Juggling the Paradoxes - Governance Mechanisms in Bimodal IT Organizations

by

Jan Jöhnk, Severin Oesterle, Till J. Winkler[1], Jacob Nørbjerg[1], Nils Urbach

[1] Copenhagen Business School (CBS)

Universität Augsburg University

UNIVERSITÄT BAYREUTH

JUGGLING THE PARADOXES – GOVERNANCE MECHANISMS IN BIMODAL IT ORGANIZATIONS

Research paper

Jöhnk, Jan, Project Group Business & Information Systems Engineering of the
 Fraunhofer FIT, Bayreuth, Germany, jan.joehnk@fim-rc.de

Oesterle, Severin, FIM Research Center, University of Bayreuth, Germany,
 severin.oesterle@fim-rc.de

Winkler, Till J., Copenhagen Business School, Denmark, winkler@cbs.dk

Nørbjerg, Jacob, Copenhagen Business School, Denmark, jno.digi@cbs.dk

Urbach, Nils, Project Group Business & Information Systems Engineering of the
 Fraunhofer FIT, University of Bayreuth, Germany, nils.urbach@fim-rc.de

Abstract

The fundamental changes associated with digitalization demand businesses and public enterprises to balance exploitative and explorative capabilities in their internal IT function. One approach to balance these paradoxical demands is the adoption of twofold organizational structures often referred to as bimodal IT. While the IS literature has made recent advances in the description and analysis of bimodal organization structures, we still lack a deeper understanding of the inner workings within bimodal IT organizations and the potential tensions between traditional and agile IT. To address this research gap, we adopt IT governance mechanisms as an analytical framework to study two bimodal IT organization cases, one at a law enforcement agency and the other at an automotive company. We analyze data collected through fourteen semi-structured interviews using grounded theory techniques. We first identify challenges associated with the implementation of and the coordination within organization's bimodal IT organizations. We then identify the structural, procedural, and relational governance mechanisms used within these organizations and elucidate how they relate to the categories of challenges. Finally, we identify and describe five novel governance paradoxes of bimodal IT organizations that emerged as core concepts from this research. Theoretical contributions and practical implications are discussed.

Keywords: IT governance mechanisms, Bimodal IT, Paradox theory, IT ambidexterity, Multiple case study.

1   Introduction

The fundamental changes widely associated with digitalization, such as the emergence of smart, digital technologies, the shortening of traditional product life cycles, and the rise of new information technology (IT)-enabled business models, demand businesses and public agencies to find new ways of organizing their internal IT functions (Horlach et al., 2016). The dynamic technological environment puts pressures on IT functions to evaluate new digital options, develop innovative IT solutions, and flexibly adapt to ever-changing business demands. At the same time, IT functions must deliver on their traditional role of managing increasingly complex IT infrastructures and providing adequate IT services at high levels of efficiency, stability, and regulatory compliance.

The Information Systems (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 for IT functions to become ambidextrous is the adoption of twofold organizational structures, in practice often referred to as bimodal IT (Horlach et al., 2016), which can nowadays be found within the IT functions at both businesses and public enterprises. 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).

The IS literature has made recent advances in the description and analysis of bimodal organization structures and provided, amongst others, a classification of different archetypes (Haffke et al., 2017a) as well as challenges of bimodal IT organizations (Horlach et al., 2016). However, the literature still lacks a deeper understanding of the inner workings of bimodal IT organizations and the potential tensions in-between traditional and agile IT modes. Under the premise that IS research has provided ample 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) for an in-depth analysis of two bimodal IT organizations. The notion of mechanisms (structural, procedural, and relational) has proved useful to study organizational boundary issues, which is why we adopt this framework to structure our analysis of bimodal IT organizations. Specifically, 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?*

Based on the study of two cases of bimodal IT organizations, one at a law enforcement agency and the other one at an automotive company, and using grounded theory analysis techniques, we first identify challenges associated with the implementation of and the coordination within organization's bimodal IT organization. We then identify the structural, procedural, and relational governance mechanisms used within these organizations and elucidate how they relate to the categories of challenges. Specifically, our axial coding leads us to distinguish between mechanisms that create governance challenges and those employed by the organizations to resolve these governance challenges in bimodal IT organizations. During the subsequent synthesis of our results, we identify tensions resulting from seemingly contradictory governance mechanisms in our cases. We discuss a conceptual model that summarizes these findings (Figure 1).

Our key contribution is twofold. First, this paper advances research on bimodal IT organizations by drilling into and elucidating the governance mechanisms used in different bimodal archetypes and their effects on coping with the bimodal IT organization challenges. Second, we identify and describe five novel paradoxes in bimodal IT organizations that emerged as core concepts from this research: the strategic vision paradox (flexibility vs. predictability), the alignment paradox (business/IT vs. IT/IT), the organization paradox (simplicity vs. complexity), the distinction paradox (comparability vs. differentiation), and the collaboration paradox (integration vs. autonomy). The following sections describe in detail the background literature, method, and findings of this research, before we highlight these contributions in the light of the broader IS literature. Overall, we conclude that our study furthers research on contemporary bimodal IT organization designs.

2 Background

2.1 Bimodal IT organizations

Pursuing efficiency and flexibility is crucial for maintaining the competitive advantage of companies in the long run (Kortmann et al., 2014). To achieve such seemingly contrary objectives, companies adopt organizational forms that are often portrayed as bimodal IT organizations (Haffke et al., 2017b). The term bimodal itself is attributed to analysts at the market research company Gartner who coined it in 2014 and defined it as "*the practice of managing two separate but coherent styles of work: one focused on predictability; the other on exploration*" (Gartner, 2015). Other consultancy companies followed

with similar concepts, including two-speed IT and two-state IT. In this paper, we use the term bimodal IT for its wide recognition by the practitioner and academic audience.

Bimodal IT divides the IT function into two separate modes (Haffke et al., 2017a). ***Mode 1*** (traditional IT) of bimodal IT emphasizes exploitative capabilities, striving for stability, reliability, efficiency, and long-term planning. Therefore, mode 1 is especially suited for predictable, low-risk, and well-known environments (Horlach et al., 2016). In contrast, ***mode 2*** (agile IT) depicts explorative capabilities, focusing on flexibility, innovativeness and experimentation, time-to-market, and customer needs (Haffke et al., 2017a). Thereby, mode 2 is designated for volatile, uncertain, complex and ambiguous environments. In addition to the differences of mode 1 and mode 2 in terms of their general nature, objectives, and overall context, the two modes also carry different interpretations in terms of business integration and development approaches (Horlach et al., 2017). While business involvement in the application lifecycle in mode 1 is usually limited, mode 2 often strives for strong interaction between business and IT. Moreover, mode 1 generally follows a sequential proceeding (e.g., waterfall model), while mode 2 operates in iterations and increments (e.g., agile methods like Scrum).

Although the concept of bimodal IT is popular among practitioners, research on bimodal IT is still in its infancy (Horlach et al., 2016). Some researchers have investigated organizational structures of bimodal IT. Haffke et al. (2017a) distinguish four archetypes of bimodal IT organizations, focusing on the structural separation of traditional and agile IT. *Archetype A* is characterized by an IT function that chooses between traditional and agile IT on a project-by-project basis. *Archetype B* refers to the subdivision of the IT function into two separated teams, one for agile IT and the other for traditional IT orchestrated within the same department. *Archetype C* comprises two completely distinct IT divisions, structurally separating traditional and agile IT in different departments. In comparison with archetype B, archetype C establishes agile IT outside the traditional IT function to distinguish both modes and their respective capabilities even clearer. *Archetype D* describes the reintegration of traditional and agile IT to form one common IT function again. Similarly, Horlach et al. (2017) differentiate five archetypes of bimodal IT organizations, considering additional distinguishing criteria besides the structural separation, for example, reach, role of outsourcing, and control of agile IT. In line with our research question, we use the classification of Haffke et al. (2017a) in the following for its stronger focus on the internal IT function as well as the emphasis on structural differences between the bimodal IT archetypes.

Summarizing, bimodal IT organizations have the potential to effectively use dual IT structures as a reaction to altered or new requirements of companies. Yet, the concept is not without critique, especially for its radical structural divide and the potential challenges arising from this divide. We address these challenges in the subsequent section.

2.2 Challenges of bimodal IT organizations

Based on prior research, we derive two preliminary categories of challenges for bimodal IT organizations, in the following referred to as transformational challenges and operational challenges. The two categories differentiate challenges resulting from the initial implementation from challenges during continuous coordination. Thereby, we account for the longitudinal development of bimodal IT organizations and their challenges.

Transformational challenges comprise the structural changes and subsequent internal disruptions of bimodal IT organizations, for example, adaptations in leadership, roles and responsibilities, or IT governance (Haffke et al., 2017a). Transformational challenges can result from the initial introduction of bimodal IT, subsequent transitions between the archetypes of bimodal IT organizations, or the reintegration of bimodal IT. Moreover, companies may choose to move beyond the archetypes of bimodal IT organizations and adopt multimodal organizational designs (Jöhnk et al., 2017). While we focus on bimodal IT and its distinct paradoxes, such multimodal designs increase companies' room for maneuver and thus, pose additional transformation challenges.

Operational challenges result from the implementation of a specific bimodal IT organization and its coordination during operational execution. For instance, the distribution of decision rights or the prioritization and allocation of resources across traditional and agile IT often cause conflicts in bimodal IT

organizations (Haffke et al., 2017a). Moreover, business/IT alignment poses new coordination challenges, because companies must differentiate and "triangularly align the traditional mode, the agile mode and the business" (Haffke et al., 2017a, p. 103). Thus, business/IT alignment in bimodal IT organizations must also take the interdependencies between systems and operations of traditional and agile IT into account. Moreover, operation challenges can result from the collaboration (or lack thereof) between traditional and agile IT. This comprises a fundamental cultural divide (Haffke et al., 2017a) as well as more particular problems like a lack of knowledge sharing or internal rivalry (de Clercq et al., 2014; Tushman and O'Reilly, 1996).

Transformational and operational challenges imply tensions between the two fundamentally different, yet co-existing modes in bimodal organizations. Therefore, the categorization of transformational and operational challenges guides our data collection and analysis process. Furthermore, two theoretical concepts appear most appropriate for our analysis of challenges in bimodal IT organizations: ambidexterity and governance mechanisms, which we elucidate in the following.

2.3 Paradoxes and ambidexterity in organizational studies

The paradox concept offers a useful lens for the study of how bimodal IT organizations manage the seemingly incongruent traditional and agile IT modalities. A paradox can be defined as *a combination of "elements that seem logical individually but inconsistent and even absurd when juxtaposed"* (Smith and Lewis, 2011, p. 386). Paradoxes constitute persistent tensions between conflicting choices which are "two sides of the same coin" (Lewis, 2000, p. 761). This emphasizes the interdependent nature of tensions, demanding for a joint elaboration rather than a solution (Schad et al., 2016). Thus, companies must embrace paradoxes, which "require[s] problem solving and creative thinking about how opposing elements can logically or meaningfully coexists" (Gregory et al., 2015, p. 59).

A growing stream of research in organizational research sees ambidexterity as a response to address seemingly paradoxical forces (Benner and Tushman, 2003; Smith and Lewis, 2011). Ambidexterity can be viewed as the capability to pursue exploitation and exploration simultaneously (O'Reilly and Tushman, 2008). Organizations often struggle with the task of embracing both, exploitative and explorative activities. They risk overemphasizing one objective at the disadvantage of the other (He and Wong, 2004). Therefore, it is necessary to find a way to combine both in order to achieve and sustain competitive success (Cao et al., 2009). However, exploitation and exploration differ in strategy, structure, processes, and cultures (O'Reilly and Tushman, 2004). Existing research has investigated the concept of ambidexterity and its management in organizations since the 1970s (Birkinshaw and Gupta, 2013; Duncan, 1976). Recently, research on bimodal IT organizations adopted ambidexterity to describe the paradoxical tensions and their implications between traditional IT, i.e. the exploitative mode of ambidexterity, and agile IT, i.e. the explorative mode of ambidexterity (Jöhnk et al., 2017). This research aims to extend this line of thought by adopting ambidexterity as a theoretical lens for our subsequent analysis.

2.4 Governance mechanisms

We conflate challenges and corresponding governance mechanisms in our analysis. This joint examination embraces the paradoxes of bimodal IT organizations because IT governance has to account for "a variety of sometimes conflicting internal and external factors" (de Haes and van Grembergen, 2004, p. 1). Generally speaking, the effective use of IT in companies is dependent on IT governance (Buchwald et al., 2014). We follow the definition of IT governance as "*the leadership and organizational structures, processes and relational mechanisms that ensure that an organization's IT sustains and extends its strategy and objectives*" (de Haes and van Grembergen, 2004, p. 1). IT governance assists in achieving overarching strategic goals of companies by means of IT (Weill and Ross, 2004).

Previous research on organizational anchoring of decision-making authority (Brown and Grant, 2005; Magnusson et al., 2015) distinguishes between centralized, decentralized, and federal decision rights. A centralized IT governance bundles all decision-making authority and emphasizes efficient operations, profitability, economies of scale, control and standards. A decentralized IT governance distributes deci-

sion rights to individual units to increase customer orientation and responsiveness while reducing constraints on innovativeness or creativity at the same time. Finally, federal or hybrid configuration aim to balance centralization and decentralization to combine the benefits of both (Weill and Ross, 2005). Thus, thinking in paradoxes is inherent to the study of IT governance.

In addition to decision-making authority, governance mechanisms are an important means for coordinating IT functions (Peterson et al., 2000). Drawing on de Haes and van Grembergen (2004) as well as the precursory work of Peterson et al. (2002), we focus on structural, procedural, and relational mechanism as a means to implement IT governance in bimodal IT organizations. ***Structural mechanisms*** are formal in nature and facilitate communication, prioritization, and decision-making between business and IT, for example, meetings and committees, roles and responsibilities, or organizational structure (de Haes and van Grembergen, 2004). While the ideal organization structure depends on a variety of factors, research suggests that organizational structures are a suitable instrument to improve the balance between exploration and exploitation (Benner and Tushman, 2003). ***Procedural mechanisms*** are measures to institutionalize IT decision-making and IT monitoring procedures, for example, strategic planning meetings, IT balanced scorecards, service level agreements, or maturity models (de Haes and van Grembergen, 2004). Thus, procedural mechanisms seek to integrate strategic and operational functions for clear IT decision-making and IT monitoring processes (Peterson et al., 2002). ***Relational mechanisms*** are less formal, describing the participation, partnerships, and collaboration between executives, business management, and IT management, for example, co-location, cross-functional training and job rotation, shared understanding, or stakeholder involvement (de Haes and van Grembergen, 2004). Such relational mechanism, while being rather implicit, are of "primordial importance" (van Grembergen and de Haes, 2005, p. 5), because structural and procedural mechanisms are dependent on a joint commitment and understanding of the stakeholders involved.

Bimodal IT organizations require specific governance mechanisms to manage the aforementioned challenges (Haffke et al., 2017a). Prior research provided initial insights on the allocation of decision rights in bimodal IT organizations by means of structural configurations (Haffke et al., 2017a; Horlach et al., 2017; Jöhnk et al., 2017). However, research still lacks specific insights into governance mechanisms adopted by bimodal IT organizations to address the paradoxical challenges. This motivated our research.

3 Method

We used a qualitative-empirical research approach to investigate challenges and governance mechanisms in bimodal IT organizations. In general, qualitative-empirical research develops a deeper understanding and generate new insights (Bettis et al., 2015). We conducted a multiple case study following an analytical-inductive approach (Carroll and Swatman, 2000; Eisenhardt, 1989) and built a tentative theory of IT governance mechanisms in bimodal IT organizations. We aimed to uncover the essence of our cases from an informed researcher perspective (VanWynsberghe and Khan, 2007) and extend the current understanding of ambidexterity in bimodal IT organizations (Grover and Lyytinen, 2015).

We analyzed two cases of bimodal IT organizations, one at a law enforcement agency (LawIT) and another at a multi-national automotive company (AutoIT). The two cases represent distinct organizational contexts, providing the opportunity for rich insights. In total, we conducted fourteen semi-structured interviews with employees of both case companies, six of them at LawIT and another eight interviews at AutoIT (Table 1). We recorded all interviews with the interviewees' consent and transcribed the interviews to allow for rigorous data analysis.

Our semi-structured interview guide contained a brief introduction to the research project and research team, followed by the interviewees' introduction comprising their position and background. Subsequently, we asked the interviewees to share their understanding of bimodal IT organizations in general as well as regarding their specific organizational context. Furthermore, we asked the interviewees to describe the coordination and collaboration within their bimodal IT organization. By constantly comparing our data with the emerging theoretical insights (Glaser and Strauss, 2017) and utilizing our preliminary understanding of IT governance mechanisms, later interviews were especially catered to gain a more thorough understanding of the challenges and corresponding governance mechanisms in bimodal

IT organizations. In the sense of a purposive snowball sampling approach, we also asked the interviewees to provide us with further contacts and secondary documentation material if applicable.

Case Company	Interviewee	Role of the Interviewee	Type	Duration
Law Enforcement	LawIT 1	IT Portfolio Manager	Personal	100 min
	LawIT 2	Program Manager	Personal	56 min
	LawIT 3	Product Owner	Personal	51 min
	LawIT 4	Head of Software Development	Personal	55 min
	LawIT 5	Chief Product Owner	Phone	53 min
	LawIT 6	Chief of Development	Phone	57 min
Automotive	AutoIT 1	Manager Backend & Apps – R&D	Personal	31 min
	AutoIT 2	Product Development – Marketing & IT	Phone	43 min
	AutoIT 3	Head of Department – Marketing & IT	Personal	38 min
	AutoIT 4	Manager e-commerce – Marketing & IT	Personal	50 min
	AutoIT 5	Manager IT Architecture, IT Security – IT	Personal	32 min
	AutoIT 6	Manager IT Infrastructure – IT	Personal	44 min
	AutoIT 7	CEO – Incubator	Personal	33 min
	AutoIT 8	Manager Marketing Aftersales – IT	Personal	49 min

Table 1.   Overview of the conducted interviews

We analyzed the transcripts of the total 692 interview minutes in three subsequent coding rounds using grounded theory analysis techniques. In line with Glaser and Strauss (2017), we conducted an initial open coding round in which two independent coders analyzed two interviews individually in order to harmonize the initial code set and align the coding procedure afterwards. After consolidation of the code sets, we continued the coding procedure with 24 categories and 196 subcategories. Using this consolidated code set, we performed a second open coding round with the remaining twelve interviews. After this round, we again merged similar code categories, subcategories, and codes resulting in a total of 1,015 codified statements in 22 categories and 359 subcategories. For instance, we coded the statement "*[…] because I have a good network*" as *success factor for collaboration business/IT*, in the subcategory *increase collaboration business/IT*, and in category *collaboration business/IT*. In the spirit of theoretical sensitivity, we discussed theoretical insights of paradoxes and governance mechanisms during the open coding procedures.

In a third step, we then performed axial coding, which identifies relationships among open codes for the purpose of theory development (Corbin and Strauss, 2015). For instance, we coded the statement mentioned before as indicator for a relational coping governance mechanism "*facilitate informal communication and strategic dialogue (e.g., as essential part of project prioritization)*". This step led us to reassemble our codified statements to more abstract core concepts from which we derived our eleven challenges and twelve governance mechanisms of bimodal IT organizations. During data analysis, we used the insights from additional internal documents we had received, such as board presentations and reports, to contextualize and interpret our interview findings. The supplementary documents provided details on the general strategy and the specific organizational setup in the case organizations. Based on our data analysis, we steadily and iteratively mapped the impeding and coping governance mechanisms. In joint discussions, we identified dependencies between these governance mechanisms which we grouped as five governance paradoxes of bimodal IT organizations (Figure 1). Thereby, we exposed contradictions from our data, vividly describing the tensions between mode 1 and mode 2.

4   Findings

4.1   Case profiles and characterization of bimodal IT organizations

Our first case, LawIT, is the corporate IT function of a governmental executive authority. The governmental authority has defined IT as one of its strategic areas. LawIT comprises more than 350 employees

who develop, maintain, and operate different systems and handle projects such as application development for citizens and police officers, similar to any other corporate IT function. Few years ago, the software development team started a bottom-up initiative toward using agile methods, and the responsible ministry decided to sponsor a large-scale agile application development program with the defined goal to develop a number of mobile apps for the police force and the general public. Since then, LawIT has institutionalized app software development in two Scrum teams. Thus, we consider LawIT as a structurally divided IT function in which the app software development teams work in an agile way, whereas the other teams operate and maintain services, but also develop other projects in a traditional waterfall-driven approach. According to Haffke et al. (2017a), we classify LawIT as *archetype B: sub-divisional bimodal IT.*

Our second case, AutoIT, is an IT function with approximately 250 employees concerned with developing and operating marketing and sales-oriented systems at a multi-national car manufacturer. The company produces and sells premium cars and commercial vehicles, and offers services such as fleet management, financing, leasing, and insurance. In addition to this, the company has recently begun to innovate in mobility services. Besides supporting the company in the development of innovative services in these growth segments, AutoIT has to manage a large number of legacy systems. To cope with current challenges of digital transformation, the overarching digitalization strategy is incorporated in a company-wide roadmap which is also part of the company's overall strategy to facilitate the required cultural change. While the IT functions at this car manufacturer is structured in various different forms, AutoIT was built up as a separate division to provide highly innovative services and products at the interface of marketing and IT. Hence, we classify AutoIT primarily as *archetype C: divisionally separated bimodal IT* according to the classification of Haffke et al. (2017a).

4.2   Challenges of bimodal IT organizations

We now elaborate the challenges of bimodal IT organizations that we found in the two cases. Generally, we found support for the two preliminary categories of challenges derived from the literature, i.e. transformational challenges and operational challenges. Table 2 provides an overview of challenges mentioned by the interviewees. We identified five categories of transformational challenges and six operational challenges in the two cases.

The first *transformational challenge* concerns the need to ***engage in a comprehensive organizational transformation***. This means that the implementation of a bimodal IT organization requires more than just the incorporation of an agile working team into a broader organizational context. It requires a shift on different organizational levels, including structure, processes, and culture. On a structural level, organizations need to implement new reporting mechanisms to deal with bimodal IT functions and to evaluate them. "*Measurement variables make sense, or agreed targets make sense, but they have to be the right targets, and I do not think we have them consistently today*" (AutoIT 4). Bimodal IT functions also need to rethink and change existing processes that span traditional and agile IT, otherwise they run the risk that traditional and agile IT may hinder each other. "*The processes are just as they are and sometimes, far too slow for what we would need*" (AutoIT 4). Cultural issues have to be tackled as well. Bimodal IT organizations need not only to prepare their business functions, but also their different IT teams to cope with the upcoming challenges. "*I believe the people who have worked for many years in traditional IT are optimized to live the process we have given ourselves and to fill it up perfectly*" (AutoIT 3). "*I just say, these agile projects often have higher visibility or are just easier to sell than a traditional project, there you will have to pay a little attention that everyone comes to his right*" (AutoIT 8).

Second, it is challenging for bimodal IT functions to ***choose the right initial design of bimodal IT organization*** most suitable to achieve the set targets. This is challenging, because there are many different options, as illustrated by the different archetypes in Haffke et al. (2017a). For example, LawIT chose to implement a subdivisional bimodal IT archetype only after some consideration. "*In the beginning, this did not start as a program. Personally, I wanted it to start as a program, but we had hoped that all the necessary prerequisites for running an app project like today's would be done right from the*

start" (LawIT 3). Third, we identified the ***delimitation of the scope of traditional and agile IT*** as a transformational challenge. IT functions should be aware that 'agile only' often does not work. "*I also believe that the more physical you become and the closer you are to the vehicle, the less agile you can work. I mean you cannot build a house in an agile way. Hence, I think as soon as it becomes physical, agile becomes really difficult*" (AutoIT 4).

Fourth, it is challenging for organizations to gain the ***necessary mindset towards openness to change***. The implementation of a bimodal IT function challenges business and IT functions equally. We found that business functions often regard IT functions as service centers where the business buys a service. "*Usually business brings the money, and then bringing in this agile idea is not always easy, because there is the expectation, 'watch out, I somehow bring half a million here, I want to know what I get for it and when'*" (AutoIT 4). In addition, organizations have to realize that agile IT is associated with some uncertainty, which differs greatly from traditional IT. "*The approach that I have in this context is entirely different from that in traditional IT with waterfall; because I have to deal with uncertainty, structurally, systematically, and processual; whereas I don't have this uncertainty in traditional IT*" (AutoIT 2). Fifth, ***provisioning of the required skills and competencies*** for a bimodal IT organization is a transformational challenge. The agile way of working requires team settings in which a broad variety of knowledge and skills exist. Therefore, in agile IT, business and IT staff work together jointly. Furthermore, the demands on IT staff in bimodal IT organizations are changing towards a more general understanding of IT combined with expert knowledge in one specific field. "*IT staff must have a vast cross-sectional knowledge. In IT infrastructure we call this T-shape profiles, which means, they must have one or they should have one characteristic in an infrastructure area in which they are specialized, but they should also have know-how about all infrastructure components, so that, when a business partner has a question the business partner can talk only to one person and not to one for the network, one for the server, one for the storage, one for the middleware, and so on*" (AutoIT 6).

Transformational Challenges Implementing bimodal IT organizations	• Engaging in a comprehensive organizational transformation • Choosing the right initial design of bimodal IT organization • Delimitating the scope of traditional and agile IT • Fostering the necessary mindset towards openness to change • Providing the required skills and competencies in staffing
Operational Challenges Coordinating bimodal IT organizations	• Prioritizing across traditional and agile IT portfolios • Allocating resources effectively and efficiently • Overcoming technical barriers in IT infrastructure and operations • Resolving day-to-day conflicts of bimodal IT organizations • Measuring performance and output sensibly • Cultivating and sustaining the open and conducive mindset

Table 2.   Challenges of bimodal IT organizations

Transformational and operational challenges are interconnected although separate in time. For instance, the transformational challenges, and the way an organization deals with them may influence the operational challenges during the ongoing coordination of bimodal IT organizations. The first operational challenge refers to the ***prioritization across traditional and agile IT portfolios***. Within bimodal IT organizations, a constant project reprioritization takes place due to changing management, or in the case of LawIT governmental, demands. "*A monthly reprioritization takes place because there is just so much. It is also frustrating wildly because people feel they are sent in each direction all the time, and back and forth between projects*" (LawIT 1). Second, the ***effective and efficient allocation of resources*** is a challenge. The constant negotiations on prioritization result in a frequent reallocation of staff and resources. "*Phew, it is a nightmare! We are spending thousands of hours allocating and reallocating people to the projects*" (LawIT 4). This can lead to inefficient allocation processes where allocation decisions no longer based on skills, but on free capacity.

Third, we identified ***technical barriers in IT infrastructure and operations*** as a challenge. During operation, there are many technical barriers between the different IT teams. Dependencies between agile

and traditional IT exist in almost every project. However, the speed of the two modes differs which leads to conflicts. "*And then there are such central functions for authentication, authorization, which are sometimes very strict, and their process has to be adhered to*" (AutoIT 8). Furthermore, another technical barrier is fixed releases which frustrate agile IT. "*Two releases a year are incredibly frustrating for the team in the long run*" (AutoIT 3). Fourth, **day-to-day conflicts of bimodal IT organizations** constitute an ongoing operational challenge. For example, traditional IT has to fight the sentiment that they are old-fashioned and not up-to-date. "*One might also think that the IT department was the dumbest in the world. It was for sure that if you could not find a job somewhere else, you could always be sent to IT because nothing will happen*" (LawIT 1). In particular, there are problems of collaboration if the agile IT function is divisionally separated. "*An employee of the legal entity is not allowed to talk to an IT infrastructure employee unless an IT service employee is present and sets the appointment, that is nonsense*" (AutoIT 4).

Fifth, we identified the **measurement of performance and output** as a challenge. Bimodal IT organizations struggle when they have to define proper evaluation and measurement criteria for agile IT. Furthermore, due to uncertainty in agile projects, the output and results are hard to estimate ex-ante. "*I cannot really say when the product will be ready and that is something we find incredibly difficult in the group*" (AutoIT 4). Sixth, we identified the challenge of **cultivating and sustaining the open and conducive mindset**. Cultural tensions do not only arise when implementing a bimodal IT organization, but also during operation. This challenge refers to the extent of how business and agile IT, as well as agile and traditional IT, collaborate and work together in daily business. "*There are some concerns about the agile development because we are now actually trying to expand this method to other domains*" (LawIT 4). "*Agility does not mean chaos, but actually means much, much more. To get stringency in small iterations and to actually get it demanded and to make everything possible is extremely exhausting*" (AutoIT 1).

4.3 Governance mechanisms in bimodal IT organizations

We identified two categories of governance mechanisms during our axial coding procedure, **impeding governance mechanisms** and **coping governance mechanisms**. Impeding governance mechanisms create or aggravate the challenges of bimodal IT organizations. Coping governance mechanisms help resolving the challenges of bimodal IT organizations. We applied the structural, procedural, and relational

	Structural	Procedural	Relational
Transformational	• Diluted and distributed strategic vision (e.g., a variety of strategy documents) • Increased organizational complexity (e.g., additional coordination units) • Presence of multiple, overlapping committees	• Processes without equal participation of business and IT • Lagging existing processes (e.g., IT infrastructure provisioning)	• Delivering on specific goals instead of incorporating a joint understanding for agile IT
Operational	• Contradictory decisions from different committees (e.g., varying decision focus) • Non-conscious assignment of roles (e.g., only based on free capacity, experience, or personal influence) • Structural divide (e.g., separate legal entities) or technical separation (e.g., different development environments) hamper collaboration	• Internal restrictions and strict procedures (e.g., communication regulations, fixed release cycles, or lengthy approvals) • Insufficient project portfolio management (e.g., missing overview of projects) • Distractions due to incessant reprioritization and subsequent reallocation	• Inconsistent handling of project deviations • Limiting interaction between traditional and agile IT to documentation rather than collaboration • Hand-over from agile IT to traditional IT lacks trust and a joint understanding

Table 3.   Impeding governance mechanisms in bimodal IT organizations

governance mechanisms (de Haes and van Grembergen, 2004; Wu et al., 2015) to these two categories of challenges. Thus, we categorize the governance mechanisms found in our analysis and identify the relevant fields of action for bimodal IT organizations.

Table 3 summarizes our case findings on impeding governance mechanisms. For instance, the structural impeding governance mechanism "*diluted and distributed strategic vision (e.g., variety of strategy documents)*" may create transformational challenges (e.g., engaging in a comprehensive organizational transformation) because it impedes a clear strategic vision for implementing a bimodal IT organization.

Table 4 synthesizes our results concerning coping governance mechanisms in bimodal IT organizations. For example, the structural coping governance mechanism "*use a separate legal entity to externalize risks of agile IT*" resolve transformational challenges (e.g., choosing the right initial design of bimodal IT organization) because it is a way to free agile IT from its organizational context, providing autonomy and limiting the consequences of its potential failure for the rest of the company.

	Structural	Procedural	Relational
Transformational	• Use a separate legal entity to externalize risks of agile IT • Align agile IT with over-arching strategy (e.g., break initiative down to projects) • Close strategic alignment gaps in IT committee (e.g., prioritization decisions) • Limit the scope of agile IT (e.g., no new or backend functions)	• Incorporate traditional and agile IT into a common master plan • Define tailored goals and measures for agile IT • Understand procedural mechanisms for agile IT as evolutionary (i.e. converging towards a moving target)	• Communication of strategic vision and responsibilities to activate cultural multipliers • Obtain management attention and support (e.g., CIO involvement to speed up IT infrastructure processes) • Facilitate change in discussions with management • Actively involve traditional and agile IT in transformation
Operational	• Use dedicated units or meetings to ensure collaboration between both modes (e.g., change team) • Allocate dedicated resources to agile IT and reserve fixed traditional IT resources in advance (e.g., work agreements) • Institutionalize knowledge sharing across both modes (e.g., spreading new technology insights) • Reflect on roles and responsibilities to identify gaps (e.g., dedicated governance meetings) • Institutionalize creative spaces (e.g., Google Friday) • Actively address tensions between traditional and agile IT in major committees	• Integrate agile IT increments in overarching organizational planning processes • Synchronize agile IT release planning with traditional IT capacities • Separate prioritization of each mode • Combine participatory decision-making (e.g., bottom-up advise for management) and autonomy (e.g., independent decisions based on strategic direction) • Define clear IT architecture specifications to foster independence and integration	• Co-location of business, traditional, and agile IT • Facilitate informal communication and strategic dialogue (e.g., as essential part of project prioritization) • Foster joint understanding and trust for mutual service provisioning (e.g., equal appreciation for both modes) • Respect scope boundaries and incremental approach of agile IT • Continuously request adherence to strategic prioritization in daily business • Incorporate constant evaluation of the overall transformation progress and organizational learning

Table 4.   Coping governance mechanisms in bimodal IT organizations

5 Discussion

5.1 Governance paradoxes of bimodal IT organizations

Our grounded theory-inspired paired case analysis was motivated by the need for a deeper understanding of the inner workings and the potential tensions within bimodal IT organizations. Figure 1 summarizes the challenges, the governance mechanisms, and their interdependencies that we identified in our data analysis and elucidated on before. Instead of reiterating through the findings of impeding and coping governance mechanisms, we organize our discussion along five paradoxes of bimodal IT organizations, that emerge from our analysis.
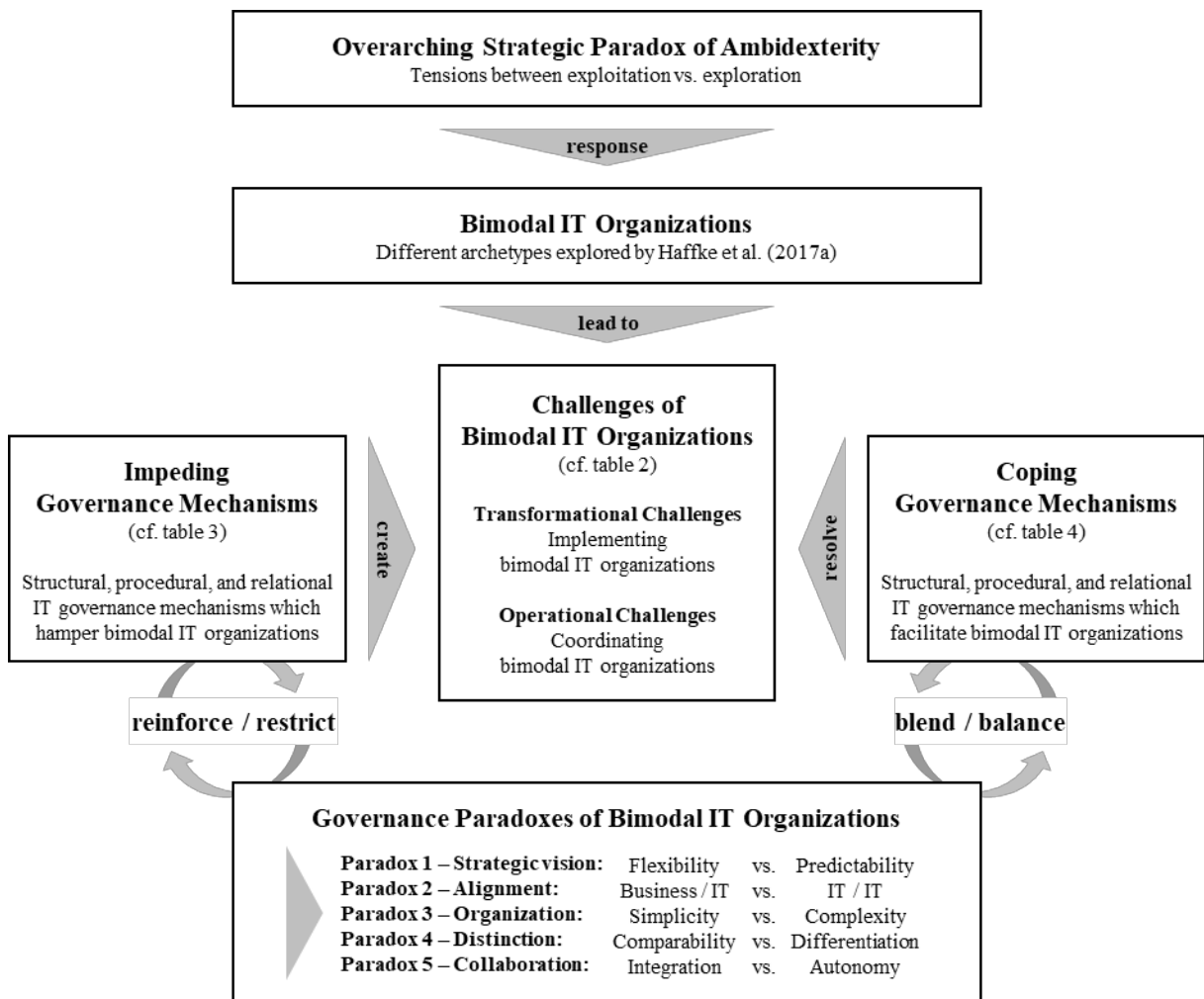

Figure 1. Interdependencies of challenges, governance mechanisms, and paradoxes

Both cases, LawIT and AutoIT, were exposed to the overarching strategic paradox of **exploitation vs. exploration,** which is why they established a bimodal IT organization. The analysis of our cases then put forth five additional paradoxes of bimodal IT organizations, which are the synthesis of seemingly contradictory governance mechanisms in our cases. For instance, the impeding governance mechanism "*increased organizational complexity (e.g., additional coordination units)*" and the coping governance mechanism "*use dedicated units or meetings to ensure collaboration of traditional and agile IT (e.g., change team)*" express such a seeming contradiction. During our iterative analysis, we constantly considered the underlying statements of our interviewees to ensure verisimilitude of our interpretation.

Paradox 1, the tensions of strategic vision between ***flexibility vs. predictability***, expresses the conflicting expectations associated with agile IT. In our cases, boundary conditions, expectations of management and business, or internal processes imposed a need for predictability and planning on agile IT. This is contrasting the flexibility agile approaches require and provide for companies.

Paradox 2 comprises the tensions of alignment between ***business/IT vs. IT/IT***. While bimodal IT organizations aim to increase business/IT alignment, this is partly to the detriment of the alignment between traditional and agile IT due to their structural separation.

Paradox 3 describes organizational tensions between ***simplicity vs. complexity***. Although agile IT wants to achieve simplicity in processes and solutions, bimodal IT organizations also increase complexity at the same time. Additional coordination units, dual reporting and decision-making structures are examples for such increased complexity.

Paradox 4 constitutes the distinction between traditional and agile IT, resulting from tensions between ***comparability vs. differentiation***. On the one hand, our cases show patterns to make traditional and agile IT comparable by, for example, utilizing similar performance measures. On the other hand, the underlying goal of agile IT is to actually be different in order to be successful.

Finally, paradox 5 addresses the collaboration of agile IT with business and traditional IT, comprising tensions between ***integration vs. autonomy***. While autonomy is a core value and success factor of agile approaches, our cases show tendencies to (optionally or mandatorily) restrict agile IT, for example, to facilitate the integration of agile IT's output in IT operations within traditional IT.

Governance mechanisms and paradoxes exhibit dynamics in their interrelation in our cases. Gregory et al. (2015) identify two different approaches to manage paradoxes in IT transformation program ambidexterity. First, blending the paradoxes describes the process of finding a solution which reveals a paradox as "harmoniously combinable" (Gregory et al., 2015, p. 75). Second, balancing the paradoxes is the practice of managing a paradox by means of compromising. Our findings confirm the managerial responses of blending and balancing for coping governance mechanisms in bimodal IT organizations. In addition to that, we see two other dynamics influencing paradoxes in bimodal IT organizations, namely ***reinforcing*** and ***restricting effects***.

Impeding governance mechanisms with a reinforcing effect emphasize the paradoxical nature of tensions in bimodal IT organizations. For instance, "*contradictory decisions from different committees*" can reinforce paradox 2 (business/IT vs. IT/IT) when one decision-making body focuses primarily on business and the other one primarily on IT concerns, neglecting the triangular alignment of business, traditional and agile IT. The restricting effect of impeding governance mechanisms is less radical but also negative in its consequences because it hampers the active response to paradoxical demands in bimodal IT organizations. The impeding governance mechanism "*internal restrictions and strict procedures*" is an example for a restricting effect on paradox 5 (integration vs. autonomy). Either internal restrictions curtail the autonomy of agile IT but facilitate integration (e.g., strict IT security requirements) or internal restrictions hamper the integration (e.g., technical separation like different development environments). Thus, bimodal IT organizations must juggle the paradoxes taking blending and balancing effects as well as reinforcing and restricting effects into account. There is no magic bullet to governance mechanisms in bimodal IT organizations owing to the effects' dynamics. The same governance mechanism may differ in its proportion of creating or resolving the challenges of bimodal IT organizations depending on the specific organizational context.

5.2   Theoretical contribution

The findings of our two cases contribute to a deeper understanding of the relevant concepts for the successful transformation and operation of bimodal IT organizations. More specifically, we synthesize insights on challenges, governance mechanisms, paradoxes, and their interdependencies from our cases. Thereby, our contribution to the existing body of knowledge is threefold. First, this research demonstrates how to use the concept of governance mechanisms (de Haes and van Grembergen, 2004; Wu et al., 2015) to study a related but different domain, i.e. bimodal IT organizations. Second, our five paradoxes extend the existing literature on bimodal IT organizations (e.g., Haffke et al., 2017a) by specifying

the overarching strategic paradox of ambidexterity and formalizing the paradoxical tensions within bimodal IT organizations. Third, past research on paradoxes of ambidexterity emphasized blending and balancing managerial responses (Gregory et al., 2015). We extend this perspective with reinforcing and restricting effects, which describe the dynamics between impeding governance mechanisms and paradoxes in bimodal IT organizations. Overall, our work may serve as a starting point for stronger theorizing and recommendations for the successful management of paradoxes in bimodal IT organizations.

5.3 Practical implications

Our research also provides practical implications for challenges and governance mechanisms in bimodal IT organizations. IT decision makers can utilize our findings to consider the descriptive overview of challenges for their own IT function's transformation and the subsequent coordination of their bimodal IT organizations. This understanding assists IT managers in assessing potential pitfalls and acting on them proactively. To respond to transformational and operational challenges of bimodal IT organizations, IT managers should abrogate impeding governance mechanisms on the one hand and foster coping governance mechanisms on the other hand. Thereby, practitioners can use our results as a sound baseline of suitable actions which they can adapt to their specific organizational context to manage bimodal IT organizations successfully.

5.4 Limitations

Our research is subject to limitations which stimulate further research. First, our sample is limited to two case companies, which differ greatly in terms of their bimodal IT organization, organizational and environmental context. While this high variance in our data enables us to gain a comprehensive understanding of challenges, governance mechanisms, and paradoxes in bimodal IT organizations, comparisons between our case companies should be considered with caution. Hence, future research could validate and extend our findings by means of theoretical sampling (Glaser and Strauss, 2017) to include, among others, other bimodal IT organization archetypes and different industries. Second, we see initial evidence for contingency factors influencing the described interdependencies, for example, company and IT size, existing organizational culture, degree of external service provisioning, or industry specifics. A more detailed investigation of such contingency factors bears the potential to develop context-dependent recommendations for governance mechanisms. Third, bimodal IT organizations are part of a dynamic environment and thus, not static structures but subject to constant transformation (Haffke et al., 2017a). Therefore, future work could investigate the longitudinal development and their specific measures taken to progress from impeding to coping governance mechanisms as well as addressing the complex relationships of the included theoretical concepts.

6 Conclusion

Bimodal IT organizations constitute a potential response to the challenges of digital transformation and the overarching strategic paradox of IT ambidexterity, i.e. the combination of exploitation and exploration. Based on a multiple case study with two companies and grounded theory analysis techniques, we identify challenges of implementing and coordinating bimodal IT organizations. Thereby, we provide a deeper understanding of paradoxes, governance mechanisms, and their interrelation in bimodal IT organizations. Building on this understanding, we identify and describe five additional paradoxes, i.e. strategic vision, alignment, organization, distance, and collaboration paradox. These five paradoxes concretize the overarching strategic paradox of IT ambidexterity in specific context of bimodal IT organizations. Moreover, we identify various governance mechanisms, which create and aggravate (impeding governance mechanisms) or resolve (coping governance mechanisms) the challenges of bimodal IT organizations. Finally, we discuss these findings in light of the interdependencies between challenges, governance mechanisms, and paradoxes. Specifically, we extend the managerial responses of blending and balancing from to include reinforcing and restricting effects as well.

References

Benner, M. J. and M. L. Tushman (2003). "Exploitation, Exploration, and Process Management: The Productivity Dilemma Revisited." *Academy of Management Review* 28 (2), 238–256.

Bettis, R. A., A. Gambardella, C. Helfat and W. Mitchell (2015). "Qualitative Empirical Research in Strategic Management." *Strategic Management Journal* 36 (5), 637–639.

Birkinshaw, J. and K. Gupta (2013). "Clarifying the Distinctive Contribution of Ambidexterity to the Field of Organization Studies." *The Academy of Management Perspectives* 27 (4), 287–298.

Brown, A. E. and G. G. Grant (2005). "Framing the Frameworks: A Review of IT Governance Research." *Communications of the Association for Information Systems* 15, 696–712.

Brown, C. V. (1999). "Horizontal Mechanisms under Differing IS Organization Contexts." *MIS Quarterly* 23 (3), 421–454.

Buchwald, A., N. Urbach and F. Ahlemann (2014). "Business Value through Controlled IT – Towards an Integrated Model of IT Governance Success and its Impact." *Journal of Information Technology* 29 (2), 128–147.

Cao, Q., E. Gedajlovic and H. Zhang (2009). "Unpacking Organizational Ambidexterity: Dimensions, Contingencies, and Synergistic Effects." *Organization Science* 20 (4), 781–796.

Carroll, J. M. and P. A. Swatman (2000). "Structured-case: a methodological framework for building theory in information systems research." *European Journal of Information Systems* 9 (4), 235–242.

Corbin, J. M. and A. L. Strauss (2015). *Basics of qualitative research:* Techniques and procedures for developing grounded theory. Fourth edition. Los Angeles, London, New Delhi, Singapore, Washington DC, Boston: SAGE.

de Clercq, D., N. Thongpapanl and D. Dimov (2014). "Contextual ambidexterity in SMEs: The roles of internal and external rivalry." *Small Business Economics* 42 (1), 191–205.

de Haes, S. and W. van Grembergen (2004). "IT Governance and Its Mechanisms." *Information Systems Control Journal* 1, 1–7.

Duncan, R. B. (1976). "The ambidextrous organization: Designing dual structures for innovation." *The Management of Organizational Design* 1, 167–188.

Eisenhardt, K. M. (1989). "Building Theories from Case Study Research." *Academy of Management Review* 14 (4), 532–550.

Galliers, R. D. (2006). "Strategizing for Agility: Confronting Information Systems Inflexibility in Dynamic Environments." In: *The Transfer and Diffusion of Information Technology for Organizational Resilience: IFIP TC8 WG 8.6 International Working Conference, June 7-10, 2006, Galway, Ireland.* 1st Edition. Ed. by B. Donnellan, T. J. Larsen, L. Levine and J. I. DeGross. Berlin: Springer US, p. 1–15.

Gartner (2015). *Gartner IT-Glossary: Bimodal.* URL: https://www.gartner.com/it-glossary/bimodal/ (visited on 03/01/2018).

Glaser, B. G. and A. L. Strauss (2017). *The discovery of grounded theory:* Strategies for qualitative research. Abingdon: Routledge.

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

Grover, V. and K. Lyytinen (2015). "New State of Play in Information Systems Research: The Push to the Edges." *MIS Quarterly* 39 (2), 271–296.

Haffke, I., B. Kalgovas and A. Benlian (2017a). "Options for Transforming the IT Function Using Bimodal IT." *MIS Quarterly Executive* 16 (2), 101–120.

Haffke, I., B. Kalgovas and A. Benlian (2017b). "The Transformative Role of Bimodal IT in an Era of Digital Business." In: *50th Annual Hawaii International Conference on System Sciences*, p. 5460–5469.

He, Z.-L. and P.-K. Wong (2004). "Exploration vs. Exploitation: An Empirical Test of the Ambidexterity Hypothesis." *Organization Science* 15 (4), 481–494.

Horlach, B., P. Drews and I. Schirmer (2016). "Bimodal IT: Business-IT Alignment in the Age of Digital Transformation." In: *Multikonferenz Wirtschaftsinformatik (MKWI)*, p. 1417–1428.

Horlach, B., P. Drews, I. Schirmer and T. Böhmann (2017). "Increasing the Agility of IT Delivery: Five Types of Bimodal IT Organization." In: *50th Hawaii International Conference on System Sciences*, p. 5420–5429.

Jöhnk, J., M. Röglinger, M. Thimmel and N. Urbach (2017). "How to Implement Agile IT Setups: A Taxonomy of Design Options." In: *25th European Conference on Information Systems (ECIS)*, p. 1521–1535.

Kortmann, S., C. Gelhard, C. Zimmermann and F. T. Piller (2014). "Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities." *Journal of Operations Management* 32 (7-8), 475–490.

Leidner, D. E., J. Lo and D. Preston (2011). "An empirical investigation of the relationship of IS strategy with firm performance." *The Journal of Strategic Information Systems* 20 (4), 419–437.

Lewis, M. W. (2000). "Exploring Paradox: Toward a More Comprehensive Guide." *The Academy of Management Review* 25 (4), 760.

Magnusson, J., U. Ask and A. Nilsson (2015). "Ambidexterity and Paradexterity: A typology of IT Governance contradictions." In: *20th Americas Conference on Information Systems (AMCIS)*, p. 1–10.

March, J. G. (1991). "Exploration and Exploitation in Organizational Learning." *Organization Science* 2 (1), 71–87.

O'Reilly, C. A. and M. L. Tushman (2004). "The Ambidextrous Organization." *Harvard Business Review* (April 2004), 74–81.

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

Peterson, R., M. Parker and P. M. A. Ribbers (2002). "Information Technology Governance Processes Under Environmental Dynamism: Investigating Competing Theories of Decision Making and Knowledge Sharing." In: *23rd International Conference on Information Systems (ICIS)*, p. 563–572.

Peterson, R. R., R. O'Callaghan and P. M. A. Ribbers (2000). "Information Technology Governance by Design: Investigating Hybrid Configurations and Integration Mechanisms." In: *21st International Conference on Information Systems (ICIS)*, p. 435–452.

Raisch, S. and J. Birkinshaw (2008). "Organizational Ambidexterity: Antecedents, Outcomes, and Moderators." *Journal of Management* 34 (3), 375–409.

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

Smith, W. K. and M. W. Lewis (2011). "Toward a Theory of Paradox: A Dynamic Equilibrium Model of Organizing." *The Academy of Management Review* 36 (2), 381–403.

Tushman, M. L. and C. A. O'Reilly (1996). "Ambidextrous Organizations: Managing Evolutionary and Revolutionary Change." *California Management Review* 38 (4), 8–30.

van Grembergen, W. and S. de Haes (2005). "Measuring and Improving IT Governance Through the Balanced Scorecard." *Information Systems Control Journal* (2), 1–8.

VanWynsberghe, R. and S. Khan (2007). "Redefining Case Study." *International Journal of Qualitative Methods* 6 (2), 80–94.

Weill, P. and J. Ross (2005). "A Matrixed Approach to Designing IT Governance." *MIT Sloan Management Review* 46 (2), 26–34.

Weill, P. and J. W. Ross (2004). "IT Governance on One Page." *Center for Information Systems Research* 349, 1–15.

Wu, S. P.-J., D. W. Straub and T.-P. Liang (2015). "How Information Technology Governance Mechanisms and Strategic Alignment Influence Organizational Performance: Insights from a Matched Survey of Business and IT Managers." *MIS Quarterly* 39 (2), 497–518.