Managing Digital Transformation:
Challenges and Choices in
Organizational Design and Decision-Making

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"All the great organizations in the world,
all have a sense of WHY that organization does what it does."

(Sinek 2012)

Abstract

Interplays between organizations and technologies are crucial to companies' sustainable success. Like two pivotal threads in a woven fabric, companies must tie and interlace both in their organizational design and decision-making (Zammuto et al. 2007). The research has looked into aspects of this interplay for several decades and has specifically acknowledged IT's importance to foster competitive advantages (see e.g. Hickson et al. 1969; Mata et al. 1995). Companies now face the paradigm shift of digitalization, which offers extensive opportunities but also poses new challenges and threatens companies' existence (Sebastian et al. 2017). Thus, our assumptions, practices, and underlying concepts of IT in organizations are changing drastically (Baskerville et al. 2020).

Emerging digital technologies such as cloud computing, mobile computing, extended reality, artificial intelligence, and distributed ledger technology require and enable business model innovations (Nambisan et al. 2017). Thus, the paradigm shift of digitalization is forcing companies to reconsider common practices for organizational design and decision-making to remain viable in times of such environmental turbulence (Pavlou and El Sawy 2010; Sambamurthy and Zmud 2000). As an effort to cope with digitalization's new requirements, companies often engage with digital transformation to reconfigure their deep structures, i.e. their prior choices on organizing and routines (Besson and Rowe 2012; Gersick 1991). However, digital transformation entails an entirely new organizational identity, requiring a profound understanding and appropriate responses to be successful (Wessel et al. 2020). In this thesis, I pursue the overarching research aim to *elucidate the challenges and choices in organizational design and decision-making for companies engaging with digital transformation.*

Contributing to its overarching research aim, this thesis consists of six individual essays. These use digital transformation, organizational design, ambidexterity, and IT governance as their locus and primary theoretical lenses. Further, I structure the essays in three research fields, with corresponding research goals:

First, I seek to conceptualize organizational change in the digital age. In this regard, Essay 1 identifies five perspectives on continuous change that foster a successful digital transformation and extend the literature's prior focus on episodic change models. Essay 2 unveils the changes to organizations' assumptions and practices in digital

transformation as well as the distinct differences between organizing for IT and organizing for digital.

Second, I seek to foster the understanding of ambidextrous IT organizations' design as a common organizational response to digital transformation. Thus, in Essay 3, I identify relevant design options for agile IT setups and seven salient archetypes of organizational design. In Essay 4, I address the challenges and IT governance mechanisms in ambidextrous IT organizations and posit five managerial paradoxes.

Third, I seek to provide guidance for organizational decision-making for the management of digital technologies. In Essay 5, I provide a process framework to successfully manage client-provider relationships in cloud computing. In Essay 6, I transfer a risk quantification approach from the automotive industry to technology platforms in the Internet of Things so as to derive implications for security governance.

Considering each essay's distinct questions and approaches, this cumulative thesis follows a multi-methodological research approach to study different facets of organizational design and decision-making (Goldkuhl 2012; Kaplan and Duchon 1988; Mingers 2001).

In sum, with this thesis, I provide a thorough and multifaceted investigation of digital transformation. Further, I contribute to the research, reflecting the associated challenges and guiding organizations toward appropriate responses (Yoo et al. 2012). Thus, I add to the discourse in IS research and organizational studies to extend our thinking and theorizing about companies' fabric of organization and technology. This stimulates further research to understand and successfully guide companies' digital transformation.

Keywords: Digitalization, digital transformation, organizational design, organizational decision-making, digital technologies.

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Bayreuth, March 2020   *Jan Jöhnk*

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Abstract

This thesis elaborates on the digital transformation of IT organizations with a primary focus on challenges and choices in organizational design and decision-making. This introduction to the thesis provides both a general motivation of the overarching research aim and an overview over current organizational challenges for companies resulting from the rise of digital technologies. Further, I delineate implications for organizational design and decision-making to foster digital transformation and successfully manage digital technologies. I consider links to established concepts from IS research and organizational studies, i.e. ambidexterity, agility, dynamic capabilities, and IT governance mechanisms. What follows is the derivation of three research goals, an explanation of the corresponding research designs, and a summary of the main findings of this thesis' six essays. Finally, I discuss this thesis' contributions to theory, implications for practice, limitations, and promising avenues for future research against the backdrop of the overarching research aim. Thus, this introduction contributes to the topical discourse on organizational design and decision-making in digital transformation and provides a synopsis of this thesis' six essays.

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1 Motivation

Like in a woven fabric, companies must effectively tie and interlace organization and technology, since they are two pivotal threads for competitive advantage and sustainable success (Zammuto et al. 2007). Research into the interplays between organizations and technologies has examined and guided organizational design and decision-making for decades (Markus and Robey 1988; Orlikowski and Robey 1991). In the 1960s, Hickson et al. (1969) already raised the question: "How far does technology determine the form taken by the structure of an organization?" (Hickson et al. 1969, p. 378). This fundamental question is more relevant now than ever. However, the concepts of organization and technology have changed drastically (Guillemette and Paré 2012). Thus, companies still face the quest to weave the threads of organization and technologies into a coherent fabric but the threads' materials and characteristics require radically different weaving techniques.

Information technology (IT) has developed into the focal technology in organizations and is of utmost importance to companies' success (Kohli and Grover 2008; Mata et al. 1995). Thus, the research has corrected early assumptions that IT is a mere infrastructure resource or cost function that has no significant impact on business units' profitability (Hitt and Brynjolfsson 1996). However, the paradigm shift from a digitized to a digital world again calls common practices for organizational design and decision-making into question (Ross 2017a; Sambamurthy and Zmud 2000). Emerging digital technologies such as cloud computing, mobile computing, extended reality, artificial intelligence (AI), and distributed ledger technology increasingly permeate our world (Sebastian et al. 2017; Yoo et al. 2012). Further, digital technologies are ubiquitous in our daily lives (El Sawy et al. 2010) and foster IT consumerization (Gregory et al. 2018). IT becomes increasingly indispensable and causes new expectations on the part of customers and users toward companies' products and services (Chanias 2017) as well as those of employees toward the inner workings of organizations (Colbert et al. 2016). Thus, digital technologies require and enable new business models (Bharadwaj et al. 2013; Buck and Eder 2018), new organizing forms such as digital platforms and ecosystems (de Reuver et al. 2018; Parker and van Alstyne 2008; van der Aalst et al. 2019), and new technology paradigms that include the Internet of Things (IoT) and layered modular architecture (Li et al. 2015; Yoo et al. 2010).

While digital technologies provide new opportunities and paths for value creation (Pagani 2013), their purposeful use in organizations is also challenging. They create considerable complexity, and especially incumbent companies have difficulties adapting to the new requirements of digital technologies (Lucas, Jr. and Goh 2009; Sebastian et al. 2017; Svahn et al. 2017). Thus, companies must find appropriate responses and take proactive measures to remain viable and competitive. Commonly, companies engage with digital transformation, as the "process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (Vial 2019, p. 118). Such organizational transformation involves challenging structural and contextual changes (Besson and Rowe 2012; Jöhnk et al. 2020; Vial 2019) that fundamentally reshape companies and their organizing logics of IT (Sambamurthy and Zmud 2000; Yoo et al. 2012). Not only must companies adapt and learn to organize in this digital world, but the research must also reflect and guide these changes (Yoo et al. 2012). Thus, this thesis' overarching research aim is *to elucidate the challenges and choices in organizational design and decision-making for companies engaging with digital transformation.*

Considering this overarching research aim, this thesis is organized around three further research goals that I address in six individual essays. This introduction describes the theoretical foundations (Section 2), research gaps and research questions of my essays (Section 3), followed by their research design and results (Section 4 and Section 5). Finally, I summarize and discuss this thesis' findings to elaborate their contributions to the overarching research aim (Section 6). In sum, my work adds to a sound conceptualization of organizational change in digital transformation (Essays 1 and 2), a better understanding of organizational design and decision-making for ambidextrous IT organizations (Essays 3 and 4), and recommendations to successfully manage emerging digital technologies and associated technology paradigm shifts such as cloud computing and IoT (Essays 5 and 6). Thus, this thesis contributes to the current discourse on digital transformation in information systems (IS) research. Following the interdisciplinary nature of the IS discipline (Agarwal and Lucas, Jr. 2005; Benbasat and Zmud 2003), my work also acknowledges the long tradition of organizational design and decision-making in organizational studies (Orlikowski and Barley 2001).

2   IT Organizations' Design and Decision-Making in the Digital Age

This section provides an overview over current organizational challenges for companies resulting from the rise of digital technologies (Section 2.1), organizational requirements for and responses to digital transformation (Section 2.2), and the role of IT governance to foster digital transformation (Section 2.3). Thus, I focus on providing a selective, yet comprehensive overview over relevant topics regarding the specific foci of this thesis' essays.

2.1   Digitalization and Digital Transformation

To clarify the concept of digitalization, the literature distinguishes it from digitization. While both terms are a potential etymological origin of digital, their concepts and underlying assumptions and practices of IT in organizations differ fundamentally (Rosenstand and Baiyere 2019; Ross 2017a). On the one hand, *digitization* is "the process of converting analog or physical artifacts to a digital state. This basically describes the transformation from atoms to bits." (Rosenstand and Baiyere 2019, p. 2;see also Ross 2017a; Tilson et al. 2010). Here, companies utilize IT to digitize organizational processes and increase their efficiency (Ross 2017a; Tilson et al. 2010). For instance, large ISs such as enterprise resource planning systems are indispensable manifestations of digitization and IS-enabled organizational transformation in companies (Besson and Rowe 2012; Wessel et al. 2020).

On the other hand, *digitalization* refers to "the integration of multiple technologies into all aspects of daily life that can be digitized." (Gray and Rumpe 2015, p. 1319; see also Legner et al. 2017). Thus, digitalization comprises totally different value propositions (Legner et al. 2017; Ross 2017a). For instance, disruptive digital innovations such as online streaming services utilize technical affordances (e.g. digital network infrastructure) to provide innovative products and services (e.g. on-demand media consumption), which have significantly changed incumbent business models (e.g. offline video rental) (Baiyere and Hukal 2020). Yet, extant work emphasizes that digitization and digitalization activities are interrelated (Baiyere and Hukal 2020; Rosenstand and Baiyere 2019). While digitization refers to the underlying aspects of technicality and rationality, digitalization leverages the technical affordances and provides socio-technical context and imagination (Rosenstand and Baiyere 2019;

Tilson et al. 2010). Thus, organizations must embrace the paradigm shift from digitization to a more holistic digitalization of their organizational design and decision-making.

To cope with the challenges of digitalization, companies engage in digital transformation (Matt et al. 2015; Ross 2017a). In contrast to the organizational transformation induced by digitization (Besson and Rowe 2012), digital transformation entails a significant enhancement of organizational capabilities as well as a new organizational identity (Wessel et al. 2020). Thus, digital transformation describes the process of utilizing digital technologies to trigger significant changes to companies' value creation paths (Vial 2019). These changes are relevant for all levels of organizational decision-making: For one thing, companies must find appropriate strategic responses to the new imperatives of emerging digital technologies (Sambamurthy and Zmud 2000). This comprises for instance digital business strategies (Bharadwaj et al. 2013; Mithas et al. 2013) and digital transformation strategies (Matt et al. 2015). Such strategies are business-centric and trans-functional (i.e. customer-focused), they posit digital technologies' affordances at the core of business models, products, and services, and they acknowledge organizations' roles as actors in digital ecosystems (Bharadwaj et al. 2013; Majchrzak et al. 2016; Matt et al. 2015; Ross et al. 2016; Ross et al. 2017b; Yeow et al. 2018). For another thing, digital transformation entails multiple initiatives to trigger structural and contextual changes in organizations (Berghaus and Back 2017; Jöhnk et al. 2020). For instance, organizations are introducing new roles and responsibilities such as the chief digitalization officer (Horlacher and Hess 2016; Tumbas et al. 2017), they create new organizational entities for experimentation and digital innovation such as digital units (Jöhnk et al. 2017; Raabe et al. 2020), or they engage in a holistic change of their organizational culture (Duerr et al. 2018; Hartl 2019; Hartl and Hess 2017).

Referring to Vial (2019), in this thesis I focus on strategic responses, the use of digital technologies, structural and contextual changes, and changes in value creation paths for companies engaging with digital transformation.

2.2   Organizational Requirements for and Responses to Digital Transformation

Historically, organizational requirements for and responses to IT comprised topics such as strategic IT alignment (Chan and Reich 2007; Preston and Karahanna 2009), standardization (Li and Chen 2012), and modularity (Schilling 2000; Yoo 2013). Thus, while organizations have acknowledged IT's business value, the strategic considerations of IT have followed a clear business imperative. Further, routinizing the IT function created inertia in organizations' deep structure (Besson and Rowe 2012; Gersick 1991; Silva and Hirschheim 2007). Considering the environmental turbulence brought about by digitalization, the organizing of IT must undergo a fundamental change (El Sawy et al. 2010; Sambamurthy and Zmud 2000). This does not mean that previous considerations of IT in organizations are no longer of any use. For instance, a stable IT infrastructure backbone is a key element of successful digital transformation (Ross et al. 2016; Ross et al. 2017b; Winkler and Kettunen 2018). Yet companies must understand the new and constantly changing requirements to delineate appropriate organizational responses for a successful digital transformation. This requires a reconceptualization of the organization and of our theorizing about it (Majchrzak et al. 2016). The remainder of this section focuses on three major theoretical concepts that provide relevant perspectives on organizational requirements for and responses to digital transformation for this thesis: ambidexterity, agility, and dynamic capabilities.[1]

Ambidexterity comprises an organization's "ability [...] to both explore and exploit – to compete in mature technologies and markets where efficiency, control, and incremental improvement are prized and to also compete in new technologies and markets where flexibility, autonomy, and experimentation are needed." (O'Reilly, III and Tushman 2013, p. 324). Thus, ambidexterity refers to the simultaneous pursuit of exploitation and exploration to cope with the environmental turbulence of digitalization for sustainable competitive advantage (Jansen et al. 2006; Lee et al. 2015). On the one hand, exploitation comprises activities that focus on efficiency, control, and the reduction of uncertainty (March 1991). On the other hand, exploration

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[1] Notably, all three theoretical concepts are deeply rooted in both organizational and IS research. Thus, their scope in extant research comprises the entire organization as well as the specific IT organization as units of analysis. In this section, I provide a general overview of the concepts' definition, characteristics, and roles in digital transformation. Thereafter, I primarily refer to the IT organization as the locus of observation and reasoning.

activities focus on experimentation, flexibility, and risk-taking to foster innovations (March 1991). Since focusing on only one of the two activities is insufficient or even detrimental, organizations must balance exploitation and exploration (Turner et al. 2013). The research has been discussing the general dichotomy[2] of ambidexterity's activities for decades (Abernathy and Utterback 1978; Duncan 1976). Yet its positive effect on firm performance – especially under market and technological uncertainty – rejuvenates its relevance in digital transformation (Lee et al. 2015; O'Reilly, III and Tushman 2013). Thus, ambidexterity serves as a multilevel theoretical concept in the research (Turner et al. 2013; Werder and Heckmann 2019). For instance, the research has used it to describe the dichotomy in organizational designs (Leonhardt et al. 2017), leadership roles and responsibilities (Gibson and Birkinshaw 2004; Haffke et al. 2016), transformation programs (Du and Pan 2016; Gregory et al. 2015), system development approaches (Vinekar et al. 2006), and IT governance contradictions (Magnusson et al. 2014).

Exploitation and exploration activities compete for scarce resources, which creates paradoxical tensions that organizations must balance (He and Wong 2004; March 1991). Owing to their different foci and demands, the two activities are (seemingly) contradictory (Gregory et al. 2015; Jöhnk et al. 2019; Soh et al. 2019). Thus, ambidexterity's successful implementation requires different organizational strategies, structures, and processes (Raisch and Birkinshaw 2008; Tushman and O'Reilly 1996). The research has proposed five major approaches to implement the exploitation-exploration dichotomy. First, *sequential ambidexterity* pursues exploitative and explorative activities as temporally separated – one at a time and one after another (Duncan 1976; O'Reilly, III and Tushman 2013). Thus, organizations must repeatedly realign their structures and processes to match the respective activity focus (Tushman and O'Reilly 1996). Second, *structural ambidexterity* separates exploitation and exploration in different organizational entities (e.g. departments or units) (Heracleous et al. 2017). Appropriate integration mechanisms between the two activities ensure their alignment and a specific focus in each structural entity (Fang et al. 2010; O'Reilly, III and Tushman 2004). Third, *contextual ambidexterity* refers to decisions and adaptations for exploitation or exploration in employee behavior (de Clercq et al. 2014;

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[2] For a conceptual discussion on dichotomies and dualities (i.e. paradexterity and ambidexterity), I may refer to Magnusson et al. (2014) and Farjoun (2010).

Gibson and Birkinshaw 2004). Thus, the organization balances these two activities by encouraging and empowering individuals to use their "behavioral capacity." (Gibson and Birkinshaw 2004, p. 209). Fourth, *dynamic ambidexterity* considers ambidexterity as a dynamic capability, enabling organizations "to dynamically adjust to a given point in between the exploration/exploitation continuum." (Kranz et al. 2016, p. 503; see also Chen 2017; Luger et al. 2013). Fifth, *hybrid or mixed ambidexterity* acknowledges sensible combinations of the aforementioned ambidexterity approaches (Cao et al. 2009). The combination of structural and contextual ambidexterity is an example of how organizations can seize opportunities of digitalization (Jöhnk et al. 2020; Ossenbrink et al. 2019).

In addition to the established scientific discourse on ambidexterity, dual structures in IT organizations – commonly referred to as bimodal IT – have fueled recent debates on IT organizations' design. Coined by the consultancy Gartner in its '2014 CIO Agenda' (Gartner 2013), it describes bimodal IT as "the practice of managing two separate but coherent styles of work: one focused on predictability; the other on exploration." (Gartner 2014). Thus, mode 1 (traditional IT) represents exploitative activities, while mode 2 (agile IT) focuses on explorative activities (Jöhnk et al. 2017). Depending on the specific implementation, bimodal IT organizations may exist on different organizational levels (e.g. projects, teams, departments, legal entities) and may have different names (e.g. digital labs, digital units). While recent research has argued that such digital labs may constitute a new form of ambidexterity (i.e. temporal ambidexterity; Holotiuk and Beimborn 2019), I see sufficient explanatory power in the extant ambidexterity concepts to describe bimodal IT and other digital transformation initiatives as one of the aforementioned five types of ambidexterity (sequential, structural, contextual, dynamic, and hybrid). Here, my reasoning concurs with extant work on ambidexterity in IT organizations (see e.g. Gerster et al. 2020; Haffke et al. 2017b; Leonhardt et al. 2017; Ossenbrink et al. 2019).

Agility describes an organization's "ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise." (Sambamurthy et al. 2003, p. 245). Thus, agility fosters the ability to swiftly implement organizational change so as to be able to make use of new opportunities (Chan et al. 2019). IT resources and capabilities are crucial to foster such organization agility and thus firm performance

(Chakravarty et al. 2013; Lee et al. 2015). This comprises aspects of infrastructures, development, organization, and personnel (Salmela et al. 2015). Further, the literature describes several agility types concerning its specific context and focus (Weingarth et al. 2018). For instance, Sambamurthy et al. (2003) as well as Tallon and Pinsonneault (2011) distinguish between the roles of customers, external partners, and operations to foster agility via exploitation, exploration, and IT.

Finally, *dynamic capabilities* express an organization's "ability to integrate, build, reconfigure internal and external competences to address rapidly changing environments." (Teece et al. 1997, p. 516). Thus, they describe higher-order organizational capabilities that enable organizations to create or modify routines for a better fit to environmental changes through the three mechanisms of sensing, seizing, and transforming (Teece 2007; Winter 2003). Further, dynamic capabilities are either planned or improvisational (Pavlou and El Sawy 2010; Weingarth et al. 2018). While both focus on reconfiguring organizations, improvisational capabilities are spontaneous and intuitive responses to urgent, unanticipated, and novel situations (Pavlou and El Sawy 2010). Planned capabilities are most suited for predictable 'waves' of environmental turbulence and improvisational capabilities cope better with 'storms' of unexpected change (Holsapple and Jin 2007; Pavlou and El Sawy 2010). Thus, dynamic capabilities are an important source of sustainable competitive advantage, especially considering the challenges of digital transformation (Teece et al. 1997; Vial 2019). Such higher-order organizational capabilities are also an appropriate concept to better understand ambidexterity and agility (Chakravarty et al. 2013; O'Reilly, III and Tushman 2008, 2013; Sambamurthy et al. 2003).

In sum, ambidexterity, agility, and dynamic capabilities describe both, requirements for organizations resulting from digitalization and potential responses to master digital transformation.

2.3 IT Governance Mechanisms' Roles in Digital Transformation

Digital transformation and the corresponding organizational responses are reflected and realized by an organization's IT governance. IT governance has a long tradition in research (Brown 1997; Brown and Grant 2005) and practice (cf. various best practices frameworks such as ITIL, COBIT, and ISO/IEC 27000). Following de Haes and van Grembergen's (2009, p. 123) definition, IT governance comprises "the leadership and

organizational structures and processes that ensure that the organization's IT sustains and extends the organization's strategy and objectives." Further, IT governance specifies decision-making authority and accountability in organizations to promote the purposive use of IT (Sambamurthy and Zmud 2000; Weill and Ross 2004). Thus, the effective use of IT depends on the IT governance in an organization (Wu et al. 2015), and researchers have examined different perspectives on the relationship between IT governance and firm performance (e.g. Zhang et al. 2016).

The literature on IT governance has elucidated prevalent governance forms and their contingencies, i.e. why and how such forms are chosen (Brown and Grant 2005). Structural, procedural, and relational IT governance mechanisms are an established classification to describe IT governance forms (Brown 1999; de Haes and van Grembergen 2004; Peterson et al. 2000). *Structural IT governance mechanisms* comprise the decision-making structures, roles, and responsibilities (de Haes and van Grembergen 2004). *Procedural IT governance mechanisms* help to formalize and institutionalize these decision-making procedures (Peterson 2004). *Relational IT governance mechanisms* support the informal "active participation of and collaborative relationship between" all involved actors (Peterson 2004, p. 65). Thus, IT governance mechanisms are key horizontal integration capabilities, fostering formal and informal decision-making across the business and IT.

The research usually conflates the multifarious combinations of IT governance mechanisms into three dominant organizational designs that differ in decision-making authority for IT activities and IT resources (Brown 1999, 1999; Brown and Grant 2005; Brown and Magill 1994; Sambamurthy and Zmud 1999, 2000; Winkler and Wessel 2018). First, a *centralized governance design* bundles all decision-making authority in a tightly integrated governance structure (Brown 1997; Peterson et al. 2000). Thus, a centralized governance design emphasizes efficient operations and profitability by greater control over IT (Weill and Ross 2005). Second, a *decentralized governance design* shifts all decision-making authority to individual units or pluralistic processes that seek to maximize responsiveness and flexibility, while minimizing standardized governance processes and constraints on creativity and autonomy toward innovation (Peterson et al. 2000; Weill and Ross 2005). Thus, a decentralized governance design relies on only a few IT governance mechanisms, for instance, investment processes, risk management, and strategic prioritization (Weill and Ross 2005). Third, a *federal*

governance design constitutes a mixed approach, that attempts to balance the contrasts between centralized and decentralized design (Weill and Ross 2005).

In sum, IT governance mechanisms are an established theoretical lens to describe different organizational designs and organizations' approaches to manage IT. They can also cater to the specifics in digital transformation and digital technologies. For instance, researchers have described IT governance mechanisms' roles to foster continuous change (Hatum et al. 2010; Hinsen et al. 2019), have used IT governance mechanisms to describe the coordination of multiple digital transformation initiatives (Gregory et al. 2015; Jöhnk et al. 2020) and bimodal IT organizations (Jöhnk et al. 2019), and have explicated IT governance mechanisms' roles in successfully managing digital technologies and emerging technology paradigms such as cloud computing and IoT (Weber 2013; Winkler and Brown 2013). Thus, organizations must implement appropriate IT governance mechanisms considering that IT governance mechanisms can enable, or can cause inertia in, digital transformation (Tiwana and Konsynski 2010). This thesis' essays follow this perspective of IT governance mechanisms' roles in digital transformation.

3   Derivation of Research Gaps and Research Questions

Resulting from the overarching research aim's holistic scope, this thesis addresses three distinct yet thematically intertwined research fields: "*Conceptualizing Organizational Change for Digital Transformation*" (Section 3.1), "*Designing Ambidextrous IT Organizations to Foster Innovation and Agility*" (Section 3.2), and "*Managing the Implications of Digital Technologies for IT Governance*" (Section 3.3). In each research field, I elucidate a research goal (RG) that guides the research process of the six essays in this thesis. Thus, the three research goals' foci shift from *analytical* (i.e. explicating and conceptualizing digital transformation, the associated challenges, and potential organizational responses), to *explanatory* (i.e. understanding and explaining common organizational responses observable in practice), and finally to *prescriptive* (i.e. providing guidance to organizational design and decision-making in digital transformation) (Gregor 2006).

3.1   Organizational Change in Digital Transformation

Digital transformation means adapting the organizational structures and routines in organizations to cope with internal, technological, and environmental dynamics in the digital age (Dean et al. 1999; El Sawy et al. 2010; Orlikowski 1996; Vial 2019). Although early work has acknowledged the constant environmental flux of organizations (Brown and Eisenhardt 1997; Orlikowski 1996), episodic change models still dominate the research into organizational change (Lyytinen and Newman 2008; Porras and Silvers 1991). Typically, such models depict organizational change as a sequence of *unfreeze-transition-refreeze* (Weick and Quinn 1999), in which organizations operate in long periods of stable equilibrium punctuated by discontinuities (Orlikowski 1996). However, this may lead to inertial structures and risky radical change programs, which are inappropriate for digital transformation (Dean et al. 1999; Romanelli and Tushman 1994; Tripsas 2009; Vial 2019). Emerging digital technologies and environmental turbulences require constant change (El Sawy et al. 2010). The research must re-examine established change models to provide novel insights into change in digital transformation. Thus, my research goal in the first research field is:

RG₁: Conceptualizing organizational change in the digital age

A promising approach to achieve organizational change in digital transformation is continuous change. In contrast to episodic change, it describes the emergent, ongoing,

and incremental variations in day-to-day activities (Orlikowski 1996). "[Such] small continuous adjustments, created simultaneously across units, can cumulate and create substantial change" (Weick and Quinn 1999, p. 375). Although prior research acknowledges the necessity for continuous change to be successful and to survive in digital business (Brown and Eisenhardt 1997), work on continuous change in IS research is still scarce. Further, the terminology in the literature is dispersed and covers among others continual change (Govindarajan 2016), continuous innovation (Boer and Gertsen 2003), continuous renewal (Chakravarthy and Lorange 2007), continuous morphing (Rindova and Kotha 2001), and continuous reinvention (Furlong and Johnson 2003). Researchers would benefit from a comprehensive overview over the current body of knowledge, potential links to established IS concepts that are relevant to digital transformation, and an agenda to structure future research. Thus, I ask:

What can IS research learn from extant literature on continuous change of organizations in hypercompetitive environments? (Essay 1)

As a result of the continuous organizational change in digital transformation, the underlying assumptions and practices of organizing for IT are subject to change. Recently, researchers and practitioners are increasingly incorporating 'digital x' as a denomination for these fundamental changes of digital transformation, where 'x' can stand for strategy, governance, and technologies, among others (Baiyere et al. 2017; Baiyere et al. 2019). Research into digital business strategies and digital business models (e.g. Bharadwaj et al. 2013; Buck and Eder 2018), digital innovation management (e.g. Nambisan et al. 2017), digital products and services (e.g. Ross et al. 2016), and digital labs and digital units (e.g. Raabe et al. 2020) explicates the recent use of 'digital x', which apparently seeks to cover some of the implications for and reactions of organizations in digital transformation. However, this leads to a lack of conceptual and nomological clarity, because the changes by 'digital x' to the previous organizing logic of IT remain vague (Baiyere et al. 2017). An organizing logic comprises the managerial rationales that determine the orchestration of organizational architecture (e.g. structural, procedural, and relational governance mechanisms) to reflect environmental and business imperatives (Sambamurthy and Zmud 2000). They reveal the dominant way of thinking that underlies the conception and associated actions in a specific context (Prahalad and Bettis 1986; Sambamurthy et al. 2003). The

research should explore and conceptualize how and to what extent the organizing logics of IT change toward a new organizing logic of digital. Thus, I ask:

How does the organizing logic of digital differ from the organizing logic of IT?

(Essay 2)

3.2   Designing Ambidextrous IT Organizations

Addressing incumbents' need to cope with digital transformation and turbulent environments, bimodal IT organizations emerged as a practice-driven phenomenon in 2013 (Gartner 2013; Horlach et al. 2016). From a theoretical perspective, it describes the structural separation of an IT organization into two distinct teams, units, departments, or even legal entities (Haffke et al. 2017a). Early research has especially focused on general archetypes of bimodal IT organizations, distinguishing the two modes' characteristics (Haffke et al. 2017b; Horlach et al. 2017). This work shed light on the general understanding of bimodal IT organizations and their contributions to IT's alignment with business. However, the research still lacks a sound understanding of common challenges and detailed guidelines for the successful implementation of bimodal IT organizations. Such insights would contribute to a comprehensive conceptualization of bimodal IT organizations as a means to foster structural IT ambidexterity for digital transformation. Thus, my research goal in the second research field is:

RG$_2$: Understanding the design of ambidextrous IT organizations as a common organizational response to digital transformation

This thesis addresses RG$_2$ with two thematically related research questions. The second research project emerged from the insights gained in the first research project and directly continues its line of reasoning. First, I address the need to structure design options for bimodal IT organizations. Despite the topicality of this, we still lack insights into the organizational rationales, design options, and typical manifestations for the explorative part of bimodal IT organizations (i.e. agile IT setups). To increase transparency in this fairly young research field, which is low on theoretical insights (Gregor 2006), I seek to add to the descriptive knowledge on the implementation of structurally ambidextrous IT organizations. Thus, I ask:

What are the design options for agile IT setups? (Essay 3)

Second, owing to the different characteristics and implementation of the exploitative part and the explorative part in structural IT ambidexterity, bimodal IT organizations must balance competing demands (Raisch et al. 2009). Further, plurality requires different structural, procedural, and relational governance mechanisms. This poses significant challenges to organizations during the formation and operation of such bimodal IT organizations (Haffke et al. 2017a), and paradoxical tensions between the two parts of a bimodal IT organization may emerge (Raisch and Birkinshaw 2008). Thus, there is a need to better understand the inner workings of bimodal IT organizations and to explain the interrelationships between challenges, governance mechanisms, and paradoxical tensions. Thus, I ask:

Which structural, procedural, and relational governance mechanisms are employed in bimodal IT organizations, and how do these mechanisms relate to challenges associated with organizational ambidexterity? (Essay 4)

3.3   Digital Technologies' Implications for IT Governance

Owing to emerging digital technologies' disruptive potential, organizations must find ways to cope with the ambivalences of digital technologies if they are to remain competitive (Sebastian et al. 2017; Vial 2019). On the one hand, digital technologies provide rich affordances and new opportunities to drive business (Sia et al. 2016; Tan et al. 2015). On the other hand, digital technologies threaten organizations' viability owing to environmental disruptions (Lucas, Jr. and Goh 2009). Thus, organizations must balance the endogenous and exogenous perspectives in their strategic responses to digital technologies (Vial 2019). For this, established IT governance mechanisms are no longer appropriate, considering the business and technological imperatives of digital technologies (Sambamurthy and Zmud 2000). Organizations require new approaches for their IT management activities and decision-making relating to digital technologies. Thus, my research goal in the third research field is:

RG$_3$: Providing guidance to organizational decision-making for the management of digital technologies

As for RG$_1$ and RG$_2$, this thesis puts forward two distinct research projects that address RG$_3$. In this case, these two projects focus on a similar topic of interest, i.e. what implications for IT governance arise from emerging digital technologies and digital

technology paradigms such as cloud computing and IoT (Vial 2019). First, cloud computing has fueled the gradual shift of organizational IT infrastructures from IT-as-a-product toward IT-as-a-service (Barrett et al. 2015). Besides the associated benefits, the dependency on cloud service providers also increases (Keller and König 2014). Organizations need new management approaches to reflect this paradigm change in their IT governance mechanisms; specifically, they require guidance to successfully manage the client-provider relationship. Thus, my research objectives are:

To strengthen the scientific discourse on managing relationships between providers and clients, I aim at structuring the existing knowledge on the management of cloud computing providers and providing a process framework for cloud service provider management. (Essay 5)

Second, IoT constitutes a technology paradigm of interconnected smart things that blend the physical world and the digital world (Oberländer et al. 2018; Whitmore et al. 2015). Among others, miniaturization and increasing computational power of IT components facilitate transforming previously physical objects into digital products and services. This comprises personal (e.g. cars and refrigerators), industrial (e.g. production machines), and societal (e.g. critical infrastructure and smart cities) application areas (Borgia 2014). However, such smart things inherit the security risks of their digital components, which are aggravated by their physical real-world representation (Atzori et al. 2010). Further, the use of technology platforms (TPs) in IoT and the high connectivity between smart things enable novel vulnerability and exploit scenarios. Different smart things may share the same vulnerabilities owing to the use of the same TP and, in case of a harmful exploit, connectivity may accelerate an attack's spread across smart things (for recent examples, see e.g. Kocher et al. 2018; York 2018). At an estimated 25 billion smart things by 2020 (Yu et al. 2015, 2015), this poses significant risks to society that require adequate IT security governance measures from individuals, manufacturers, platform providers, and regulators. Thus, I ask:

What are implications for security governance at the individual, company, and regulatory levels to deal with technology platforms in IoT? (Essay 6).

4   Thesis Structure and Research Designs

Overall, this thesis comprises six essays that address the research goals introduced in Section 3. Essays 1 and 2 address RG$_1$, Essays 3 and 4 RG$_2$, and Essays 5 and 6 RG$_3$. The essays follow after the introduction and reflect the cumulative nature of this dissertation, in which essays or their previous versions seek to contribute to the scientific discourse through publication in journals or presentations at conferences.[3]

At the time of publication of this thesis, some essays were under review or, owing to the cumulative nature of this thesis, in preparation for submission. For each research goal, Table 1 summarizes the essays, their previous versions, and the publication statuses. All essays are the result of joint work with my co-authors. Appendix A: Declarations of Co-Authorship and Individual Contribution states the authors' involvement in the essays. Thus, when referring to the research approaches of such joint work, I use the plural *we*.

From a philosophical perspective, research follows different ontological and epistemological assumptions about the nature of reality and our knowledge of it (Mingers 2001). Generally, this comprises positivist, interpretivist, critical, and pragmatist stances.[4] The epistemological stance has important implications for the choice of research methods (Becker and Niehaves 2007) and the results' potential theory types (Gregor 2006). Yet, scholars acknowledge that research can and – where appropriate – should adopt a combination of different epistemological stances (Goldkuhl 2012; Lee 1991). Likewise, scholars have argued for greater pluralism in research methods in order to complement their potentials (Kaplan and Duchon 1988; Mingers 2001).

In my judgment and belief, digital transformation is an emerging research field that requires a thorough understanding of its underlying dynamics and should provide practitioners with useful guidance to facilitate successful organizational change. Thus, this thesis' epistemological stance mainly follows interpretivist and pragmatist assumptions (Goldkuhl 2012), with qualitative-empirical methods as the main

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[3] For my other work, relating to the three research goals and other research streams, I may refer to Appendix B: Other Publications.

[4] A detailed discussion of ontological and epistemological stances falls outside the scope of this thesis, which is to provide a general understanding and to reflect on the essays' research designs. Considering the extensive debates and different philosophical schools, I may refer to the literature (see e.g. Chen and Hirschheim 2004; Mueller and Urbach 2017; Orlikowski and Baroudi 1991).

research approach (Sarker et al. 2013; Sarker et al. 2018a, 2018b). Nonetheless, the essays partly reflect epistemological and research method pluralism in order to broaden the perspectives on this thesis' overarching research aim (Benbasat and Weber 1996; Robey 1996).

Table 1. Publication Histories of the Essays in This Thesis

Research Goals	Title	Publication Outlet	Publication Status
RG₁: Conceptualizing organizational change in the digital age	**Essay 1:** Disentangling the Concept and Role of Continuous Change for IS Research – A Systematic Literature Review	Proceedings of the 40th International Conference on Information Systems (ICIS 2019)	Published
	Essay 2: Organizing of Digital: An Empirical Unpacking of Digital Versus IT	Scientific journal	Submission in preparation
RG₂: Understanding the design of ambidextrous IT organizations as a common organizational response to digital transformation	**Essay 3:** How to Implement Agile IT Setups: A Taxonomy of Design Options **Previous version:** Proceedings of the 25th European Conference on Information Systems (ECIS 2017)	Scientific journal	Submission in preparation Published with distinction as Best Research Paper
	Essay 4: Juggling the Paradoxes – Governance Mechanisms in Bimodal IT Organizations **Previous version:** Proceedings of the 27th European Conference on Information Systems (ECIS 2019)	Scientific journal	Submission in preparation Published
RG₃: Providing guidance to organizational decision-making for the management of digital technologies	**Essay 5:** A Contingency Lens on Cloud Provider Management Processes	Scientific journal	Revision in preparation (2nd round)
	Essay 6: When Your Thing Won't Behave: Security Governance in the Internet of Things	Scientific journal	Under review

Table 2 summarizes the research design for each individual essay comprising the specific research methods we used for data elicitation and data analysis. I will now briefly describe the individual rationales for each essay's research approach. For a detailed description, I may refer to the essay in question's method section.

Table 2. Applied Research Methods of the Essays in This Thesis

Research Goals	Title	Research Methods
RG_1: Conceptualizing organizational change in the digital age	**Essay 1**: Disentangling the Concept and Role of Continuous Change for IS Research – A Systematic Literature Review	• Structured literature review (Webster and Watson 2002)
	Essay 2: Organizing Logic of Digital: An Empirical Unpacking of Digital Versus IT	• Multiple-case study (Eisenhardt 1989; Leonard-Barton 1990; Yin 2018) • Abductive theory building (Siggelkow 2007; Thomas 2010)
RG_2: Understanding the design of ambidextrous IT organizations as a common organizational response to digital transformation	**Essay 3:** How to Implement Agile IT Setups: A Taxonomy of Design Options	• Interview study (Myers and Newman 2007; Schultze and Avital 2011) • Taxonomy development (Nickerson et al. 2013) • Survey instrument (Gable 1994) • Cluster analysis (Hair et al. 2014)
	Essay 4: Juggling the Paradoxes – Governance Mechanisms in Bimodal IT Organizations	• Multiple-case study (Carroll and Swatman 2000; Eisenhardt 1989) • Analytical-inductive theory building (Corbin and Strauss 2015; Glaser and Strauss 2017)
RG_3: Providing guidance to organizational decision-making for the management of digital technologies	**Essay 5:** A Contingency Lens on Cloud Provider Management Processes	• Interview study (Myers and Newman 2007; Schultze and Avital 2011) • Qualitative content analysis (Miles and Huberman 1994)
	Essay 6: When Your Thing Won't Behave: Security Governance in the Internet of Things	• Mathematical modeling and simulation (Betrand and Fransoo 2002) • Formal deductive analysis (Davis et al. 2007)

In Essay 1, we conduct a structured literature review so as to gain a comprehensive overview over the research into continuous change and provide a sound conceptualization for future research (Paré et al. 2015). We follow Webster and Watson's (2002) guidelines in a three-step research process. First, we gain an initial overview over continuous change from discussions with practitioners and subject matter experts, complemented by a preliminary literature search in different scientific databases. This enables us to better scope the research question that guides our subsequent steps. Second, we conduct a systematic literature search with search strings in scientific databases without limiting the publication date. Owing to the interdisciplinarity of research into organizational change (Jacobs et al. 2013), our search is not limited to IS journals and conferences. In four screening iterations, we reduce the 730 initial search results to our final set of 34 eligible papers for subsequent analysis. Third, by using a uniform template, we extract and analyze the conceptualizations, theories, and findings regarding continuous change from each paper. Iterating between the insights from our data analysis and our emerging understanding of continuous change and its links to IS research, we derive predominant research streams and recommendations for future research into continuous change.

In Essay 2, we draw on data from a multiple-case study with three organizations that provides rich insights into the organizing logics of digital and IT (Eisenhardt 1989; Leonard-Barton 1990; Yin 2018). The three organizations – Danske Bank (a Danish financial service provider), Fastems (a Finnish engineering company), and Daimler (a German automotive company) – are established organizations that are deeply engaged in digital transformation. We seek to identify consistent patterns for the organizing logics of digital and IT across all three cases while ensuring sufficient variety in terms of organizational, industry, and national characteristics to strengthen our theorizing (Eisenhardt and Graebner 2007; Leonard-Barton 1990; Siggelkow 2007). Through different contractual arrangements, three authors were immersed in each organizational context from an employee-level perspective for more than two years each (Chughtai and Myers 2014). Thus, our data comprises interviews (semi-structured and informal), observations, field notes, and additional internal and external documents (van de Ven and Huber 1990). For data analysis, we choose an abductive, iterative approach (Srivastava and Hopwood 2009; Thomas 2010), combining insights from the literature with insights from our within- and cross-case

analyses to foster our emerging theorizing (Eisenhardt 1989). Thereby, we use a data schema to derive a common understanding for each case, to depict links to existing theories, and to consolidate joint themes across the cases. As a result, our theorizing of the organizing logics of digital and IT builds on three underlying managerial rationales: strategy, routine, and technology.

In Essay 3, we use a multimethod research approach, combining qualitative- and quantitative-empirical methods in two subsequent research steps (Gable 1994). First, we develop a taxonomy of agile IT setups. Following the guidelines of Nickerson et al. (2013), we identify relevant dimensions and characteristics for classifying real-world agile IT setups. Specifically, we conduct one conceptual-to-empirical and two empirical-to-conceptual iterations. Thus, our dimensions and characteristics reflect the extant knowledge (i.e. conceptual-to-empirical iteration) and new insights from expert interviews (i.e. empirical-to-conceptual iterations). Further, we use our expert interviews to evaluate our taxonomy's real-world fidelity (Szopinski et al. 2019). We conduct 16 expert interviews with interviewees from various industries (Myers and Newman 2007; Schultze and Avital 2011). Thus, we gain comprehensive insights into how the organizations' contexts influenced the design of agile IT setups. Second, we collect a sample of 99 real-world manifestations and use cluster analysis to identify evident agile IT setup archetypes. We develop an online survey based on our taxonomy of agile IT setups and collect the following information from respondents: their current and future organizational designs, an evaluation of their current organizational design and the underlying motivation, an assessment of context factors, and demographic information. Next, we use hierarchical, agglomerative clustering to group the real-world manifestations according to their distance in the dimensions of our taxonomy (Hair et al. 2014). We use statistical quality measures, our additional data (i.e. our expert interviews and the other survey sections), and the literature to decide on the final number of clusters, triangulating the emerging agile IT setup archetypes.

In Essay 4, we collect data from four bimodal IT organizations constituting a multiple-case study (Carroll and Swatman 2000; Eisenhardt 1989). We follow an analytical-inductive approach (Glaser and Strauss 2017), combining novel insights from different manifestations of bimodal IT organizations with suitable theoretical concepts, i.e. IT ambidexterity and IT governance. We organize data elicitation in two subsequent rounds with two cases each. In round one, we especially focus on the general

organizational setup and aspects of coordination and collaboration between traditional IT and agile IT. We constantly compare the emerging theoretical insights to specify our sampling criteria and the interviews' focus (Glaser and Strauss 2017). Thus, in round two, we elaborate on the challenges and corresponding governance mechanisms in bimodal IT organizations. This helps us to increase the abstraction level in our emerging theory of IT governance mechanisms in bimodal IT organizations (Grover and Lyytinen 2015). Also, our case organizations vary in terms of their industry (law enforcement, automotive, medical technology, and manufacturing) and size, which further fosters our understanding of IT ambidexterity in different organizational realities. Finally, we use ancillary insights from three other organizations to substantiate our theorizing (Urquhart 2013). We collect data from 34 interviews complemented by internal and external documents. For data analysis, two co-authors engage in multiple, iterative coding rounds (Corbin and Strauss 2015). In open coding, we assign conceptual labels to our data grouped into categories and subcategories. Further, we harmonize and consolidate the results of the two co-authors in joint discussions. We then identify relationships among the labels and reassemble them into more abstract core concepts for the purpose of theory development.

In Essay 5, we combine insights from a literature analysis of research into cloud service provider management (Webster and Watson 2002) with insights from 12 semi-structured interviews (Myers and Newman 2007; Schultze and Avital 2011). From the literature analysis, we identify common challenges and existing management processes for the client-provider relationship in cloud computing. We then validate and extend the preliminary cloud management framework with 16 experts from 10 organizations. For data analysis, we use qualitative content analysis (Miles and Huberman 1994) and code the interview transcriptions for the interviewees' feedback on the cloud management framework and potential contingencies from the specific organizational context. Contingency theory is strongly rooted in organizational theory research (e.g. Gresov 1989; Hofer 1975) and is an established theoretical lens in IS research (e.g. Sambamurthy and Zmud 1999; Weill and Olson 1989). Drawing on contingency theory, we unpack the salient factors that influence the client-provider relationship. Using these factors to consider the organizational context in each cloud management process may increase management decisions' and actions' efficacy (Lee et al. 2004).

In Essay 6, we transfer a model for TP risk propagation from the automotive industry to IoT (Kang et al. 2015). We represent TP risk in IoT in mathematical terms as a quantitative-analytical model and explain its underlying dynamics (Meredith et al. 1989). This research approach is based on the assumption that quantitative-analytical models can objectively reflect (parts of) real-world phenomena or decision-making problems (Betrand and Fransoo 2002). Thus, we abstract from the complex reality (Betrand and Fransoo 2002; Meredith 1993) and focus on variables and parameters that are relevant to assessing security risks in IoT. Specifically, we distinguish between different models of smart things that share a common TP, vulnerability and exploit probabilities, and a correlation coefficient to express homogeneity among models of the same TP. Further, we use mathematical simulation to depict the reality of IoT security risks via plausible parameter values derived from real-world observations and literature-based assumptions (Meredith et al. 1989). Using the BusyBox TP as our application example (BusyBox 2020), we illustrate TP security risks in three scenarios and theorize on the underlying TP characteristics. We follow the iterative cycle of description, explanation, and testing of Meredith et al. (Meredith et al. 1989; Meredith 1993) to derive prescriptive security governance measures for the individual, company, and regulatory levels (Davis et al. 2007).

5   Summary of Results

Building on the diversity of utilized research approaches and methods, this thesis' essays contribute to a thorough and multifaceted investigation of the three research goals introduced in Section 3. Specifically, Essay 1 organizes extant research into continuous change in a conceptual model of five research streams and establishes links to dynamic capabilities, ambidexterity, and agility (Section 5.1). Essay 2 demarcates the organizing logics of digital and IT according to their three underlying managerial rationales (Section 5.2). Essay 3 presents a taxonomy of design dimensions for agile IT setups and describes evident archetypes of such ambidextrous IT organizations (Section 5.3). Essay 4 describes the results of a multiple-case study that elucidates the paradoxical tensions and governance mechanisms' roles in ambidextrous IT organizations (Section 5.4). Essay 5 proposes a framework for managing cloud service providers and unpacks three contingency factors that influence the reasonability and configuration of cloud management processes (Section 5.5). Finally, Essay 6 analyzes the implications of increasing platform use in IoT and derives potential governance measures to manage the associated risk (Section 5.6). As noted in Section 4, all essays are the result of joint work with my co-authors. Thus, when referring to the results of our joint work, I use the plural *we*.

5.1   Essay 1: Disentangling the Concept and Role of Continuous Change for IS Research – A Systematic Literature Review

In Essay 1, we describe five distinct research streams on continuous change – cause, process, governance, capabilities, and results – which we derive from a structured literature review containing 34 eligible papers. *Cause* describes the continuous change in external and internal conditions, which require adequate responses by organizations. *Process* comprises the different levels for consideration of continuous change in organizations: strategic, tactical, and operational. *Governance* and *capabilities* address the facilitating factors of continuous change in organizations, while *results* consider the outcomes of continuous change. Further, we discuss our results against the backdrop of three major theoretical concepts relevant for IS research and delineate implications for future research. In sum, dynamic capabilities, ambidexterity, and agility foster organizations' ability to pursue continuous change, which contributes to their long-term success.

Our results demonstrate the multifacetedness of continuous change and express its value for organizations to prevail in today's hypercompetitive environments (Lawrence et al. 2006). Further, we call for a stronger consideration of continuous change in IS research, in contrast to established punctuated change models (Lyytinen and Newman 2008), because this would better reflect the roles of change in emerging technologies and their management in IT organizations (Kumar et al. 2016). Thus, we contribute to a better understanding of the conceptual demarcation of continuous change and its links to IS research. Also, we provide a research agenda to stimulate further research that builds on our systematic review's results. Finally, our five research streams may provide guidance to structure managerial decision areas in organizations.

5.2 Essay 2: Organizing Logic of Digital: An Empirical Unpacking of Digital Versus IT

In Essay 2, we demarcate the organizing logics of digital and IT according to their three underlying managerial rationales. Comparing our case organizations, the rationales express the fundamental changes in organizations' assumptions and practices. First, in the strategy rationale, IT is *business-aligned*, while digital is *business-centric*. Thus, organizations' strategizing for technology either follows or is an intrinsic part of the business strategy. Second, in the routine rationale, IT organizes for *stability*, while digital organizes for *experimentation*. Organizational architecture (e.g. structural, procedural, and relational governance mechanisms) therefore either focuses on ensuring the reliability of existing processes or on fostering the exploration of new business opportunities. Third, in the technology rationale, IT is an *enabler*, while digital is an *outcome*. Thus, organizations' perceptions differ about whether technology is a tool that organizations use to achieve their goals or a key component of organizations' output. Thus, we conclude that digital is more than just a new denomination in 'digital x'.

Our empirical unpacking of digital and IT emphasizes the need to reexamine our dominant ways of thinking about organizing for and around emerging technologies. Considering the evident changes to the managerial rationales, common assumptions and practices of our organizing logic of IT no longer apply to digital. Thus, 'digital x' is not just a relabeling of concepts but comprises a new organizing logic of digital. Thus, although digital and IT are both concerned with managing technologies in organizations, they require different theorizing and practical handling (Baskerville et

al. 2020; Yoo et al. 2012). Our distinction between the organizing logics of digital and IT contributes to a purposeful choice of framing, theories, and methods when studying digital and IT phenomena. Further, we provide practitioners with a sound understanding of the shift in organizing logics to successfully manage the requirements of and implications from 'digital x'.

5.3   Essay 3: How to Implement Agile IT Setups: A Taxonomy of Design Options

In Essay 3, we present a taxonomy of agile IT setups' design dimensions to better understand the explorative part of ambidextrous IT organizations. We propose seven dimensions – scope, institutionalization, accountability, governance, location, staffing, and technical integration – each with detailed characteristics. The dimensions elucidate agile IT setups' design by defining which task(s) they perform (*scope*), how persistently they are anchored in the organization (*institutionalization*), which department(s) legitimize(s) their activities (*accountability*), which internal governance framework applies to them (*governance*), where their employees are physically located (*location*), from which source(s) they recruit their human resources (*staffing*), and how strongly they are interrelated with existing IT resources (*technical integration*). Further, we cluster our sample of 99 real-world manifestations in four existing and three planned agile IT setup archetypes. Thus, we reveal typical combinations of characteristics in our taxonomy's dimensions that depict organizations' approaches to implement and transform agile IT setups.

Our taxonomy of design dimensions adds to the descriptive knowledge of agile IT setups and provides a sound basis for further theorizing on the phenomenon of bimodal IT organizations. Further, the identified archetypes explore the contextual factors and specific approaches to implement agile IT setups as well as their longitudinal progression (Gerster et al. 2020). Thus, our results provide practically relevant insights into existing agile IT setups and their future transformation. Practitioners may draw on our findings to purposefully design agile IT setups considering their organizations' context.

5.4   Essay 4: Juggling the Paradoxes – Governance Mechanisms in Bimodal IT Organizations

In Essay 4, we elucidate the specific challenges, governance mechanisms, and governance paradoxes of bimodal IT organizations. From our analysis, we identify three different states of bimodal IT organizations – formation, coordination, and reintegration – that structure our subsequent reasoning. Drawing on our cases, we summarize typical challenges for bimodal IT organizations in each state. Further, we use the theoretical lens of IT governance mechanisms to structure the structural, procedural, and relational responses to these challenges. In our cases, we observed that the IT governance mechanisms entail positive and negative implications. Thus, the IT governance mechanisms lead to managerial tensions that express underlying paradoxes of bimodal IT organizations. We synthesize five governance paradoxes that comprise the tensions of *strategic vision* (flexibility vs. predictability), *alignment* (business/IT vs. IT/IT), *organization* (simplicity vs. complexity), *distinction* (comparability vs. differentiation), and *collaboration* (integration vs. autonomy).

Our results address the need for a deeper understanding of the inner workings and the potential tensions in bimodal IT organizations. Thus, we contribute to the existing literature on bimodal IT organizations by explicating ambidexterity's overarching paradox of exploitation and exploration in five specific governance paradoxes (Magnusson et al. 2014; Wareham et al. 2014). Our findings are a sound starting point for stronger theorizing and recommendations to overcome bimodal IT organizations' managerial tensions. Further, our descriptive overview of bimodal IT organizations' challenges helps practitioners to anticipate potential problems for their own IT organization's transformation.

5.5   Essay 5: A Contingency Lens on Cloud Provider Management Processes

In Essay 5, we present two major findings for the effective management of cloud services in companies. First, we develop a holistic framework of cloud management processes along the entire cloud service lifecycle. We identify 10 cloud management processes that companies must consider in order to successfully steer their cloud service provider. These processes comprise manifold activities to structure and guide client-provider interactions. Second, we unravel the complex reality of the client-provider relationship and identify three salient factors by drawing on contingency

theory (Sambamurthy and Zmud 1999; Weill and Olson 1989). Further, we exemplify their implications on the 10 cloud management processes by juxtaposing two contrasting cases from our interview study. Specifically, we elucidate the client-provider ratio, the cloud service's specificity, and the service delivery models as three contingency factors for the client-provider relationship.

Our results contribute to the successful management of cloud service providers by deepening the understanding of client-provider relationships and by introducing a viable governance instrument. Further, our preliminary findings regarding the three contingency factors for cloud service provider management extend the – often one-dimensional or procedural – literature.

5.6   Essay 6: When Your Thing Won't Behave: Security Governance in the Internet of Things

In Essay 6, we introduce and explicate the concept of TPs in IoT (Fichman 2004; Thomas et al. 2014; Weber 2013). We emphasize their characteristics and resulting vulnerabilities, which pose increasing risks, considering the increasing 'smartification' of previously mere physical objects. Smart things often share the same TP and thus the same vulnerabilities, leading to a larger number of compromised smart things in the case of an exploit. We model the resulting risk for three illustrative scenarios by drawing on an existing risk quantification model from the automotive industry (Kang et al. 2015), transferring it to IoT's specifics. Thus, we derive implications of TP design parameters and decisions (e.g. the extent of homogeneity across different types of smart things) for IoT security. We then delineate appropriate governance measures for the individual, company (TP providers and smart thing manufacturers), and regulatory levels.

Our results contribute to a better understanding of the necessary governance measures to cope with the rapid technological advances of digitalization, using IoT as a specific example. In particular, we identify and discuss correlation, vulnerability probability, exploit probability, model and platform size, and connectivity as relevant parameters to guide governance decisions for IoT. Thus, we reveal initial cause-and-effect relationships that are relevant to sound risk assessments by individuals, companies, and regulators. Our prescriptive governance implications provide guidance for decision-makers to ensure the deliberate design and use of TPs in smart things.

6   Discussion and Conclusion

I will now discuss my results and conclude this thesis considering the overarching research aim: *elucidating the challenges and choices in organizational design and decision-making for companies engaging with digital transformation*. Thus, I provide a brief summary of this introduction (Section 6.1), elucidate the contributions to theory and implications to practice (Section 6.2), reflect on my work's limitations (Section 6.3), and provide an outlook for future research into IT organizations' design and decision-making in the digital age (Section 6.4).

6.1   Summary

At the interface of IS research and organizational studies, this thesis elaborates on the concepts and challenges of digital transformation, the resulting requirements, the potential responses by organizations, and IT governance mechanisms' roles to foster digital transformation. Prior work on digital transformation, organizational design, ambidexterity, and IT governance serve as the locus and primary theoretical lenses for this thesis. Structured along three research goals, this thesis comprises six essays that provide perspectives on continuous change for IS research (Essay 1), distinct rationales of digital's organizing logic (Essay 2), design options and archetypes of agile IT setups to establish structurally ambidextrous IT organizations (Essay 3), paradoxical tensions and governance mechanisms' roles in structurally ambidextrous IT organizations (Essay 4), a process framework to manage cloud service providers (Essay 5), and governance implications considering the platform risks in IoT (Essay 6).

6.2   Contributions to Theory and Implications for Practice

Considering its overarching research aim, this thesis contributes to the research, reflecting and guiding the changes induced by digital transformation (Yoo et al. 2012). I build my work on existing theories and concepts from IS research and organizational studies to extend our current thinking on organizational design and decision-making in the digital age (Baiyere et al. 2020; Orlikowski and Barley 2001; Whetten 1989). Thus, this thesis' essays comprise insights into theorizing the problems and theorizing potential solutions for organizations (Majchrzak et al. 2016). Further, these insights may also foster practitioners' understandings and actions when engaging with digital transformation.

Summarizing the insights of all six essays, this thesis makes three primary theoretical contributions. First, this thesis conceptualizes organizational change in digital transformation to include new approaches of organizations change toward the moving target of 'digital x' (Baiyere et al. 2017). Thus, I add to research into the changes to the previous organizing logics of IT in companies. Second, this thesis elucidates and explicates the concept and roles of IT ambidexterity for successfully managing digital transformation (Werder and Heckmann 2019). I provide insights into the general importance of balancing exploitation and exploration in turbulent environments as well as into suitable approaches to foster IT ambidexterity in organizations. Third, I explicate how to apply and tailor IT governance as an established theoretical lens to questions of digital transformation (DeLone et al. 2018). Thus, I demonstrate that IT governance mechanisms are a focal instrument to successfully manage the digitalization paradigm shift.

In accordance with the three research goals, three primary areas of practical implications result from this thesis. First, practitioners may draw on my results to better understand the complex interplays between digital technologies and organizational design and decision-making. Drawing on my conceptualizations of organizational change in digital transformation, companies can determine relevant fields of action and can clarify the impacts of digital technologies and environmental turbulence on their specific organizational context. Second, this thesis' results may guide decisions on organizational architecture in the form of structural, procedural, and relational IT governance mechanisms. Based on a comprehensive understanding of the requirements of and potential responses to digital transformation, companies can determine appropriate measures. Third, companies may gain insights into the management of digital technologies and their implications for organizational design and decision-making. Thus, practitioners can better reap the opportunities of emerging digital technologies in their specific digital ecosystem.

6.3   Limitations

When engaging with digital transformation, organizations face a multitude of challenges with new challenges emerging constantly. My thesis covers some of these challenges and specific aspects of organizational design and decision-making. Thus, I will now reflect on my thesis' overarching limitations, focusing on its thematic

shortcomings. For a detailed discussion of the individual limitations of the essays and their research approaches, I may refer to the essay in question's discussion section.

First, this thesis primarily takes an intra-organization perspective on the challenges and choices in digital transformation. Following Vial's (2019) digital transformation process, this thesis' essays address strategic responses, the use of digital technologies, structural and contextual changes from an IT governance perspective, and changes in value creation paths with a focus on IT ambidexterity (see also Jöhnk et al. 2020). The antecedents (e.g. underlying technological disruptions that trigger strategic responses) and decedents (e.g. positive and negative outcomes generated by changes in value creation paths) mostly fall outside this thesis' scope (Vial 2019). Further, with the exception of Essay 6, this thesis focuses less on digital transformation's consequences for individuals, ecosystems, networks, or society.

Second, this thesis elucidates digital transformation mostly from a snapshot perspective, observing it as a major IT management topic during the work on this thesis. However, as the name implies, digital transformation is a process that requires adaptations and reactions to changing contexts along the way (Vial 2019; Wessel et al. 2020). Thus, while the insights in the essays constitute sensible reactions in specific situations, it cannot be claimed that these organizational design and decision-making responses provide sound measures for long-term success. Further, the observed measures are contingent on each organizational context, among others.

Third, this thesis' results predominantly build on qualitative-empirical research designs (Essays 2, 3, 4, and 5). This approach allowed for a context-rich description of the complex realities of digital transformation, fostering a preliminary understanding of phenomena in such a fairly recent and emerging research stream (Bettis et al. 2015). Further, the research designs of Essays 1 and 6, and partly Essay 3, are an initial step toward greater methodological pluralism (Kaplan and Duchon 1988; Mingers 2001). Yet, this thesis' results are contingent on the realities of digital transformation as depicted by the involved organizations, respondents, and researchers.

6.4   Future Research

Building on the results of this thesis and considering its limitations, promising avenues for future research emerge. Regarding **RG₁** – *conceptualizing organizational change in the digital age* – this thesis stimulates further research into people aspects in

organizational change for digital transformation.

Concerning the people aspects in digital transformation, previous research has focused on detailed yet isolated topics, including digital technologies' changes to interactions and collaboration in organizations (e.g. Ciriello et al. 2019), changing competence requirements and job profiles (e.g. Horlacher and Hess 2016), and overall cultural change in organizations for digital transformation (e.g. Hartl 2019). Thus, the importance of people in the successful management of digital transformation and the need to revisit common conceptions of people's roles in organizations are evident (Colbert et al. 2016). Owing to the isolated results of these exemplary research streams, future research may provide a holistic perspective on people's roles in digital transformation, may elaborate on organizational capabilities and governance mechanisms to design future-proof organizations, and may further study users' collaborations with digital technologies in teams of augmented or hybrid intelligence (Dellermann et al. 2019; Rai et al. 2019; Raisch and Krakowski 2020).

For **RG₂** – *understanding the design of ambidextrous IT organizations as a common organizational response to digital transformation* – this thesis opens new research opportunities on the decedents of ongoing digital transformation efforts in organizations. This comprises further elaboration of the tensions and complexity resulting from digital transformation as well as the long-term progression of digital transformation initiatives in organizations.

Digital transformation often involves various initiatives that seek to foster innovativeness, speed, and flexibility as well as to establish among others simple structures for swift decision-making. However, such multiple concurrent digital transformation initiatives also create considerable organizational and technological complexity during and after the transformation process, partly to the detriment of their original objectives (Jöhnk et al. 2020). For instance, the focus on continuous innovation and new features may lead to a lack of updates, maintenance, efficiency, and code quality. Constant changes to the competitive and technological environment exacerbate this tendency of prioritizing exploration over exploitation during digital transformation (Ossenbrink et al. 2019). The results of some of the first digital transformation initiatives are already more than 10 years old (Kohli and Johnson 2011). Thus, the history of problems with antiquated legacy systems threatens to repeat itself. Researchers therefore need to elucidate the long-term progression of digital

transformation initiatives and to propose sensible strategies to consolidate, integrate, and scale digital transformation initiatives in ambidextrous IT organizations.

Additional questions for **RG₃** – *providing guidance to organizational decision-making for the management of digital technologies* – revolve especially around the interplays between digital technologies. The widespread diffusion of digital technologies across intraorganizational and interorganizational boundaries fuels the various interdependencies between technologies. For instance, research has described characteristics of a 'system of systems' (Boardman and Sauser 2006; e.g. a smart city that bundles various systems such as IoT, autonomous driving, or smart grids) or of digital ecosystems (Hein et al. 2020; Parker et al. 2017). However, organizations are currently primarily concerned with understanding digital technologies in an isolated way. For instance, there are few effective measures to manage AI and to derive its business potentials (Hofmann et al. 2020). Yet organizations must consider interdependencies between their existing IT infrastructure and digital technologies as well as between different digital technologies (Fürstenau et al. 2019). Thus, suitable governance mechanisms for managing the interplays between digital technologies and the identification of evolution patterns in technology landscapes (Hofmann et al. 2019) are important future research opportunities here.

Finally, this thesis focuses on digital transformation as the overarching "process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies." (Vial 2019, p. 118). Organizations are currently deeply engaged in digital transformation activities and still face multiple challenges and obstacles to successfully managing digital transformation. However, despite all current concerns, the question arises: *what comes next?* Trends and emerging technologies such as quantum computing (Gyongyosi and Imre 2019), decentralized autonomous organizations(Beck et al. 2018; Hsieh et al. 2018) , and human enhancement (Teunisse et al. 2019) are unfolding and will – besides all opportunities – also pose new challenges to organizations and to society. Initial timid and visionary approaches make assumptions for an era after digital transformation in organizations (Röglinger et al. 2019). For instance, the roles and interplays between business and IT units will potentially be disrupted in the future, with IT organizations in their classic form vanishing altogether (Urbach et al. 2019; Urbach and Ahlemann 2019). However, we still lack sound insights

and assumptions to conceptualize and describe such a post-digitalization paradigm. Thus, researchers and practitioners should proactively join forces to evaluate the future and to propose scenarios for a post-digitalization paradigm, similar to the shift from the digitization paradigm to the digitalization one.

Despite all trends and emerging digital technologies in the future, the fundamental goals for organizations will remain the same: coping with external market demands, enabling proactive organizational responses, and organizing structures, procedures, and people for effective and efficient inner workings. Yet, companies must find new techniques to successfully weave the fabric of organization and technology. Thus, I trust that this thesis' results and ideas will provide a first contribution to the discourse about challenges and choices in organizational design and decision-making during digital transformation – and beyond.

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Appendix

Appendix A: Declarations of Co-Authorship and Individual Contributions

Here, I outline the contributions of all co-authors to the essays[5].

Essay 1: Disentangling the Concept and Role of Continuous Change for IS Research – A Systematic Literature Review

I co-authored this research paper with Silvana Hinsen and Nils Urbach. The co-authors contributed as follows:

Silvana Hinsen (co-author)

Silvana Hinsen provided the initial research idea and contributed by co-initiating and co-developing the entire research project. Further, she managed the research process and conducted the literature analysis. Specifically, she engaged in the further development of the research idea, the theoretical background as well as textual elaboration. Thus, Silvana's co authorship is reflected in the entire research project.

Jan Jöhnk (co-author)

Jan Jöhnk contributed by co-initiating and co-developing the entire research project. Further, he participated in research discussions, and provided feedback on the paper's content and structure. Specifically, he engaged in the further development of the research idea, the synthesis and presentation of the research results as well as textual elaboration. Thus, Jan's co-authorship is reflected in the entire research project.

Nils Urbach (subordinate co-author)

Nils Urbach supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, and engaged in textual elaboration. Thus, Nils' co-authorship is reflected in the entire research project.

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[5] Signed copies declaring the authors' individual contributions for each essay have been submitted with this thesis.

**Essay 2: Organizing Logic of Digital: An Empirical Unpacking of
              Digital Versus IT**

I co-authored this research paper with Abayomi Baiyere, Markus Zimmer, and Kalina
Staykova. The co-authors contributed as follows:

Abayomi Baiyere (co-author)

Abayomi Baiyere provided the initial research idea, guided the research process, and
co-developed the entire research project. He provided empirical case data and
contributed by conducting data analysis. Additionally, he engaged in the further
development of the research idea as well as textual elaboration, especially in Section 1,
Section 2, Section 4, and Section 5. Further, he participated in research discussions,
provided feedback on the paper's content and structure, and helped to finalize the
paper for submission. Thus, Abayomi's co authorship is reflected in the entire research
project.

Markus Zimmer (co-author)

Markus Zimmer co-developed the entire research project. He provided empirical case
data and contributed by conducting data analysis. Additionally, he engaged in the
further development of the research idea as well as textual elaboration, especially in
Section 3, Section 4, and Section 5. Further, he participated in research discussions,
provided feedback on the paper's content and structure, and helped to finalize the
paper for submission. Thus, Markus' co authorship is reflected in the entire research
project.

Kalina Staykova (co-author)

Kalina Staykova co-developed the entire research project. She provided empirical case
data and contributed by conducting data analysis. Additionally, she engaged in the
further development of the research idea as well as textual elaboration, especially in
Section 3 and Section 4. Further, she participated in research discussions, provided
feedback on the paper's content and structure, and helped to finalize the paper for
submission. Thus, Kalina's co authorship is reflected in the entire research project.

Jan Jöhnk (co-author)

Jan Jöhnk co-developed the entire research project. Additionally, he engaged in the
further development of the research idea as well as textual elaboration, especially in
Section 2. Further, he participated in research discussions, provided feedback on the

paper's content and structure, and helped to finalize the paper for submission. Thus, Jan's co authorship is reflected in the entire research project.

Essay 3: How to Implement Agile IT Setups: A Taxonomy of Design Options

I co-authored this research paper with Maximilian Röglinger, Markus Thimmel, and Nils Urbach. The co-authors contributed as follows:

Jan Jöhnk (co-author)

Jan Jöhnk provided the initial research idea and co-developed the entire research project. Further, he contributed by conducting expert interviews and data analysis. Additionally, he managed the research process and engaged in the further development of the research idea as well as textual elaboration. Thus, Jan's co-authorship is reflected in the entire research project.

Maximilian Röglinger (co-author)

Maximilian Röglinger supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, guided the entire research process, and engaged in textual elaboration. Thus, Maximilian's co-authorship is reflected in the entire research project.

Markus Thimmel (co-author)

Markus Thimmel co-developed the entire research project. Further, he contributed by conducting expert interviews and data analysis. Additionally, he managed the research process and engaged in the further development of the research idea as well as textual elaboration. Thus, Markus' co-authorship is reflected in the entire research project.

Nils Urbach (co-author)

Nils Urbach supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, guided the entire research process, and engaged in textual elaboration. Thus, Nils' co-authorship is reflected in the entire research project.

Essay 4: Juggling the Paradoxes - Governance Mechanisms in Bimodal IT Organizations

I co-authored this research paper with Severin Oesterle, Till J. Winkler, Jacob Nørbjerg, and Nils Urbach. The co-authors contributed as follows:

Jan Jöhnk (co-author)

Jan Jöhnk provided the initial research idea and contributed by co initiating and co-developing the entire research project. Further, he contributed by conducting case interviews and data analysis. Additionally, he managed the research process and engaged in the further development of the research idea as well as textual elaboration. Thus, Jan's co authorship is reflected in the entire research project.

Severin Oesterle (co-author)

Severin Oesterle contributed by co initiating and co-developing the entire research project. Further, he contributed by conducting case interviews and data analysis. Additionally, he engaged in the further development of the research idea and textual elaboration. Thus, Severin's co authorship is reflected in the entire research project.

Till J. Winkler (subordinate co-author)

Till J. Winkler supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, guided the entire research process, and provided textual elaboration. Thus, Till's co authorship is reflected in the entire research project.

Jacob Nørbjerg (subordinate co-author)

Jacob Nørbjerg supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, guided the entire research process, and provided textual elaboration. Thus, Jacob's co authorship is reflected in the entire research project.

Nils Urbach (subordinate co-author)

Nils Urbach supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, and provided textual elaboration. Thus, Nils' co authorship is reflected in the entire research project.

Essay 5: A Contingency Lens on Cloud Provider Management Processes

I co-authored this research paper with Severin Oesterle, Robert Keller, Nils Urbach, and Xin Yu. The co-authors contributed as follows:

Severin Oesterle (co-author)

Severin Oesterle contributed by co-initiating and co-developing the entire research project. Further, he contributed by conducting case interviews and data analysis. Additionally, he managed the research process and engaged in the further development of the research idea as well as textual elaboration of the entire manuscript. Thus, Severin's co-authorship is reflected in the entire research project.

Jan Jöhnk (co-author)

Jan Jöhnk contributed by co-developing the entire research project based on a previous version of the manuscript. Further, he contributed by conducting case interviews and data analysis. Additionally, he engaged in the further development of the research idea and textual elaboration of the entire manuscript. Thus, Jan's co-authorship is reflected in the entire research project.

Robert Keller (subordinate co-author)

Robert Keller provided the initial research idea and contributed by co-initiating and co-developing the entire research project. Further, he participated in research discussions, provided feedback on the paper's content and structure, guided the research process, and engaged in textual elaboration. Thus, Robert's co-authorship is reflected in the entire research project.

Nils Urbach (subordinate co-author)

Nils Urbach supervised the research project and provided mentorship. Further, he participated in research discussions, provided feedback on the paper's content and structure, and engaged in textual elaboration. Thus, Nils' co-authorship is reflected in the entire research project.

Xin Yu (subordinate co-author)

Xin Yu contributed by co-initiating and co-developing the initial research project. Further, he contributed by conducting the literature analysis and initial case interviews.

Essay 6: When Your Thing Won't Behave: Security Governance in the Internet of Things

I co-authored this research paper with Gilbert Fridgen and Sven Radszuwill. The co-authors contributed as follows:

Gilbert Fridgen (co-author)

Gilbert Fridgen supervised the research project and provided mentorship. He contributed by providing feedback to the research idea, research content, article structure, and textual elaboration. Thus, Gilbert's co-authorship is reflected in the entire research project with a focus on Sections 1, 2, 4, and 5.

Jan Jöhnk (co-author)

Jan Jöhnk contributed by introducing, developing, and elaborating the entire research project. In particular, he contributed to the literature analysis and the elaboration of governance implications in the research context. Thus, Jan's co-authorship is reflected in the entire research project with a focus on Sections 1, 2, 4, and 5.

Sven Radszuwill (co-author)

Sven Radszuwill contributed by introducing, developing, and elaborating the entire research project. In particular, he conducted the model analysis and carried out textual elaboration. Thus, Sven's co-authorship is reflected in the entire research project with a focus on Sections 3 to 5.

Appendix B: Other Publications

Table 3. Overview of Other Publications

Research Goal	Reference	Title	Publication Outlet
RG$_2$	Jöhnk, J.; Oesterle, S.; Ollig, P.; Riedel, L.-N. (2020)	The Complexity of Digital Transformation – Conceptualizing Multiple Concurrent Initiatives	Proceedings of the 15th International Conference on Wirtschaftsinformatik (WI 2020)
RG$_3$	Jöhnk, J.; Hofmann, P.; Eymann, T.; Urbach, N. (2016)	Sicheres IT-Sourcing: Technische Möglichkeiten und ökonomische Implikationen	Bayreuther Studien zum Wirtschafts- und Medienrecht – Datenschutz in der betrieblichen Praxis
	Alan, Y.; Urbach, N.; Hinsen, S.; Jöhnk, J.; Beisel, P.; Weißert, M. Blumenthal, S.; Hofmann, P.; (2019)	KI, mein Freund und Helfer – Herausforderungen und Implikationen für die Mensch-KI-Interaktion	Ernst & Young and Fraunhofer FIT Whitepaper
	Hofmann, P.; Jöhnk, J.; Protschky, D.; Urbach, N. (2020)	Developing Purposeful AI Use Cases – A Structured Method and Its Application in Project Management	Proceedings of the 15th International Conference on Wirtschaftsinformatik (WI 2020)
	Hofmann, P.; Jöhnk, J.; Protschky, D.; Stähle, P.; Urbach, N.; Buck, C. (2020)	KI-Anwendungsfälle zielgerichtet identifizieren	Wirtschaftsinformatik & Management
Other	Haase, M.; Jöhnk, J.; Lipowsky, S.; Urbach, N. (2017)	Der Einfluss des Agilitätsgrads auf den Erfolg von Softwareentwicklungs-projekten unter Berücksichtigung der Unternehmenskultur	Proceedings of the 13th International Conference on Wirtschaftsinformatik (WI 2017)
	Jöhnk, J.; Hartmann, M.; Urbach, N. (2020)	All Roads Lead to Burning Rome: Towards a Conceptual Model of IT Project Success	Proceedings of the 15th International Conference on Wirtschaftsinformatik (WI 2020)

Disentangling the Concept and Role of Continuous Change for IS Research – A Systematic Literature Review[6]

Authors

Hinsen, Silvana; Jöhnk, Jan; Urbach, Nils

Abstract

To ensure their business success in the digital age, organizations must continuously adapt to an increasingly hypercompetitive environment. Although the topic of continuous change has been addressed by previous research, we perceive a lack of attention on continuous change as an appropriate organizational change approach to tackle the challenges of digital business in the IS domain. Thus, our research goal is to analyze what IS research can learn from extant literature on continuous organizational change in today's business environments. By carrying out a systematic literature review and analyzing 34 relevant papers, we identify and describe five major research streams which explore continuous change from different perspectives. Furthermore, we discuss links to well-known theoretical concepts to stimulate interdisciplinary exchange and we present a research agenda to transfer the identified results into the IS domain. Finally, we provide organizations with guidance to manage the challenges of digital business.

Organizing Logic of Digital:
An Empirical Unpacking of Digital Versus IT[7]

Authors

Baiyere, Abayomi; Zimmer, Markus; Staykova, Kalina; Jöhnk, Jan

Extended Abstract

Information technology (IT) is a focal component of organizations and common rationales on how to manage IT to meet organizational goals have evolved over the decades (Sambamurthy and Zmud 2000; Yoo et al. 2010). Thus, our theorizing and organizing of IT rest on long-held assumptions that have hitherto served us well. An organizing logic comprises the managerial rationales that determine the orchestration of organizational architecture to reflect environmental and business imperatives (Sambamurthy and Zmud 2000). It reveals the dominant way of thinking that underlies the conception and associated actions in a specific context (Prahalad and Bettis 1986; Sambamurthy et al. 2003). Based on extant research, we distinguish three rationales of the organizing logic of IT: strategy rationale, routine rationale, and technology rationale.

The strategy rationale captures the relative position of IT strategy with regard to the organizational strategy. In the organizing logic of IT, IT strategy needs to be aligned with the business and organizational objectives (see e.g. Chan and Reich 2007; Coltman et al. 2015; Lederer and Salmela 1996). Thus, we conclude that IT is business-aligned in the strategy rationale. The routine rationale comprises the operational assumptions and practices behind the daily activities and organizational responsibilities of IT within an organization. Typically, the IT unit is responsible for handling the information needs of an organization, providing reliable and efficient services to the business (see e.g. Davenport and Short 1990; Recker 2014; Sambamurthy and Zmud 2000). Thus, we posit that IT aims for stability in the routine rationale. The technology rationale describes the dominant view of IT's roles as an essential component in the attainment of organizations' goals. Currently, IT is often a focal organizational component that can be leveraged in achieving business goals (see

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[7] At the time of publication of this thesis, this essay is in preparation for submission to a scientific journal. Thus, I provide an extended abstract that covers the essay's content.

e.g. Bharadwaj 2000; Boh and Yellin 2006; Mitra 2005). Thus, we conclude that IT is an enabler in the technology rationale.

However, emerging technologies are increasingly reshaping how we think about IT in organizations and thus, are challenging the current organizing logic of IT with its underlying managerial rationales and assumptions (Baskerville et al. 2019, Bharadwaj et al. 2013; Sambamurthy and Zmud 2000; Yoo 2013). Coined as 'digital x', researchers and practitioners are increasingly incorporating new notations to describe the fundamental changes of digital transformation (Baiyere et al. 2017; Baiyere et al. 2019). Considering the resulting lack of conceptual and nomological clarity, we see the need to explicate the changes to the previous organizing logic of IT and ask:

How does the organizing logic of digital differ from the organizing logic of IT?

Drawing on a multiple-case study with three organizations, we explore and conceptualize how and to what extent the organizing logic of IT changes toward a new organizing logic of digital (Eisenhardt 1989; Leonard-Barton 1990; Yin 2018). All cases are established organizations that engage in digital transformation and accommodate emerging technologies to reshape their business. By explicating and juxtaposing the managerial rationales in our three cases, we present a conceptual delineation of digital and IT. Further, we suggest that the traditional rationales are likely unsuitable and in need of recalibration considering the fundamentally different context opened up by emerging technologies (Baiyere et al. 2020; Prahalad and Bettis 1986). Against this backdrop, we posit that the organizing logic of digital diverges from the traditional organizing logic of IT in the strategy rationale (IT = business-aligned vs. digital = business-centric), routine rationale (IT = stability vs. digital = experimentation), and technology rationale (IT = enabler vs. digital = outcome). Thus, our empirical unpacking of digital and IT helps to demarcate their organizing logics according to their three underlying managerial rationales. Our findings contribute to a clearer ontological and conceptual distinction of digital and IT. This implies the need for researchers and practitioners to rethink our assumptions as we theorize about how to organize for digital versus IT considering the rapid spread of emerging technologies.

Keywords: Digital x, digital unit, IT unit, organizing logic, multiple case study, conceptual clarity.

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How to Implement Agile IT Setups: A Taxonomy of Design Options[8]

Authors

Jöhnk, Jan; Röglinger, Maximilian; Thimmel, Markus; Urbach, Nils

Extended Abstract

The digital transformation requires organizations to rethink how they interact with customers, define value propositions, leverage data, and organize internal operations (Vial 2019). Evolving into an indispensable part of value creation, IT organizations are required to not only plan, build, and run IT services in the safe and steady mode but also to enable organizations to seize digital opportunities in an agile and adaptive mode. Agile IT setups are a potential measure to cope with these challenges and to address the quest for more agility and speed (Gerster et al. 2020). We use the term agile IT setup to describe the part of a bimodal IT organization that focuses on innovation, adaptivity, and speed (Horlach et al. 2016). Thus, we embed the recent discussion of agile IT setups in the context of IT ambidexterity, framing agile IT as the explorative activities in bimodal IT organizations (Lee et al. 2015). Despite mature knowledge of IT organizations, ambidextrous IT, and agile methods, there is high uncertainty on how to implement bimodal IT organizations (Haffke et al. 2017; Horlach et al. 2016; Horlach et al. 2017). Specifically, the literature lacks a comprehensive description of how to implement agile IT setups. Thus, we ask:

What are the design options for agile IT setups?

To answer our research question, we choose a multimethod research approach, combining qualitative- and quantitative-empirical methods in two subsequent research steps (Gable 1994). Following the guidelines of Nickerson et al. (2013), we develop a taxonomy of design options that comprises relevant dimensions and characteristics for classifying real-world agile IT setups. We collect data from 16 expert

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[8] At the time of publication of this thesis, this essay is in preparation for submission to a scientific journal. Thus, I provide an extended abstract that covers the essay's content. An earlier version of this essay was published in the Proceedings of the 25th European Conference on Information Systems (ECIS 2017) and earned the distinction of Best Research Paper:

- Jöhnk, Jan; Röglinger, Maximilian; Thimmel, Markus; Urbach, Nils (2017): How to Implement Agile IT Setups: A Taxonomy of Design Options. In: Proceedings of the 25th European Conference on Information Systems. Guimarães, Portugal.

interviews to discuss and extend our taxonomy, to evaluate its real-world fidelity, and to reflect on existing agile IT setups and their organizational context (Myers and Newman 2007; Schultze and Avital 2011; Szopinski et al. 2019). Further, we collect a sample of 99 real-world manifestations of agile IT setups from an online survey. The survey asks for companies' current and future organizational design of their agile IT setup, an evaluation of their current organizational design and the underlying motivation for their agile IT setup, an assessment of context factors, and demographic information. We use hierarchical, agglomerative cluster analysis to identify evident agile IT setup archetypes in our sample according to their distance in the dimensions of our taxonomy (Hair et al. 2014). Thereby, we triangulate from statistical quality measures, contextual data from the expert interviews and other survey sections, and the literature to derive the final number of clusters (i.e. archetypes).

Our findings show that companies can choose from seven dimensions to design their agile IT setups: scope (Which tasks does the agile IT setup perform?), institutionalization (How persistently is the agile IT setup anchored in the organization?), accountability (Which department legitimizes the agile IT setup and is authorized to issue directives?), governance, risk, and compliance (Which internal governance framework applies to the agile IT setup?), location (Where are the employees of the agile IT setup physically located?), staffing (From which sources does the agile IT setup recruit its human resources?), and technical integration (How strongly is the agile IT setup interrelated with existing IT resources?).

Further, we posit six archetypes that characterize companies' current and future approaches to designing their agile IT setups: digital lab (focusing on innovation and development with a strong spatial and structural separation to the rest of the organization), digital accelerator (a temporary business-IT undertaking to engage in all activities from innovation to market), digital innovation unit (a permanent business-IT undertaking that refrains from operations and maintenance), digital delivery center (focusing on development in close collaboration with external providers), digital IT organization (focusing on innovation, development, and operations and maintenance with strong ties to the established IT organization), and digital factory (collaborating with external providers to foster innovation and development).

In sum, our findings contribute to a better understanding of ambidextrous IT

organizations' explorative part. Thus, we add to the descriptive knowledge of agile IT setups and enhance transparency in this comparatively young field, which is low on theoretical insights (Gregor 2006). Further, we shed light on the operationalization and longitudinal progression of agile IT setups (Gerster et al. 2020). Practitioners may find our findings useful to purposefully design their agile IT setups.

Keywords: IT organization, bimodal IT, IT ambidexterity, taxonomy, archetypes.

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Juggling the Paradoxes –
Governance Mechanisms in Bimodal IT Organizations[9]

Authors

Jöhnk, Jan; Oesterle, Severin; Winkler, Till J.; Nørbjerg, Jacob; Urbach, Nils

Extended Abstract

The fundamental changes associated with digitalization demand businesses and public enterprises to balance exploitative and explorative capabilities in their internal IT function (Leonhardt et al. 2017; Ossenbrink et al. 2019). The IS literature has described these opposing needs – between being stable, efficient, and compliant on the one hand, and flexible, innovative, and agile on the other – as a paradox that IT functions aim to tackle through becoming strategically and organizationally ambidextrous (Galliers 2006; Gregory et al. 2015; Leidner et al. 2011). These opposing forces are also consonant with the tensions between exploration and exploitation in the wider management literature (March 1991) and the desire for company-wide organizational ambidexterity (Raisch and Birkinshaw 2008). One approach to balance these paradoxical demands is the adoption of twofold organizational structures often referred to as bimodal IT (Horlach et al. 2016). Bimodal IT organizations separate traditional IT (mode 1; focusing on stability, reliability, reduction of uncertainty, and efficiency) from agile IT (mode 2; focusing on flexibility, speed, experimentation, and innovation).

Recently, the IS literature has made advances in the description and analysis of bimodal IT organization structures and has provided, amongst others, a classification of different archetypes as well as challenges of bimodal IT organizations (Haffke et al. 2017; Horlach et al. 2016). However, the literature still lacks a deeper understanding of the inner workings of bimodal IT organizations and the potential tensions between traditional and agile IT modes. Under the premise that IS research has provided ample

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[9] At the time of publication of this thesis, this essay is in preparation for submission to a scientific journal. Thus, I provide an extended abstract that covers the essay's content. An earlier version of this essay was published in the Proceedings of the 27th European Conference on Information Systems (ECIS 2019):

- Jöhnk, Jan; Oesterle, Severin; Winkler, Till J.; Nørbjerg, Jacob; Urbach, Nils (2019): Juggling the Paradoxes – Governance Mechanisms in Bimodal IT Organizations. In: Proceedings of the 27th European Conference on Information Systems. Stockholm, Sweden.

insights into a related, but different, intra-organizational interface, namely the business-IT interface, we adopt IT governance mechanisms (Brown 1999; Wu et al. 2015) as an analytical framework for an in-depth analysis of bimodal IT organizations. The notion of mechanisms (structural, procedural, and relational) has proved useful to structure organizations' measures to organize their inner workings (de Haes and van Grembergen 2004; Peterson et al. 2000). Thus, we ask:

Which structural, procedural, and relational governance mechanisms are employed in bimodal IT organizations, and how do these mechanisms relate to challenges associated with organizational ambidexterity?

To address this research gap, we study four bimodal IT organization cases and their internal governance mechanisms following an analytical-inductive approach (Carroll and Swatman 2000; Eisenhardt 1989): a) a law enforcement agency, b) a multi-national automotive company, c) a manufacturing company specialized in medical aids, and d) a multi-national medical technology company. The four cases represent distinct organizational contexts, providing the opportunity for rich insights. Further, we use ancillary insights from three other organizations to substantiate our emerging theorizing (Urquhart 2013). We analyze the collected data from 34 interviews in two subsequent coding cycles using grounded theory techniques (Glaser and Strauss 2017). Constantly comparing our emerging theoretical insights from the data with the literature streams on IT ambidexterity and IT governance, we gradually increase the abstraction level in our emerging theory of IT governance mechanisms in bimodal IT organizations (Grover and Lyytinen 2015).

Our paper presents three major findings. First, we identify challenges associated with bimodal IT organizations. Corroborating and explicating previous work on bimodal IT organizations' longitudinal progression and their challenges, we differentiate three states of bimodal IT organizations (Haffke et al. 2017): *formation*, *coordination*, and *reintegration*. From the specific situations of our cases, we show that bimodal IT organizations pose challenges in each of the three states. Second, we identify structural, procedural, and relational governance mechanisms used within bimodal IT organizations. Thereby, we structure our observations according to the three states and elucidate how the governance mechanisms relate to challenges. Third, we identify and describe five novel governance paradoxes of bimodal IT organizations that emerged as core concepts from this research. In our cases, we observed that IT governance

mechanisms entail positive and negative implications. Thus, IT governance mechanisms lead to managerial tensions that express the underlying paradoxes of bimodal IT organizations (Gregory et al. 2015; Smith and Lewis 2011). Specifically, we posit the following paradoxes: *strategic vision* (flexibility vs. predictability), *alignment* (business/IT vs. IT/IT), *organization* (simplicity vs. complexity), *distinction* (comparability vs. differentiation), and *collaboration* (integration vs. autonomy). These five paradoxes concretize the overarching strategic paradox of IT ambidexterity in the specific context of bimodal IT organizations. Thus, we provide a deeper understanding of paradoxes, governance mechanisms, and their interrelation in bimodal IT organizations. Our work may serve as a starting point for stronger theorizing and recommendations for the successful management of paradoxes in bimodal IT organizations.

Keywords: IT governance mechanisms, bimodal IT, paradox theory,
             IT ambidexterity, multiple case study.

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A Contingency Lens on
Cloud Provider Management Processes[10]

Authors

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Extended Abstract

Provider management in information technology (IT) outsourcing projects generally describes a client's activities to plan, control, coordinate, and maintain provider relationships (Balaji and Brown 2005). The management of IT outsourcing relationships is an important topic in IS research owing to its ambivalent effects on such projects' success (Ruzzier et al. 2008). Provider management is constantly changing owing to new management approaches or emerging technological concepts (Wiedemann and Wiesche 2018). One emerging technological concept that has altered the fundamental characteristics of IT service provisioning over the past decades is cloud computing (Keller et al. 2019; Xiao and Hedman 2019).

Cloud computing is an IT provisioning form in which pooled IT resources are offered to users in a flexible and scalable way. In contrast to traditional on-premise IT solutions, cloud computing requires no long-term financial investments and, in most cases, little to none IT-specific knowledge (Armbrust et al. 2010; Marston et al. 2011). Because the use of cloud services can reduce IT expenditures while enabling new business opportunities (Etro 2009; Marston et al. 2011), cloud computing is attractive to IT managers (Fahmideh et al. 2018; Xiao and Hedman 2019). However, the shift from IT-as-a-product to IT-as-a-service makes enterprise cloud clients constantly dependent on their cloud service provider. Thus, the use of cloud services requires an altered way to manage such relationships, because traditional ways of managing IT service providers are no longer applicable. Unmanaged relationships between cloud service providers and users can lead to an even stronger dependency by client companies on their cloud service provider and can lead to lock-ins. Although there are first approaches regarding specific aspects of the management of cloud providers, the literature lacks a holistic framework that addresses all phases of such a relationship.

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[10] At the time of publication of this thesis, this essay is in the review process of a scientific journal. Thus, I provide an extended abstract that covers the essay's content.

The literature has also neglected the specific realities of the client-provider relationship, which are mostly discontinuous and context-specific. Our research objective is:

To strengthen the scientific discourse about managing relationships between providers and clients, we seek to structure the existing knowledge on the management of cloud computing providers and to provide a process framework for cloud service provider management.

To address our research objective, we develop a process framework for managing cloud computing providers based on the literature and 12 interviews with 16 industry experts. The resulting framework illustrates 10 processes from the client perspective that cope with CSP management. Further, we identify salient factors of the client-provider relationship by drawing on contingency theory and juxtaposing two contrasting cases from our interview study. We elucidate three preliminary contingencies – client-provider ratio, specificity, and service delivery model – that describe the reality of client-provider interactions in cloud service provisioning. Thus, we contribute to the theoretical discourse about cloud governance, specifically in the context of cloud service provider management. Further, from a practical perspective, our study supports companies that plan to capitalize on cloud technologies. Companies can use our process framework to professionally manage their relationship with cloud service providers over the entire cloud service lifecycle (i.e. from the pre-contract to the post-contract phase).

Keywords: Cloud computing, cloud sourcing, IT sourcing, provider management, contingency theory, interview study.

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When Your Thing Won't Behave:
Security Governance in the Internet of Things[11]

Authors

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Extended Abstract

The Internet of Things (IoT) constitutes a new paradigm, with interconnected smart things enabling new products and services in a blended physical and digital world. Smart things inherit IT security risks from their digital component, emphasizing them via IoT-specific vulnerabilities such as physical representation, connectivity, or the use of technology platforms (TPs). In IoT, TPs describe a tangible (e.g. hardware) or intangible (e.g. standards) general-purpose technology that is shared between different smart things. While TPs are evolving rapidly owing to their functional and economic benefits, yet this is partly to the detriment of security and governance, which cannot keep pace with technological development, as several recent IoT security incidents demonstrate.

We address this problem by explaining the situation's dynamics with a risk quantification approach from platforms in the automotive industry (Kang et al. 2015). We define an IoT platform as any component type (hardware, software, or standard) that is shared between smart things. We regard a smart thing as the product, which is a "previously nondigital physical artifact" (Yoo et al. 2012, p. 1399) that is now equipped with digital technology (Yoo et al. 2012). We consider an IoT model to be a type of smart thing that is based on a specific TP. This implies that different IoT models' physical shapes can vary substantially. We consider an IoT unit as one specific smart thing.

Further, we transfer the concepts of TP defect and failure (Kang et al. 2015) to the specifics of TPs in IoT. We follow Howard and Longstaff's (1998) classification and draw on the notion of vulnerability and exploit, to account for the IS specifics of TPs. A vulnerability is "a weakness [in the design, implementation, or configuration] of a system allowing unauthorized action." (Howard and Longstaff 1998, p. 14). An exploit

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[11] At the time of publication of this thesis, this essay is in the review process of a scientific journal. Thus, I provide an extended abstract that covers the essay's content.

is a successful "group of attacks that can be distinguished from other attacks because of the distinctiveness of the attackers, attacks, objectives, sites, and timing." (Howard and Longstaff 1998, p. 15). An attack is a combination of vulnerabilities, tools, actions, targets, and unauthorized results (Howard and Longstaff 1998). Analogous to Kang et al.'s (2015) definition of a defect, a vulnerability refers to a flawed design. Thus, an exploit constitutes a manifestation of a vulnerability of the IoT TP.

Using the parameters of correlation between different models of a TP (homogeneity/heterogeneity), vulnerability probability, exploit probability, platform size, and TP connectivity, we outline and discuss the implications for security risks of TP use in IoT. We argue that these parameters should be considered in IoT governance decisions and should delineate governance implications. We distinguish the following levels for IoT governance measures: the individual level (i.e. professional or private end-users of smart things); the supplier company level (i.e. companies developing the TP), the manufacturer company level (i.e. companies adopting the TP in their smart things), and the regulatory level (i.e. policymakers, regulators, and authorities).

Based on the parameters' impacts, we then identify several potential governance measures at the individual, company, and regulatory levels. For instance, from the individual perspective, IoT TPs are often not apparent, limiting the potential governance measures to increasing awareness and security-focused behaviors. However, we see the need for stronger collaboration at the company and regulatory levels to find an appropriate balance between regulation and open IoT interfaces. This is especially challenging, considering the requirement for international regulation frameworks owing to a global IoT.

We provide initial evidence on promising governance measures for IoT TPs, contributing to the descriptive body of knowledge by elucidating TP use in IoT as well as the associated risks. By transferring Kang et al.'s (2015) risk quantification approach from the automotive industry, we explain the situation's dynamics by addressing "the underlying causal structure of the theory." (Meredith et al. 1989, p. 303). We outline which parameters of TPs affect the risks of TP use in IoT and delineate governance implications. Thus, we help to reveal the relevant cause-and-effect relationships, which individuals, companies, and regulators can incorporate for sound risk assessments.

Keywords: Internet of Things, IT governance, IT security, risk quantification.

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