Journal of Strategic Information Systems, 28(1), 17–33. https://doi.org/10.1016/j.jsis.2018.11.003

Doz, Y. L., & Kosonen, M. (2010). Embedding Strategic Agility. Long Range Planning, 43(2-3), 370–382. https://doi.org/10.1016/j.lrp.2009.07.006

Hannan, M. T., & Freeman, J. (1984). Structural Inertia and Organizational Change. American Sociological Review, 49(2), 149–164. https://doi.org/10.2307/2095567

Keller, R., Ollig, P., & Rövekamp, P. (2022). Pathways to Developing Digital Capabilities within Entrepreneurial Initiatives in Pre-Digital Organizations. Business & Information Systems Engineering, 64(1), 33–46. https://doi.org/10.1007/s12599-021-00739-3

Orton, J. D., & Weick, K. E. (1990). Loosely Coupled Systems: A Reconceptualization. Academy of Management Review, 15(2), 203–223. https://doi.org/10.5465/amr.1990.4308154

Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise Agility and the Enabling Role of Information Technology. European Journal of Information Systems, 15(2), 120–131. https://doi.org/10.1057/palgrave.ejis.3000600

Pentland, B. T. (1999). Building Process Theory with Narrative: from Description to Explanation. Academy of Management Review, 24(4), 711–724. https://doi.org/10.5465/amr.1999.2553249

Perrow, C. (1984). Normal Accidents: Living with High-Risk Technologies. Basic Books.

Ramasubbu, N., & Kemerer, C. F. (2016). Technical Debt and the Reliability of Enterprise Software Systems: A Competing Risks Analysis. Management Science, 62(5), 1487–1510. https://doi.org/10.1287/mnsc.2015.2196

Rolland, K. H., Mathiassen, L., & Rai, A. (2018). Managing Digital Platforms in User Organizations: The Interactions Between Digital Options and Digital Debt. Information Systems Research, 29(2), 419–443. https://doi.org/10.1287/isre.2018.0788

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. MIS Quarterly, 27(2), 237–263. https://doi.org/10.2307/30036530

Tallon, P. P., & Pinsonneault, A. (2011). Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model. MIS Quarterly, 35(2), 463–486. https://doi.org/10.2307/23044052

Tallon, P. P., Queiroz, M., Coltman, T., & Sharma, R. (2019). Information technology and the search for organizational agility: A systematic review with future research possibilities. The Journal of Strategic Information Systems, 28(2), 218–237. https://doi.org/10.1016/j.jsis.2018.12.002

Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for Innovation in the Digitized World. Organization Science, 23(5), 1398–1408. https://doi.org/10.1287/orsc.1120.0771