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Managing paradoxes in bi-modal information technology functions: A multi-case study

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Abstract

Leveraging digital technologies is a major concern for companies and has significant implications for their information technology (IT) functions. In many cases, a bi-modal IT function is established: a 'traditional IT' mode focusing on the stability and exploitation of existing IT resources and an 'agile IT' mode focusing on exploring new technologies. Whereas previous research has predominantly taken an organisational-level view of bi-modal IT by treating it as a single, aggregated entity, we provide a micro-foundations perspective on the intricate and paradoxical interrelationships between the two IT modes. Based on a multi-case study with companies from different industries and of varying sizes, we uncover nine core tensions between traditional IT and agile IT as manifestations of five underlying paradoxes. We also identify corresponding management practices to address these tensions and paradoxes. Our study contributes to Information Systems research by *disaggregating* bi-modal IT and capturing the tensions and their underlying paradoxes at the organisational *and* individual levels that bi-modal IT entails. By highlighting the intricate interdependencies between the traditional and agile IT modes, we show that bi-modal IT can be messier and more contested than previously anticipated. For practitioners, our study offers an overview of paradoxes and tensions that

may arise in bi-modal IT settings and provides suggestions on how to manage them.

1 | INTRODUCTION

Across all sectors, companies are increasingly offering products and services that are embodied in digital technologies or enabled by them, often leading to fundamental shifts in value creation and value capture (Legner et al., 2017; Matt et al., 2015; Wessel et al., 2021). The information technology (IT) function has become the core driver of such transformational shifts due to its focus on technology, which has become indispensable for any business or innovation activity (Urbach et al., 2017). Expectations towards the IT function have increased, as it is still considered a cost center focused on 'keeping the lights on', while additionally assuming the task of driving activities to digitise products, processes, or even business models (Benlian & Haffke, 2016; Haffke et al., 2017a). To meet these expectations, many companies have adopted the concept of bi-modal IT consisting of two different IT modes within one company: a 'traditional IT' mode (mode 1), which optimises for safe and steady operations, and an 'agile IT' mode (mode 2), which strives for fast innovation (Horlach et al., 2016). Gartner (2015) showed that in 2014, 45% of Chief Information Officers (CIOs) affirmed that their organisations' IT functions had a 'second, fast mode of operation', and that the percentage was expected to rise. Similarly, McKinsey & Company affirmed 'two-speed IT' as a requirement for companies to fully harness the business opportunities of digital technologies (Bossert et al., 2014). This was confirmed by Sebastian et al. (2017), who showed that for all 25 companies they studied, bi-modal IT was a prerequisite to exploit the potentials of novel digital technologies. With bi-modal, IT driving complexity and change in organisations, paradoxes—contradictory yet interrelated elements—have emerged, and researchers have observed tensions as manifestations of such paradoxes (Schad et al., 2016; Wimelius et al., 2020). Indeed, 80% of the senior information systems (IS) managers surveyed by Teubner and Ehnes (2018) agreed that both IT modes would co-exist in the future and that the interrelationships between them were and would be challenging. With the IT function being the core engine of IT-enabled business transformations (Wessel et al., 2021), however, tensions between the traditional and agile IT modes may cause this engine to stall and for transformation processes to come to a complete standstill. Against this background, it is of critical importance for research and practice to understand such tensions and their underlying paradoxes, as well as the practices that help manage them.

Previous research on bi-modal IT has primarily focused on describing different archetypes of bi-modal IT and the ways in which they are set up, while only anecdotally pointing to potential tensions arising from splitting the IT function into two modes (e.g., Haffke et al., 2017a; Horlach et al., 2017; Joehnk et al., 2017). However, while providing valuable insights for further studies, research still largely treats bi-modal IT as an aggregate concept without looking into the interactions and tensions within bi-modal IT—namely, between the traditional and agile IT modes—thus taking a purely organisational-level view of the phenomenon. This comes as a surprise, given that bi-modal IT is, per definition, based on two very different IT modes. Joehnk et al. (2019) echoed this shortcoming, as they uncovered governance paradoxes, tensions, and practices on an organisational level while calling for more nuanced research into lower-level bi-modal IT paradoxes.

With our study, we want to address this and related calls for a deeper analysis of how to manage paradoxes in bi-modal IT—a form of ambidextrous IT (Gregory et al., 2015; Montealegre et al., 2019). We, therefore, follow the emergent micro-foundations research movement, which aims to unpack collective concepts by understanding how individual-level factors, and interactions between individual- and organisational-level variables, impact organisations

(Felin et al., 2015). In doing so, we aim to zoom in on bi-modal IT by (1) identifying emergent tensions, (2) shedding light on the underlying *individual- and organisational-level* paradoxes, and (3) uncovering adequate practices to manage them. Thus, we ask the following research questions:

RQ1. What tensions emerge due to bi-modal IT, and how are they related to the underlying individual- and organisational-level paradoxes?

RQ2. How do IS practitioners manage these tensions and paradoxes?

To provide answers to our research questions, we drew on a paradox theoretical lens and conducted an interpretive multi-case study (Keutel et al., 2014; Sarker et al., 2018) with nine different companies from various industries and of different sizes.

Our study contributes to IS research in three important ways. First, we advance the conversation from taking a purely organisational-level view of bi-modal IT to a micro-foundational perspective that seeks to understand *both* organisational- *and* individual-level phenomena and how they relate to each other. By treating the traditional and agile IT modes in bi-modal IT as separate units rather than as a single entity, as has largely been the case (Haffke et al., 2017a; Horlach et al., 2017), we are able to uncover between-mode tensions and their underlying paradoxes that exist at multiple levels. Second, through this shift in perspective, we identify novel individual-level tensions and paradoxes that have been largely overlooked in bi-modal IT research. In response to previous calls for research (Putnam et al., 2016; Schad et al., 2016), we particularly highlight the importance of emotional tensions—such as envy, resentment, or fear—as critical manifestations of the underlying individual-level paradoxes. Third, by responding to calls for more research into the 'real-world' intricacies of IT ambidexterity (Gregory et al., 2015; Montealegre et al., 2019), we contribute by challenging the prevailing notion that separating exploitation and exploration of the IT function is a straightforward solution (O'Reilly & Tushman, 2013), as we reveal what problematic knock-on effects the separation can have in actuality. In addition to our research contributions, we provide practical implications for IS practitioners by offering an overview of potential tensions that may arise between the traditional and agile IT modes, and by revealing how these tensions can be remedied using managerial practices (Peppard et al., 2014).

In the following section, we present the conceptual background of our study and related research on bi-modal IT as a form of ambidextrous IT. We then introduce the paradox theoretical lens guiding our research. Next, we outline our interpretive multi-case study approach and present our results, which is followed by a discussion of our findings and a depiction of avenues for future research.

2 | CONCEPTUAL BACKGROUND

2.1 | Bi-modal IT as a form of IT ambidexterity

The IT function plays an essential role in leveraging digital technologies to create and capture business value, often having to transform itself to be able to sense and seize new digital opportunities (Hess et al., 2016; Vial, 2019). Researchers are unanimous in calling such a transformation of the IT function a paradigm shift, as it increasingly moves from being a pure service provider with a reactive posture to an innovator that proactively enables new value propositions in cooperation with business units (Benlian, 2013; Peppard, 2016; Vithayathil, 2018). For example, Sebastian et al. (2017) showed that across all 25 cases studied, the IT function offered 'technology and business capabilities that ensure the efficiency, scalability, reliability, quality, and predictability of core operations', while ramping up 'the technology and business capabilities that facilitate rapid development and implementation of digital innovations' (Sebastian et al., 2017, pp. 201, 203).

These simultaneous yet opposing demands placed on IT functions resonate with the concept of ambidexterity, that is, the challenge of allocating limited resources between the 'exploration of new possibilities' and the 'exploitation of old certainties' (March, 1991). Indeed, organisations that manage this challenge and balance exploration with exploitation achieve better financial performance than organisations focusing on only one of these two aspects (Hughes, 2018; O'Reilly & Tushman, 2013). While companies use several different approaches for the transformation of their IT functions, an increasingly prevalent concept to incorporate diverging demands is bi-modal IT, a form of ambidextrous IT (Haffke et al., 2017a).

Bi-modal IT, a term initially coined by the market research firm Gartner (2015), establishes two different IT modes within one company to respond to heterogeneous requirements, and both modes are essential in creating substantial value (Gartner, 2015). The two modes usually differ in various aspects. Mode 1, referred to as 'traditional IT', is optimised for areas that are more predictable and well understood. It focuses on IT exploitation; thus, it runs on the established IT infrastructure and IT architecture and avoids risks by optimising reliability, stability, and security (Horlach et al., 2016). Traditional management and IT governance principles are applied (e.g., waterfall-driven approaches in software development), and an IT-centric culture, remote from the customer, is prevalent, leading to a slow speed of delivery (Haffke et al., 2017b; Leonhardt et al., 2017). In contrast, mode 2, referred to as 'agile IT', is exploratory, involves experimentation to solve new problems, and is optimised for areas of uncertainty. It focuses on IT exploration and is responsible for fast consumer-facing digital innovations, emphasising agility, and speed (Haffke et al., 2017a). Cross-functional, co-located teams (e.g., including employees from business units) employ iterative approaches, such as agile software development (Benlian, 2022; Mueller & Benlian, 2023), to deliver services and products in weeks, while a business-centric culture is emphasised (Horlach et al., 2016).

Previous studies have shown how bi-modal IT has been set up in practice, deriving different organisational archetypes, such as a project-by-project separation of the two modes, a sub-divisional bi-modal IT, or a divisional separation of the two IT modes (Haffke et al., 2017a, 2017b). Further research extended this high-level view of archetypes by adding additional dimensions (e.g., data governance, outsourcing state) to the bi-modal IT archetypes (Andersen et al., 2017; Horlach et al., 2017). Follow-up studies have largely focused on the novel agile IT mode with digital labs or digital innovation units as a recent topic in both research and practice, and as a manifestation of an organizationally separated agile IT mode (e.g., Barthel et al., 2020; Fuchs et al., 2019; Joehnk et al., 2017; Raabe et al., 2020). These archetypes fit the common pathway for organisations to become ambidextrous through structural ambidexterity—organising exploration and exploitation in separate units (Tushman et al., 2010). Finally, Joehnk et al. (2019) uncovered tensions, paradoxes, and practices that were exclusively related to governance on an organisational level between the two modes, which they considered a starting point for more nuanced research on how to manage tensions and address paradoxes in bi-modal IT.

From our review of the literature on bi-modal IT (see Table A.1 in the Appendix), we highlight two salient, interrelated issues that have remained largely unexplored. First, previous research studies on bi-modal IT have predominantly looked at the concept from an organisational-level view and have theoretically and empirically collapsed bi-modal IT into a single aggregate concept, even though it is based on two very different modes (Überbacher, 2014). Such accounts have largely overlooked problematizing the interrelationships between the two modes in bi-modal IT. Second, there is a lack of research on the tensions within bi-modal IT between mode 1 and mode 2. The few studies that have looked into relationships between both modes and their related tensions have focused on a purely organisational-level view (Joehnk et al., 2019), yet to date, they have largely ignored the micro-foundations of bi-modal IT.

The study of micro-foundations is an emerging research movement in management that seeks potential micro-explanations of aggregated macro-concepts or outcomes, emphasising the need to examine bottom-up influences and emergence (Foss & Linder, 2019). Looking into the micro-foundations has been a 'reaction to an over-emphasis on collective constructs, as well as the seeming disregard for individual-level and social interactional considerations in explaining organizational outcomes' (Felin et al., 2015, p. 582). Accordingly, while not denying that collective constructs and macro-variables (e.g., on an organisational level) have explanatory relevance (Barney & Felin, 2013; Little, 1991), an emphasis on micro-foundations aims to bring individuals back into the equation as a foundation to

better understand micro- *and* macro-level phenomena. Indeed, research in related areas has shown that an understanding of micro-elements (e.g., individuals) can lead to a more rigorous understanding of the macro-(e.g., organisational) level, for example, of agility (Crick & Chew, 2020), ambidexterity (Rogan & Mors, 2014), and also paradoxes (Miron-Spektor et al., 2018).

From this perspective, we run two major risks in bi-modal IT research if micro-foundations are ignored. First, we omit important individual-level tensions and paradoxes and thus paint an incomplete picture of the intricacies in bi-modal IT. Second, we cannot theoretically grasp the dynamic cross-level interdependencies among tensions, paradoxes, and the corresponding management responses. With this in mind, we introduce the paradox concept below to serve as a theoretical lens through which we unpack the micro-foundations of bi-modal IT.

2.2 | Paradoxes as a theoretical lens for unpacking bi-modal IT

The IS research has seen growing interest in paradoxes in recent years, with digital transformation fostering turbulent environments with competing demands (Danneels & Viaene, 2022). Indeed, with the proliferation and intensification of digital technology use, IT functions are urged to embrace IT exploration while sustaining their IT exploitation. Since the simultaneous pursuit of IT exploration and IT exploitation is contradictory yet necessary (Andriopoulos & Lewis, 2009), IT ambidexterity aligns well with Smith and Lewis' (2011, p. 382) definition of a paradox, as it consists of 'contradictory yet interrelated elements that exist simultaneously and persist over time'. The elements (i.e., IT exploration and IT exploitation) seem logical individually, but absurd when juxtaposed, and hence this creates seemingly irrational situations and tensions with almost impossible choices (Putnam et al., 2016). Accordingly, a paradox theoretical perspective lends itself to uncovering the conflicts and contradictions in the relationships between two opposing elements, such as IT exploitation and IT exploration.

The most widespread categorization of paradoxes in the literature includes four types that represent the core activities and elements of organisations: *learning* (knowledge), *organising* (processes), *performing* (goals), and *belonging* (identity/interpersonal relationships; Lewis, 2000; Luescher & Lewis, 2008). Following Smith and Lewis (2011), *learning* paradoxes occur as dynamic systems change, renew, and innovate. *Learning* paradoxes refer to contradictory efforts to build upon and destroy existing capabilities and knowledge to create the future, including radical versus incremental innovation or episodic versus continuous change in organisations (Smith & Lewis, 2011). *Organising* paradoxes are contradictions that surface in competing structures or processes. A contradiction might be empowerment versus direction, for instance, when self-managed teams, designed to be autonomous, have to follow executive mandates (Luescher & Lewis, 2008). *Performing* paradoxes are the result of a plurality of stakeholders in organisations that seek and foster competing goals (Smith & Lewis, 2011; Soh et al., 2019). Such a paradox arose, for instance, in a newspaper corporation between internal stakeholders (journalists) following gatekeeping practices to maintain legitimacy and external stakeholders looking for participation (e.g., reader-contributed content creation; Thorén et al., 2018). Finally, *belonging* paradoxes relate to different identities on or across individual and collective levels, with competing yet co-existing values, roles, and memberships (Smith & Lewis, 2011). Examples include competing identities that emerge among priests, creating tensions between their professional role and their sense of self (Kreiner et al., 2006). These *belonging* paradoxes have been less researched and often relegated to the background, as they are less evident and more implicit than the other three paradox types (Schad et al., 2016).

While paradoxes as abstract concepts usually remain latent and less tangible in organisations, they become salient and express themselves in tensions, which can then also be dealt with by actors (Johansen, 2019; Wimelius et al., 2020). For example, tensions might be related to *learning*, *organising*, and *performing* paradoxes, as they manifest in contradictory processes, goals, and structures, while tensions related to *belonging* paradoxes are less visible and often surface in emotional responses (Andriopoulos & Gotsi, 2017; Keller & Chen, 2017). Understanding the latter, however, has remained relatively vague, as researchers often view paradoxes from a rationalist perspective, largely ignoring emotional conflicts and tensions (Miron-Spektor et al., 2018; Putnam et al., 2016). Some studies have

shown that paradoxes can indeed generate emotions such as anger, resentment, or discomfort, notably in situations of belonging paradoxes (Dubé & Robey, 2009; Zheng et al., 2011), leading to burnout and even health issues in some cases (Johansen, 2019). Putnam et al. (2016) thus posit that a better understanding of emotions is necessary to grasp paradoxes and their outcomes more comprehensively.

Despite such calls for a more holistic view of paradoxes, we still know little about emotional tensions as manifestations of paradoxes at the individual level, especially in IT ambidexterity research, as our literature review reveals (see Table A.2 in the Appendix). For example, Gregory et al. (2015) studied IT transformation programme ambidexterity and identified six paradoxes, such as IT programme agility versus IT project stability, focusing on *organising* and *performing* paradoxes at the organisational level. Similarly, Montealegre et al. (2019) examined digital infrastructure ambidexterity from an organisational capabilities perspective and highlighted *learning* and *performing* paradoxes (e.g., digital infrastructures as potentially saving resources versus as a distraction that can drain resources). To the best of our knowledge, Joehnk et al.'s (2019) study is the only one to date that has shed light on paradoxes in bi-modal IT. Focusing exclusively on organisational-level tensions, they uncovered five governance paradoxes of bi-modal IT organisations (e.g., simplicity of agile IT versus complexity due to extra reporting and coordination) that can be related to the *performing* and *organising* paradox types. Taken together, while previous research has yielded valuable findings by showing that IT ambidexterity entails a complex set of tensions and paradoxes, it has focused primarily on a single level (i.e., the organisational level) and on *organising*, *performing*, and *learning* paradoxes, neglecting individual-level tensions and paradoxes (i.e., belonging paradoxes) and their cross-level implications.

It is important to note here that even though a paradox involves a dynamic relationship between contradictory elements, it is impervious to resolution (Schad et al., 2016). However, paradoxes still necessitate responses, as they can be detrimental if not recognised or appropriately managed, which can lead to vicious cycles with reinforcing feedback loops (Aubert et al., 2015). Even if paradoxes cannot be definitively resolved, they can be addressed by managing their manifestations in tensions (Johansen, 2019). In this regard, scholars have identified two main practices for managing tensions and their underlying paradoxes: *integration* and *differentiation*. Integration refers to emphasising connections and interdependencies and even capturing synergies between the contradictory elements. Differentiation emphasises the distinctions between the elements and their unique characteristics and acknowledges them (Smith, 2014). Both practices are complementary, and the simultaneous or successive employment of these practices is not uncommon.

By using paradoxes as a theoretical lens and the micro-foundations perspective, we embark on our investigation of emerging tensions and paradoxes at the individual and organisational levels, the differentiation and integration practices by which they can be managed, and the interrelations between paradoxes and practices on different levels.

3 | RESEARCH METHODOLOGY

We draw on an interpretive multi-case study approach to examine our research questions for several reasons. First, our understanding of bi-modal IT—the interactions between the two modes, in particular—is still very limited, and an interpretive case study approach is useful for generating insights into new research areas (Walsham, 1995). Second, interpretive case studies enable us to study the phenomenon in a real-life setting close to actual IS practitioners. This is important, as we also aim to investigate individual-level tensions, paradoxes, and practices to manage them; hence, we will examine nuanced aspects based on subjective realities (Trauth, 2013). Thus, we place ourselves within the tradition of social constructivism as our research philosophy (Sarker et al., 2013, 2018). Finally, following previous multi-case studies (e.g., Bunduchi, 2005; Kranz et al., 2016), we conducted our research on various unrelated cases to increase the comprehensiveness of the collection of the tensions that could be uncovered. Hence, we paused after each case to analyse and code the case data before beginning with the next case and increased the number of cases until we discovered no new

theoretical insights, thus reaching saturation (Keutel et al., 2014; Stake, 2005). In terms of the research design, we followed the interpretive research principles of Klein and Myers (1999; see Table A.3 in the Appendix).

3.1 | Selection of cases and interviewees

We employed purposeful sampling and selected companies if they fulfilled the following three filter criteria (Li et al., 2017; Palinkas et al., 2015): (1) the company had to be a well-established player within its industry (i.e., we excluded start-ups); (2) the company had to have started the transformation of its IT function into a bi-modal IT two or more years prior to the study to avoid pilot projects or small-scale agile IT modes (e.g., few individuals) and to sufficiently inform the research (Bilgeri & Wortmann, 2017); and (3) the first bi-modal IT initiatives (e.g., new digital products or services) had to show success with customers, going beyond beta versions, thus proving the seriousness of the transformation (Kaltenecker et al., 2015). All case companies had their headquarters in Germany with subsidiaries around the world. In Table 1, we give a brief overview of the selected cases, including the industry, revenue, number of employees, and the bi-modal IT archetype (Haffke et al., 2017a). Detailed information on the cases and their contexts can be found in Appendix A.4.

TABLE 1 Overview of case companies

Case ID	Company facts and figures	Bi-modal IT archetype
1	• High-tech • ~6 bn EUR revenue • 10 000–50 000 employees	Divisionally separated bi-modal IT (agile IT unit reporting to the CEO, traditional IT unit to the CIO)
2	• Pharmaceutical • ~20 bn EUR revenue • >50 000 employees	Sub-divisionally separated bi-modal IT (both IT modes reporting to the CIO)
3	• Retail • ~6 bn EUR revenue • <10 000 employees	Started with a divisionally separated bi-modal IT (IT modes reporting to the Chief Customer Officer and CIO, respectively) and then the company moved towards a reintegrated bi-modal IT
4	• Mobility • ~0.8 bn EUR revenue • <10 000 employees	Started with a divisionally separated bi-modal IT (IT modes reporting to the Chief Digital Officer and CIO, respectively) and then the company moved towards a reintegrated bi-modal IT
5	• Automotive • >100 bn EUR revenue • >100 000 employees	Sub-divisionally separated bi-modal IT archetype (both IT modes reporting to the CIO)
6	• Utilities • ~20 bn EUR revenue • 10 000–50 000 employees	Divisionally separated bi-modal IT (agile IT unit reporting to the CEO, traditional IT unit to the CIO)
7	• Logistics • ~1.5 bn EUR revenue • <10 000 employees	Sub-divisionally separated bi-modal IT (both IT modes reporting to the CIO)
8	• Automotive • ~15 bn EUR revenue • >50 000 employees	Started with a project-by-project bi-modal IT, then the company moved towards a divisionally separated bi-modal IT (agile IT unit reporting to the CEO, traditional IT unit to the CIO)
9	• Software • ~20 bn EUR revenue • >50 000 employees	Divisionally separated bi-modal IT (agile IT unit reporting to the CEO, traditional IT unit to the CIO)

Abbreviations: CIO, Chief Information Officer; IT, information technology.

3.2 | Data collection

Semi-structured interviews formed the basis of the retrospective data collection process and took place face-to-face or by phone. We followed a 'key informant' methodology, where targeted respondents assume the role of a key informant who is able to provide rich information about different units of analysis (i.e., on individual and organisational phenomena) simultaneously (Kumar et al., 1993). For each case company, we interviewed two managers who were intimately involved with and most knowledgeable about the challenges and risks of bi-modal IT for individuals 'on the ground' and for the organisational units. Following the methodology of Li et al. (2017) and Hanelt et al. (2017), we included one manager from the agile IT unit (e.g., heads of agile IT units) and one manager from the traditional IT unit (e.g., team leaders within traditional IT units)[1] to discover divergent viewpoints and triangulate the reports (Benlian & Haffke, 2016; Myers & Newman, 2007). Table 2 provides an overview of the 17 interviewees.

After ascertaining that the interviewees were appropriate key informants in terms of their experience, career path, and current role in the selected company, we used open interviewing techniques, asking our interviewees to recount the journey chronicle that led to the current bi-modal IT function (Webb & Mallon, 2007). Then, following our interview guidelines, we engaged in a semi-structured interview to comprehensively understand the activities of the respective IT mode and the relationships between the IT modes. We delved into emerging tensions when the interviewees mentioned such topics themselves (which happened in each interview), following the procedures laid down by Andriopoulos and Lewis (2009). When the first interviewee of a case mentioned a tension, we would ask the second interviewee, in case they had not mentioned it, about their perspective regarding the situation. As such, we did not mention that the research sought to identify tensions, and we used neither the word 'tension' nor any similar terms that might have influenced the interviewees. We tuned our interview guidelines after each case to reflect our latest understanding of interactions between the modes (e.g., adding a question on the handover of digital products; see Table A.5 in the Appendix for the interview guidelines).

The interviews were conducted throughout 2018 and lasted about an hour. We recorded, transcribed, and coded them. For each case, we gathered additional secondary data. We added internal documentation given by interviewees (e.g., board meeting presentations) and public information, such as publicly available interviews, the companies' websites, or press articles about the company. After the ninth case, we observed that the new case data did not add substantially to our findings and that we had reached theoretical saturation (Eisenhardt, 1989; Keutel et al., 2014).

TABLE 2 Overview of interviewees

Case ID	Sector	Dyadic interviewees (from agile information technology [IT] and traditional IT)
1	High-tech	Head of agile IT mode, Project manager within traditional IT
2	Pharmaceutical	Management team member of agile IT mode, Team leader within traditional IT mode
3	Retail	Chief Customer Officer (leading agile IT mode), Chief Information Officer (CIO) (leading traditional IT mode)
4	Mobility	Chief Digital Officer (leading agile IT mode), CIO (leading traditional IT mode)
5	Automotive	Management team member of agile IT mode, Team leader within traditional IT mode
6	Utilities	Management team member of agile IT mode, Team leader within traditional IT mode
7	Logistics	Management team member of agile IT mode, CIO (leads both IT modes)
8	Automotive	Head of agile IT mode, Team leader within traditional IT mode
9	Software	Team leader within agile IT mode

3.3 | Data analysis

For the data analysis, we went through three phases, following established recommendations for qualitative data analysis (Miles & Huberman, 1994). While Phase 1 was based on within-case analysis only, the other two phases included within-case and cross-case analyses.

3.3.1 | Phase 1: Understanding bi-modal IT

The first analysis had the objective of developing a comprehensive description of the bi-modal IT setup for each case company. Additional data sources (e.g., public interviews and press releases) were helpful in completing the picture. At the end of this phase, we had detailed descriptions of both IT modes and their interactions for each company, which served as the unit of analysis for our search for tensions in the next phase. These within-case analyses were conducted after each case but were updated at the end of the multi-case study, as we checked the descriptions based on the latest understanding of interaction possibilities after the last case.

3.3.2 | Phase 2: Pinning down tensions and paradoxes

For each case, we identified tensions using an open-coding approach. First-order tension codes were identified based on contradictory descriptions, mixed messages, or passages directly referring to tensions (e.g., 'envy that the agile IT unit is not bound to corporate IT policies') within a case following the analysis techniques of Hatch and Ehrlich (1993) and Andriopoulos and Lewis (2009). Each case revealed at least one tension, with 26 unique first-order tension codes in total across all cases. We grouped similar tensions across the cases via axial coding (Flick et al., 2004) and arrived at nine core tensions (second-order tension codes). This grouping emerged from the data and relied on an inductive procedure (Klein & Myers, 1999). Based on the same axial coding approach, we abstracted second-order tensions into paradoxes (which act as aggregated dimensions). Although paradox types may overlap (Smith & Lewis, 2011), the identified tensions could be clearly connected to a single dominant paradox type (i.e., learning, performing, organising, or belonging) based on the direct quotes and context information collected in our database. Figure 1 depicts our data structure after Phase 2. Further details (i.e., exemplary quotes) are presented in Table A.6 in the Appendix.

3.3.3 | Phase 3: Investigating practices to manage tensions and paradoxes

In the third phase, we aimed to identify how IS practitioners use integration or differentiation practices to manage tensions and address the underlying paradoxes. After the identification of tensions and underlying paradoxes in the previous phase, we went back to our data and identified text passages that fit the management practices described in Section 2.2 of this paper, similar to Gregory et al. (2015). Figure 2 depicts our data structure regarding management practices after Phase 3. Exemplary quotes are presented in Table A.7 in the Appendix. In this phase, we also identified dynamic interrelationships between paradoxes, tensions, and practices at the individual and organisational levels.

4 | RESULTS

In this section, we present five core paradoxes that emerged from the tensions identified in our data, as seen in Figure 1. We start with the organisational-level paradoxes before presenting the results at the individual level. For
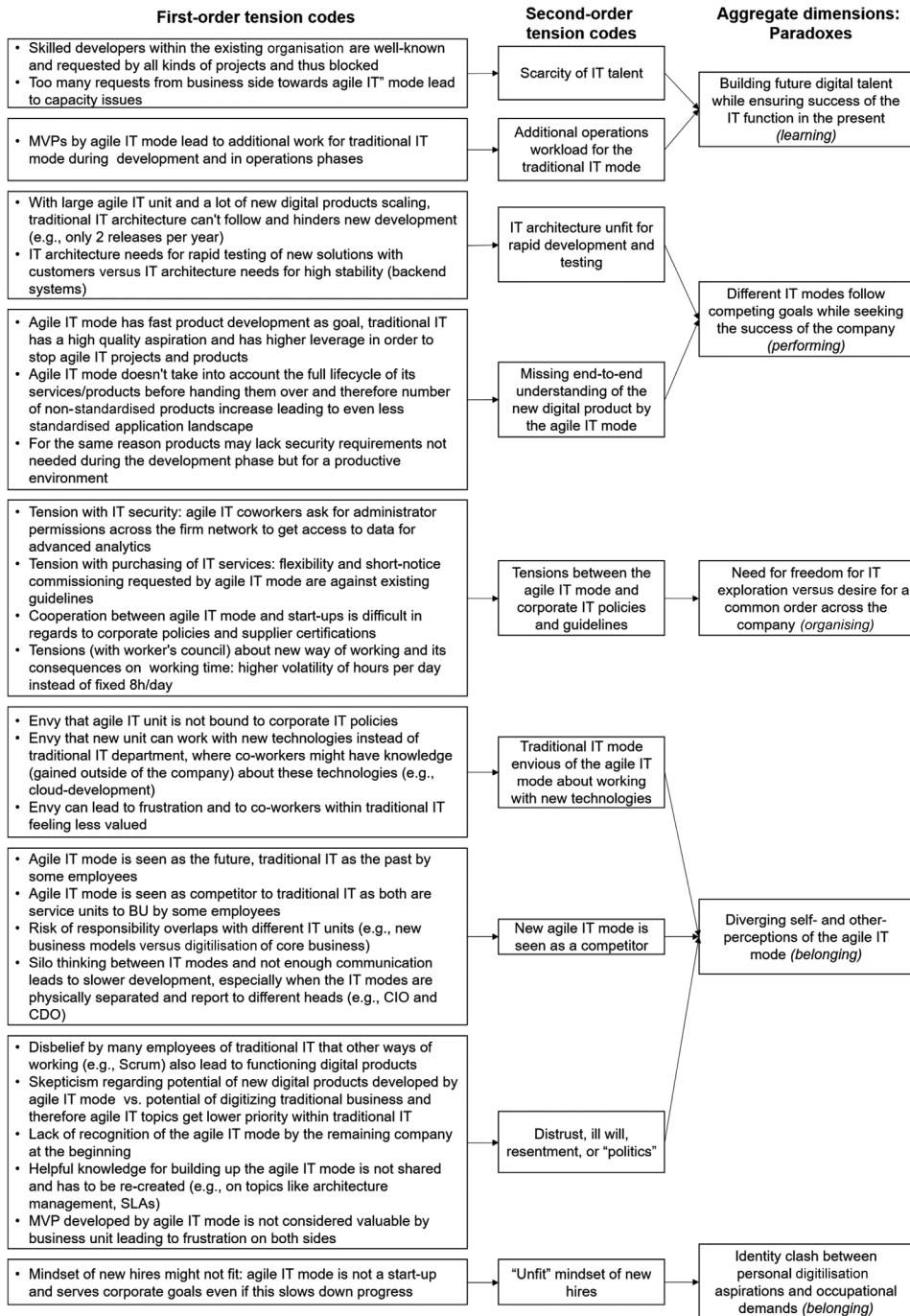
FIGURE 1 Illustration of data structure for tensions and underlying paradoxes

each paradox, we summarise the core tensions between the traditional and agile IT modes and show how companies managed these tensions to address the underlying paradox. Table 3 summarises these results. Finally, we present our findings on the dynamic cross-level interdependencies between tensions, paradoxes, and management practices.
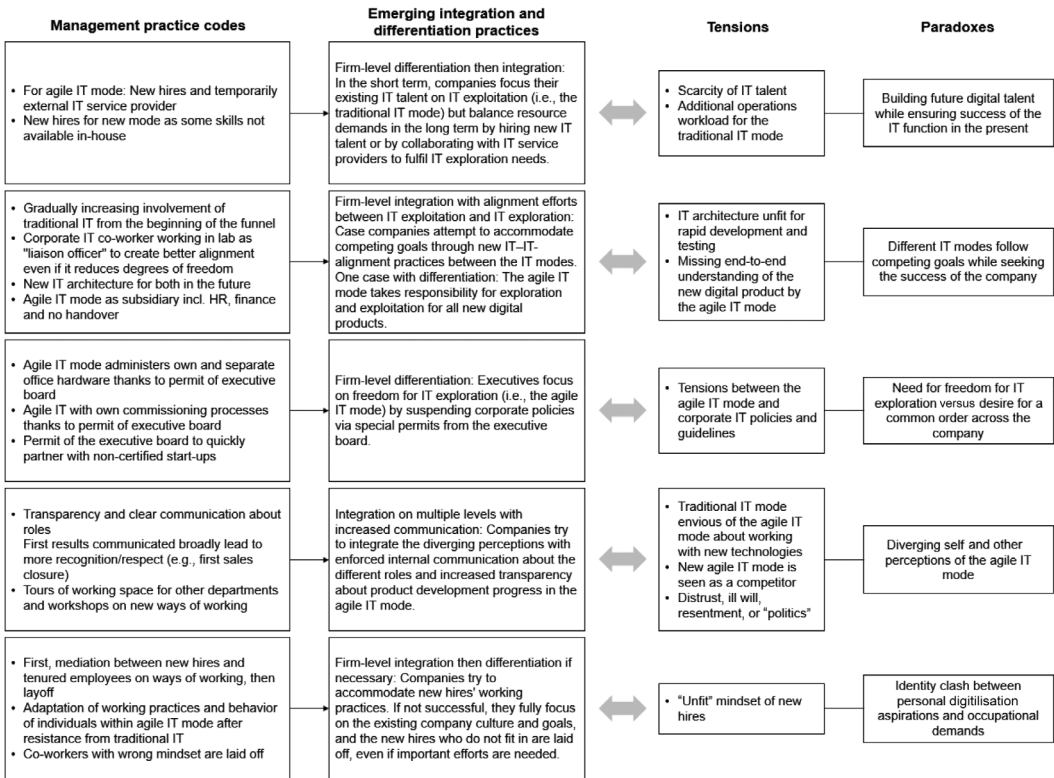
FIGURE 2 Illustration of data structure for management practices addressing tensions and underlying paradoxes

4.1 | Organisational-level paradoxes and corresponding management practices

4.1.1 | Paradox 1 (learning): Building future digital talent while ensuring the success of the IT function in the present

The setup of an additional IT mode usually requires additional IT employees. Given that all case companies tried to staff their new agile IT mode with existing employees, they were soon confronted with the organisational-level issue that well-trained and available IT employees (with appropriate technical and non-technical skills) were scarce. The following quotes illustrate this tension:

> There is no doubt that there are good colleagues who can do this. But they are, because they are good, rarely available. And then you are faced with a problem. (Team leader within traditional IT mode - Case 6)

> Corporate IT has given us very few people. The challenge is simply to keep the capacity situation under control. (Management team member of agile IT mode - Case 5)

> Of course, we have some IT talent within the organization. But these people are already over-burdened. Or promoted. (Head of agile IT mode - Case 1)

Allocating existing employees to one IT mode means draining resources from the other mode. This tension mirrors the most frequently discussed issue of resource allocation in the ambidexterity literature. While working in the new

TABLE 3 Summary of bi-modal information technology (IT) paradoxes, tensions, and management practices

Paradox	Core tension	Exemplary management practice
Organisational-level paradoxes		
Paradox 1—Learning paradox: Building future digital talent while ensuring success of the IT function in the present	Scarcity of IT talent Additional operations workload for the traditional IT mode	*Differentiation then integration*: In the short term, companies focus their existing IT talent on IT exploitation (i.e., the traditional IT mode) but balance resource demands in the long term by hiring new IT talent or by collaborating with IT service providers to fulfil IT exploration needs
Paradox 2—Performing paradox: Different IT modes follow competing goals while seeking the success of the company	IT architecture unfit for rapid development and testing Missing end-to-end understanding of the new digital product by the agile IT mode	*Integration* with alignment efforts between IT exploitation and IT exploration: Case companies attempt to accommodate competing goals through new IT–IT-alignment practices between the IT modes One case with differentiation: The agile IT mode takes responsibility for the exploration and exploitation of all new digital products
Paradox 3—Organising paradox: Need for freedom for IT exploration versus desire for a common order across the company	Tensions between the agile IT mode and corporate IT policies and guidelines	*Differentiation*: Executives focus on freedom for IT exploration (i.e., the agile IT mode) by suspending corporate policies via special permits from the executive board
Individual-level paradoxes		
Paradox 4—Belonging paradox: Diverging self and other perceptions of the agile IT mode	Traditional IT mode is envious of the agile IT mode regarding working with new technologies New agile IT mode is seen as a competitor Distrust, ill will, resentment, or 'politics'	*Integration* on multiple levels with increased communication: Companies try to integrate the diverging perceptions with enforced internal communication about the different roles and increased transparency about product development progress in the agile IT mode
Paradox 5—Belonging paradox: Identity clash between personal digitalization aspirations and occupational demands	'Unfit' mindset of new hires	*Integration then differentiation* if necessary: Companies try to accommodate new hires' working practices. If not successful, they fully focus on the existing company culture and goals, and the new hires who do not fit in are laid off, even if important efforts are needed

agile IT mode requires a different set of technical and non-technical skills compared to the traditional IT mode (e.g., higher autonomy and entrepreneurial work, different programming languages), several interviewees reported that many co-workers within the traditional IT mode had such non-technical skills and could easily acquire the lacking technical skills. While this prevalent organisational-level tension reveals a tension in resource allocation, the overall resource situation is more complex, as the next tension shows.

In nearly all cases, the agile IT mode was responsible for the development of new digital products. However, the traditional IT mode was responsible for the operations and maintenance of these products once productive, and a

handover between the modes had taken place. Consequently, traditional IT had to hold back resources for these new digital products, even though these resources were not foreseen in the budgets. Additionally, these products led to a broader application landscape and, due to the use of new technologies (e.g., cloud technology), to an even more complex application landscape. As team leaders within traditional IT put it:

> Our IT application landscape and architecture are already very fragmented. When the agile IT unit constantly feeds in new platforms, it gets even less standardized. (Team leader within the traditional IT mode - Case 5)

> Then we're back to the capacity issue, that just because there's an agile IT unit, they have to kind of increase central IT as well. Just to absorb what's coming in. (Team leader within the traditional IT mode - Case 2)

The two tensions highlight how strongly both IT modes are intertwined, indicated by numerous handovers that have to be managed and the diverse resources and skills that need to be allocated. In fact, both IT modes need to build up resources to cover the responsibilities for the development, operations, and maintenance split between the agile IT mode and the traditional IT mode.

Our cases showed an underlying paradox manifested in these two tensions: Bi-modal IT functions need to build capabilities for future technologies (e.g., cloud development) in both modes without draining resources from the traditional IT mode that are necessary for running existing products and performing in the present. As it is centred on knowledge and capabilities, this paradox is a prime example of a *learning* paradox in ambidextrous IT and goes beyond the often-discussed pure resource-allocation issue of existing resources in ambidexterity research.

To manage these tensions and their underlying paradoxes, managers and executives from all cases in our study used an organisational-level differentiation practice regarding talent *in the short term*. Even if many interviewees acknowledged that several employees within the IT function had the necessary technical and non-technical skills, the agile IT mode was mainly staffed with new hires (having profiles such as user experience / user interface (UX/UI) designers, data scientists, front-end and back-end developers, agile coaches), which required additional time and resources for recruiting and onboarding. Senior managers of the new mode were always staffed from within the existing organisation. Another case company used a build–operate–transfer model, with external service providers contributing to the development in the beginning, continuously moving out and being replaced by new hires in the end. In the *longer term*, regarding the additional resource needs of traditional IT, we noted a firm-wide integration practice concerning the workload. The traditional IT mode opened up its application landscape to new technologies that could also replace existing products and architecture (e.g., cloud technology), but it also obligated the agile IT mode to rework some digital products in order to reach a certain level of harmonisation with existing products. Our interviewees also reported that these combined practices benefited both modes, as they led to reduced innovativeness in the short term but increased it in the long term, as operations and maintenance could now be taken over more easily by the traditional IT mode, while the agile IT mode could focus entirely on innovation. Thanks to these dynamic practices, tensions were resolved once resources in both modes were no longer scarce, although tensions might surface again once new resources were needed, for instance, due to additional digital product initiatives.

4.1.2 | Paradox 2 (performing): Different IT modes follow competing goals while seeking the success of the company

The agile IT mode usually has different goals than the traditional IT mode (e.g., agility and speed vs. reliability and stability), which translate into IT architecture requirements that contradict the existing IT architecture requirements of

the traditional IT mode (e.g., in terms of fast testing and deployment). All case companies faced this tension on an organisational level regarding how to manage these requirements. As one IT manager stated:

> As long as I am in a research and development phase, it does not make sense to use corporate IT infrastructure, because it is like an engine room, far away from the customer. We have an ambidexterity there—a large area of tension. We still need to operate some topics in a highly stable and very cost-efficient manner. However, this world does not fit to "Let me try this" or "I need to change something quickly." (Team leader within the traditional IT mode - Case 6)

We observed a similar tension due to the different goals for feature prioritisation for new digital products. Several interviewees described a tension that surfaced during the handover of a digital product from agile IT to traditional IT. While agile IT optimises speed during the development of an innovative digital product and might assign a lower priority to other product features, traditional IT might miss these features in favour of stable product operations. One IT manager summarised it as follows:

> In the development phase, other things must also be considered (e.g., security, appropriate tools) in order to be able to hand them over at all. We have, by then, already completely shot down some products. (Team leader within the traditional IT mode - Case 2)

The IT executives are confronted with the fact that the primary goals they want to achieve with a bi-modal IT—namely, IT exploitation and IT exploration—conflict as soon as the two IT modes interact (e.g., during handovers, when working on the same architecture). From our data, tensions emerged that pointed towards the paradox that different IT modes follow competing goals, even though both seek the success of the company. With such competing goals, this presents a *performing* paradox on an organisational level. Although the organisational separation of the IT exploitation and IT exploration goals is the fundamental assumption of structural IT ambidexterity, this finding again highlights that with a bi-modal IT function, both IT modes heavily interact.

In most cases, the case companies established integrational initiatives to manage the paradox and the inherent tensions. While the agile IT mode built up a separate IT architecture in all cases, regular exchange was ensured between the IT modes to learn from the new IT architecture, and in one case, it was used as a blueprint to modernise the IT architecture of the traditional IT mode. Increasing alignment between the IT modes was another significant integrative action in that context. Day-to-day practices included the placement of integrative roles such as 'liaison officers' from the traditional IT mode within the agile IT mode, as one interviewee described it, for a regular exchange. Also, the further a product's development progressed, the more the companies increased IT–IT alignment: Several traditional IT co-workers who were responsible for the future operations and maintenance of the product would work closely together (co-located) with the agile IT mode in the last phase of product development. Job rotations between traditional IT and agile IT units were employed in two cases and were highlighted by our interviewees as a measure to increase alignment in the long term. While alignment efforts required resources and slowed down the processes of both IT modes, they helped both IT exploration and IT exploitation in the longer term, as one executive explained. Nevertheless, the paradox persists, and this management practice requires a continuous balance, as it bears the risk of eventually favouring one IT mode. One interviewee explained it as follows:

> We need to drive both simultaneously. We need to develop our IT strategy as in the last years, and we need to continue investing in our existing IT services, not only in the new stuff. (Team leader within the traditional IT mode - Case 2)

Additionally, we observed one case in which the company decided on a differentiation practice and founded a new subsidiary company based on the agile IT mode, adding HR and finance functions to it. In that particular case, the

agile IT mode did not collaborate with the traditional IT mode anymore, and was responsible for the whole product lifecycle, integrating IT exploitation and IT exploration for novel digital products. This comprehensive responsibility also led to the better balancing of IT architecture requirements and feature-prioritisation goals, thus resolving the tensions.

4.1.3 | Paradox 3 (Organising): Need for freedom for IT exploration versus desire for a common order across the company

In each case, the interviewees stated that corporate IT policies and guidelines restricted certain activities to retain a common order across the company. However, with the objective being to innovate and with freedom being an essential enabler of innovation (Arvidsson & Troels, 2018), several interviewees described tensions between the agile IT mode and existing corporate IT policies and guidelines enforced by the traditional IT mode:

> Yes, the digital innovation unit needs freedom regarding IT, but we had some serious disputes about this in the beginning. Wishes did not meet reality. They wanted to have access to all firm data. That was their ambition. In my IT role, I said: Forget it. (Team leader within the traditional IT mode - Case 8)

> Freedom was not given to us in the beginning. We had several confrontations with the executive board about this. (Management team member of the agile IT mode - Case 6)

> We asked to get access to some ports to test a peer-to-peer protocol (for a blockchain product). Our IT security manager freaked out and said, "Only over my dead body!" (Team leader within the agile IT mode - Case 9)

The agile IT mode usually requested a maximum of freedom for digital innovation, which notably included access to large amounts of (company) data and reduced compliance requirements in terms of security and safety standards that IT policies typically encompass. Submission of the agile IT unit to the same policies and guidelines as the rest of the company was at the expense of innovativeness. Based on our analysis, we observe a paradox between the need for freedom for IT exploration and the desire to retain common order across the company. As the paradox consists of contradictory processes and structures, we identify it as an *organising* paradox.

Across different cases, we noticed a differentiation practice on an organisational level to address the paradox. Executives and board members in these cases gave the agile IT mode the requested freedom after several escalations and discussions by suspending corporate policies for the agile IT unit, which were still valid for other parts of the organisation. Thus, they coped with the paradox by emphasising the differences between the IT modes and the uniqueness of the situation. As a result, the agile IT mode had the leeway it needed, for example, concerning IT procurement or IT security.

4.2 | Individual-level paradoxes and corresponding management practices

4.2.1 | Paradox 4 (belonging): Diverging self and other perceptions of the agile IT mode

In each case, the interviewees reported that the agile IT mode had the responsibility for developing new digital products and services based on new technologies (e.g., cloud development, machine learning). Even if these new technologies were not previously used by the IT function, knowledge and interest from some co-workers in the traditional IT mode might already have existed. As others in the same company could now test and use the new technologies,

emotional tensions of frustration and envy arose on an individual level. The envy increased when traditional IT employees perceived the new, often divisionally separated IT mode as an extension of the existing IT mode (compared to a new non-related unit). As a consequence, these employees had difficulties understanding why budgets were given to the new unit instead of the existing IT division. As one interviewee explained:

> An IT that has been doing this for 20–30 years knows what innovations there are and would like to do more than it can and is slowed down by savings in the department. When a new area is created that is allowed to do the cool shit, it makes for a massive envy factor. (Team leader within the traditional IT mode - Case 8)

Beyond envy, we identify a related tension. With divisionally separated IT units and each unit working together with business units, rivalry can arise. In detail, two interviewees stated the following:

> There is a certain competitive situation between the agile IT unit and central IT, since both are, in principle, service centers for the business areas. Of course, central IT could say that "innovative IT is also my turf," but this is not so much decided on the board level. If you ask the business organizations, then the situation looks different again, because, in the end, they do not care where they got their services from. (Project manager within the traditional IT mode - Case 1)

> They [employees within the traditional IT unit] have always felt like those who sit on systems, procedures, and processes, which are obsolete. Then there was the fast IT—the new IT. I think you have to do something here so that you do not get a vast cultural gap. (Chief Information Officer - Case 4)

While both IT modes belong to the same company, employees create identities regarding their modes (based on roles and responsibilities) that do not correspond to the identity perceived by employees in the other IT mode. For instance, employees within the agile IT mode may see the mode as an innovation unit coincidentally using IS but being non-related to the IT function. The business-centric culture of this mode might enforce this perception, as employees might see themselves as being closer to the business units than to the traditional IT mode. At the same time, employees within the traditional IT mode with its IT-centric culture might focus on the fact that the agile IT mode develops software and perceive the novel mode as an enlargement of the traditional IT mode or even as a replacement and thereby a rival to traditional IT. In our cases, such diverging perceptions were especially intense when both IT modes were divisionally separated, reporting to different executives. In addition to these emotional tensions of envy and rivalry, nearly all examined cases reported tensions in terms of distrust, ill will, or resentment of varying intensity against the agile IT mode by individuals:

> We were smiled at in the beginning. Many did not quite understand why we should be needed. The employees could not identify with us. (Management team member of the agile IT mode - Case 7)

> Some said at the beginning: these odd sandbox players. Running around, sitting on colorful cushions with MacBooks, and just having fun. (Head of the agile IT mode - Case 1)

> Of course, there are people who look at it with ill will. In every organization, there is politics; that is just the way it is. All in all, a good image, in some places, ill will. (Chief Information Officer - Case 7)

It is worth highlighting the differences between the previous emotional tensions of envy and rivalry. While the previous tensions occur between the IT modes, this tension touches the broader company and is based on the repulsion felt for the agile IT mode by some employees due to its novelty and otherness. In many cases, this otherness led

employees to create an alienated perception of the agile IT mode that was viewed as a playground or small experiment rather than as a supporter or enabler of digital technologies.

The underlying paradox that emerges across these tensions is that the same agile IT mode may be simultaneously perceived by some employees as part of the IT function and by others as a non-IT function. As this paradox touches on the identity of individuals and collectives, it marks an example of a *belonging* paradox, going beyond the paradox types discussed previously in IT ambidexterity and bi-modal IT research, emphasising the subjectivity and emotional tensions in organisational paradoxes that are per se non-rational.

We often observed an integration practice on multiple levels to address this paradox, consisting of enforced internal communication to highlight the importance of the agile IT mode for the success of the (digital) transformation of the company and to value the work of the traditional IT mode as a foundation and precursor for digital transformation. This practice did not necessarily lead to an overarching perception of the agile IT mode, thus maintaining the paradox, as expected by theory. However, resentment, envy, and rivalry tensions decreased as employees in the traditional IT mode felt valuable (again) and as recognition of the agile IT mode increased. More specifically, agile IT mode co-workers increased their informal communication towards other units about the particularities of their mode and why it was necessary nowadays while taking care not to be arrogant, as one manager insisted:

> The secret is that you work at eye level with your colleagues and do not make yourself the kind of person who has eaten wisdom with spoons. (Management team member of the agile IT mode - Case 6)

On a team level, discussions between IT modes took place to clarify roles, and the intensity of internal communication by the agile IT mode was increased (e.g., internal blog posts, newsletters, guided tours through agile IT workplaces). The internal communication focused on (1) explaining new ways of working and (2) reporting on the progress and success of IT exploration—namely, new digital products (e.g., first customer or first revenue)—thus helping to increase the appreciation of the new IT mode in some cases. As one manager summarised:

> It was a difficult discussion up to this day, but it has now been resolved. For me, corporate IT is an extremely important function. But that does not mean that it should compete with me. That was not clear until now. They have to provide infrastructure. They have implemented an Enterprise Service Bus (ESB). This thing is the best thing they have done for the business for decades. Without this ESB, I would be lost. That is the gold nugget to scale up. (Head of the agile IT mode - Case 1)

4.2.2 | Paradox 5 (belonging): Identity clash between personal digitalization aspirations and occupational demands

Many interviewees reported that the agile IT mode had hired new employees, sometimes competing against technology companies or start-ups (e.g., Facebook) in the recruiting process. However, even if the activities in terms of IS development are similar to those of start-ups, new employees face a different culture. Established companies in our sample had a tradition of building fail-safe products, which contradicts the fault-tolerant, fast, and agile software development approaches expected by new IT talent. Collaboration with the non-agile traditional IT mode and business units, for which products are developed, often requires an adaptation of methods in the agile IT mode, which slows down development. Newly hired individuals experience that their expectations and reality collide, and frustration might be the consequence. In addition, while the goal of the agile IT mode is to explore new digital products, performance targets, such as revenue or the number of pilot clients, are also set for this mode. Such targets might restrict experimentation and exert unexpected pressure on new employees. Consequently, individuals might primarily face tension in their thoughts, beliefs, values, and emotions, as the following quotes succinctly summarise:

> This new [agile IT] unit hired a lot of very talented IT people. They have a drive, but then run up against walls, which causes frustration. And even if this unit has a somewhat good reputation by now, you will not break down these walls. (Project manager within the traditional IT mode - Case 1)

> They [newly hired IT talent] forget that life is not full of bliss and that this is not a playground, but a full-grown company. Their performance is very well tracked, and they are measured by their results. (Management team member of the agile IT mode - Case 5)

With such conflicting values and beliefs, the new hires face an emotional identity crisis and tension that points to an underlying paradox on the individual level: New hires' identities based on their understanding of an employee in modern IS development clash with their occupational demands. More specifically, they have the same role and are supposed to execute similar tasks and activities as in previous jobs but now face prior unmet methods and organisational goals. With tensions affecting individuals' identities, this presents a *belonging* paradox on an individual level.

As we learned from different interviewees across cases, managers often organised workshops with new hires and representatives of both IT modes (and business units) on how to adapt working practices to meet each other's expectations and to achieve a better mutual understanding, thus, following an integrative approach. As one manager puts it:

> They want things and need things and mean to be right, which I question. But that's helped a lot of times after we discussed it. Both sides of the card. I think it's important. (Project manager within the traditional IT mode - Case 1)

However, if the integrative approach was unsuccessful, companies decided to lay off new hires that did not fit the bi-modal IT world with two very different modes having to collaborate. This is especially noteworthy, as, for some of the case companies, firing is a rare and extraordinary event. The following quotes summarise this differentiation approach:

> I fired three people because the mindset was wrong. And that is also a success factor in removing them immediately. (Head of the agile IT mode - Case 1)

> More specifically, you have some people who want to continue playing so to speak but at a certain size you have to do business. Some then had to leave. (Management team member of the agile IT mode - Case 5)

> Firing is sometimes more difficult at our company. But clear and consistent management is important. (Management team member of the agile IT mode - Case 7)

4.3 | Dynamic cross-level interrelationships between paradoxes, tensions, and practices

The tensions, paradoxes, and management practices we identified in our interviews did not emerge in isolation but were often interrelated with one another. Indeed, we found that individual-level paradoxes can become salient due to management practices that target organisational-level tensions and paradoxes. Conversely, we also uncovered how management practices dealing with individual-level tensions and paradoxes can make organisational-level paradoxes more salient again. For the sake of illustration, we focus on three informative instances that emerged from our data.

First, we noted that the organisational-level paradox 2 (different IT modes follow competing goals while seeking the success of the company) and its manifestations as tensions (inadequate IT architecture and missing end-to-end understanding) were addressed by an *individual-level* integration practice in one case: one team member of the traditional IT mode took a second role within the agile IT mode, now wearing 'two hats', making alignment and communication through this unique position easier:

> And the great thing is that our Head of Development is also the Chief Architect of the IT function. He set up the initial tech stack for our agile IT mode, and with his double role, this initial tech stack becomes the main tech stack for IT. (Management team member of the agile IT mode - Case 2)

Second, we observed that a *differentiation* practice to manage organisational-level tensions and their underlying paradox made an individual-level paradox more salient. As mentioned above, in another case, we found that the organisation opted for a differentiation practice to attend to paradox 2 and its emerging tensions, strictly separating both IT modes. This differentiation practice made the individual-level paradox 4 (diverging self-perceptions and perceptions by others of the agile IT mode) more salient and reinforced envy among the members of the traditional IT mode, as the following quote mirrors:

> The department that is supposed to take care of all the innovative topics is taken out of IT. There is no exchange taking place, and all learning is made again on the side of the agile IT mode. They would not ask us, and we would not want to answer. In sum, this creates enormous envy among us. (Team leader within the traditional IT mode - Case 8)

Similarly, we identified knock-on effects on the individual level triggered by a *differentiation* practice organisations used to deal with tensions arising from paradox 3 (need for freedom for IT exploration vs. desire for a common order across the company). The practice of giving leeway to the agile IT mode often made paradox 4 more salient again, creating envy among other employees who still had to align with corporate IT policies and who would have preferred to do otherwise. Thus, a new emotional tension arose on an individual level.

Third, paradoxes and practices at the organisational level can not only be a consequence of, but also a precursor to paradoxes and practices at the individual level. Especially for paradox 5 (identity clash between personal digitalization aspirations and occupational demands), we observed that if the integration practice we discussed above (adapting working practices to meet each other's expectations) was not effective, individuals opted for a *differentiation* practice (leaving the unit or company). Such a separation would only resolve tensions for former employees but would also lead to a higher salience of paradox 1 and an exacerbation of resource tensions, as the following quote illustrates:

> Let me put it this way: Keeping the organization agile in its size is an ongoing task. Once a person joins or leaves, the whole thing is a bit on the brink of collapse. It's really a very, very sensitive construct. (Management team member within the agile IT mode - Case 8)

Overall, the dynamic, cross-level interrelationships between paradoxes, tensions, and practices that can be derived from the above cases highlight the importance of the micro-foundations perspective for a more comprehensive understanding of bi-modal IT.

5 | DISCUSSION

The goal of this research was to deepen our understanding of the multi-layered nature of tensions and paradoxes in bi-modal IT and to unearth promising practices to manage them. Previous research has conceptualised bi-modal IT
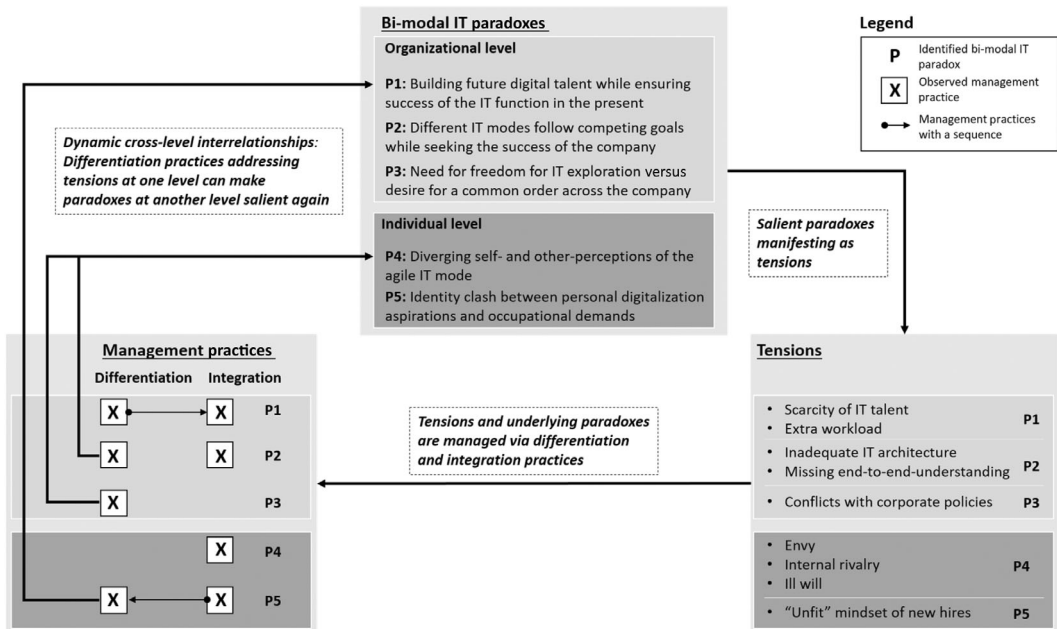
FIGURE 3 Emergent model of interrelationships between paradoxes, tensions, and management practices in bi-modal IT

largely as a single, aggregated entity without paying much attention to paradoxical interdependencies between the two constituent IT modes. Moreover, it has primarily focused on tensions and associated paradoxes in terms of goals, structures, and processes on an organisational level, disregarding emotional responses on the individual level. Against this background, our study shows that these tensions and paradoxes can be much more intricate and far-reaching than previously discussed in the IT ambidexterity literature. In this vein, our micro-foundations perspective reveals important individual- and organisational-level paradoxes, tensions, and management practices as well as dynamic cross-level interdependencies, as summarised in Figure 3.

The transformation of the IT function into bi-modal IT not only presents organisational-level challenges in terms of structures, processes, capabilities, and goals; it may also engender paradoxes that are felt at the individual level and cause organisational actors to experience serious emotional tensions (e.g., envy or ill will). Management practices that address such tensions can in turn mitigate or resolve conflicts, or even trigger negative feedback cycles that make lower- or higher-level paradoxes salient (again). We found that differentiation practices, in particular, can lead to unintended ripple effects. On the one hand, by addressing organisational-level tensions and their underlying paradoxes (e.g., P2 and P3), differentiation practices may have knock-on effects on individual-level paradoxes (e.g., P4) and tensions. On the other hand, and conversely, they may also render a paradox at an organisational level salient again (e.g., P1) by dealing with individual-level tensions and their underlying paradoxes (e.g., P5). Collectively, these dynamic, cross-level interdependencies highlight the importance of considering paradoxes and tensions at both the organisational *and* individual levels to obtain a more comprehensive account of the inner workings and challenges of bi-modal IT.

5.1 | Contributions to theory, research, and practice

This study makes three important contributions to IS research. First, our study offers novel insights into the nascent research on bi-modal IT. Previous studies have largely focused on phenomenological descriptions of the bi-modal IT concept using an organisational-level perspective (Haffke et al., 2017a; Joehnk et al., 2019). In doing so, they treated bi-

modal IT largely as a single entity without paying much attention to the complicated set of tensions inherent in the interactions between the two constituent IT modes. In contrast, our study introduces a micro-foundational perspective that seeks not only to understand organisational-level *and* individual-level tensions and paradoxes but also to shed light on their intricate interrelationships. This emphasis on individual-level paradoxes and cross-level interdependencies is aligned with the emerging view that a full understanding of organisational phenomena is incomplete without an understanding of their micro-foundations (e.g., Felin et al., 2015). From this perspective, we advance previous research by unpacking the intricacies in bi-modal IT and uncovering the dynamic interlinkages between paradoxes and tensions emerging at multiple levels. Consequently, we advocate paying increased research attention to the micro-foundations of bi-modal IT, which is to date largely missing in the literature yet burgeoning in related fields (e.g., Miron-Spektor et al., 2018).

Second, through this shift towards a micro-foundational perspective, we uncover novel individual-level tensions and paradoxes that have been largely overlooked in bi-modal IT and IT ambidexterity research that mainly assumed a rational perspective to make sense of paradoxes (Joehnk et al., 2019). In answering the calls by Putnam et al. (2016) and Schad et al. (2016) for more research into non-rational responses to paradoxes, our study identifies envy as a salient emotional tension along with other related affective responses (e.g., fear, ill will/resentment) as manifestations of paradoxes on the individual level. Accounting for the emotional side of paradox responses adds a new dimension to our conversation about bi-modal IT and opens up multiple avenues for combining rational and non-rational perspectives.

Third, we contribute novel findings that challenge previous structural ambidexterity theory (Christensen, 2013; Raisch & Birkinshaw, 2008) and advance 'the world as-is' understanding of ambidextrous IT organisations (Grover & Lyytinen, 2015). In contrast to the prevailing notion that separating exploitation and exploration for the IT function is an effective solution (Raisch & Birkinshaw, 2008), we found that the differentiation practices put in place often exacerbated—rather mitigated—tensions between traditional and agile IT, spurring negative feedback loops. We even found the tensions to be most evident in cases of divisionally separated bi-modal IT, with the traditional IT mode reporting to the CIO and the agile IT mode reporting to the CEO. As such, and in response to calls for research into the complexities of IT ambidexterity (Gregory et al., 2015; Montealegre et al., 2019), we demonstrate that the interactions between traditional and agile IT modes are not always clear-cut and straightforward but are often messy and contested, with potentially problematic ripple effects throughout the organisation.

Our results also provide several practical implications for managers who are responsible for handling emerging tensions and inherent paradoxes in bi-modal IT. First, IT managers may want to use the tensions and paradoxes summarised in Table 3 and Figure 1 as a blueprint to identify the types of tensions in their respective bi-modal IT structures. This may accelerate processes to diagnose the root causes of problems and issues during the implementation of bi-modal IT. We specifically point out the importance of managers having their eyes and ears wide open to identify emotional tensions (such as envy and resentment) early on. Second, in analysing how practitioners manage bi-modal IT tensions, we answer the call by Karpovsky and Galliers (2015) for increased inquiry into what IS practitioners do on the ground to balance alignment with progress. We demonstrate that both integration practices (e.g., liaison officers, job rotation, internal communication) and differentiation practices (e.g., new hiring, special permits, exemptions) are used—in isolation or in conjunction—to address emerging tensions and underlying paradoxes. Practitioners are encouraged to use these integration and differentiation practices as a source of inspiration for individual adaptations. Finally, the dynamics in the relationship between traditional and agile IT indicate that practitioners should continuously reflect on the current state of bi-modal IT in their respective organisations and on how to adapt in light of emerging tensions. As such, IT managers are advised to handle bi-modal IT as a continuous and recursive 'work in progress' towards a moving target instead of a linear process with a fixed goal.

5.2 | Limitations and future research

As with any research, our study is subject to several limitations that should be kept in mind when interpreting our results. We acknowledge that the selection of our cases has limitations. We had to balance the

in-depth observations of each case with the number of cases to reach a comprehensive coverage of tensions, paradoxes, and management practices we were aiming for. Thus, the depth of the observations might be limited. Moreover, although we followed common guidelines (Klein & Myers, 1999; Walsham, 1995), the headquarters of all nine case companies were in Germany. Even if they are multi-nationals, companies from different geographies or cultures might face other bi-modal IT tensions and paradoxes and might manage them differently. Therefore, our results should be seen in the light of the contexts of our cases (Davison, 2014). Furthermore, we employed retrospective data collection to capture relevant developments in the IT function, as has been done in previous IS research (e.g., Li et al., 2017; Ramesh et al., 2007). However, ethnographic methods and continuous longitudinal data collection may have allowed for the collection of even more relevant data. Moreover, while we uncovered multiple bi-modal IT tensions and paradoxes in our study, deriving their relative importance for organisations was beyond the scope of our study. Quantitative studies could be helpful in this respect; they could complement our qualitative findings and explore our research questions on a larger scale.

Our study also opens up new directions for future research. Future studies could evaluate which external tensions (e.g., conflicts with existing and new customers), in combination with internal tensions that were the focus of our study, impact and shape organisations. Future research endeavours are also invited to examine the activities at the interface of traditional IT, agile IT, and other parts of the company in more detail to increase our understanding of the paradoxical concept of bi-modal IT. For instance, bi-modal IT re-integration, as seen in two of our cases, might be a relevant research topic for further studies. Finally, future research could provide a more fine-grained view on IT ambidexterity and bi-modal IT by taking an IS artefact-level perspective to study how the differentiation between IT exploitation and IT exploration affects system applications' evolution (e.g., in terms of features, releases) over time.

6 | CONCLUSION

Bi-modal IT is a powerful engine to leverage digital technologies for value creation and value capture in organisations. Despite its increasing prevalence, previous research has paid little attention to how tensions between the traditional and agile IT modes emerge and how the underlying paradoxes can be managed in practice. Our study contributes to research by revealing nine core tensions in bi-modal IT that can be traced back to five fundamental paradoxes and managed via specific integration and differentiation practices. Based on a micro-foundations perspective, we suggest that an incomplete picture is painted when only organisational-level paradoxes are considered and cross-level interdependencies are overlooked, which is unfortunately common practice in the bi-modal IT literature. In doing so, we not only uncover novel emotional tensions at the individual level. Counter to the prevailing view that divisional separation is a straightforward solution, we also show that the value of structural ambidexterity for the IT function is constantly contested. We hope that our findings lay useful conceptual foundations and provide food for thought in future research, which is needed to expand our current understanding of bi-modal IT.

CONFLICT OF INTEREST
The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT
Authors elect to not share data due to privacy and confidentiality restrictions.

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ENDNOTE

[1] For case 9, only one of the targeted managers agreed to be interviewed.

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