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IT Governance in the Digital Era: Insights from Meta-Organizations

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TILBURG UNIVERSITY

IT GOVERNANCE IN THE DIGITAL ERA: INSIGHTS FROM META-ORGANIZATIONS

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IT Governance in the Digital Era: Insights from Meta-Organizations

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CHAPTER 1

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INTRODUCTION

1. Introduction

The increased adoption of digital technologies is fundamentally reshaping the behaviors and interactions of people within and around organizational settings (Vial, 2019). Such technologies—including social, mobile, analytical, cloud, and internet of things solutions (Sebastian et al., 2017)—provide many opportunities for organizations to radically transform the way they operate and enhance the value they provide to their stakeholders. Organizations, for instance, can use social media and mobile technologies to reach a broader customer base beyond physical spatiotemporal boundaries (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2014) or leverage advanced algorithmic solutions to generate value by learning from the data they collect from stakeholders (Gregory, Henfridsson, Kaganer, & Kyriakou, 2021). Digital native, or born-digital, organizations are especially successful at exploiting such opportunities, thereby radically transforming and challenging existing ways of creating value (e.g., Chanias, Myers, & Hess, 2019; Tumbas, Berente, & Brocke, 2018). Widely known examples of such organizations include Uber, Airbnb, and Spotify (Skog, Wimelius, & Sandberg, 2018).

Organizations, however, can only exploit such opportunities by understanding the characteristics of digital technologies and reconsidering the way they operate. Nowadays, organizations need to be mindful of, *inter alia,* changing stakeholder demands due to the wide consumerization of digital technologies (Harris, Ives, & Junglas, 2012), managing the (digital) relationships between an increasing number of interconnected stakeholders (e.g., Hanisch, Goldsby, Fabian, & Oehmichen, 2023), as well as the access to and use of immense amounts of data (Abraham, Schneider, & Vom Brocke, 2019). Such radical changes brought forward by digital technologies require organizations to reconsider their decision-making processes, rights, and accountability to realize an alignment between organizational objectives and information technology (IT) and encourage desirable behavior of stakeholders (Brown & Grant, 2005). In other words, to fully harness the opportunities that digital technologies bring forward, organizations must pay renewed attention to their IT governance mechanisms.

While there is a large body of literature on IT governance (e.g., Van Grembergen, De Haes, & Guldentops, 2004; Weill & Ross, 2005), the existing theoretical insights fail to capture governance changes, mechanisms, and challenges that surround digital technologies. Such insights, however, are vital in supporting organizations to operate effectively in the digital era. In the short term, paying scant attention to the challenges of digital technologies for IT governance may result in complex and costly implementations of such technologies, while in the long term, it may inhibit organizations from harnessing their latent value (Tiwana,

Konsynski, & Venkatraman, 2013). Such challenges are further exacerbated by the large number of organizations from various industries that fail to realize their digital transformation endeavors (De la Boutetière, Montagner, & Reich, 2018). Whilst information systems (IS) scholars have started examining the governance implications of digital technologies (e.g., DeLone, Migliorati, & Vaia, 2018; Gregory, Kaganer, Henfridsson, & Ruch, 2018; Kellogg, 2022), much remains to be explored for reconceptualizing governance in the digital era (e.g., Aubert & Rivard, 2020). To contribute to such conceptualization, I aim to answer the following research question:

"How can organizations deal with the governance challenges brought forward by digital technologies?"

With my doctoral dissertation, I join the academic conversation on the topic by exploring governance challenges associated with three fundamental and related changes brought forward by digital technologies. In contrast to more traditional enterprise-centric IT, digital technologies are inherently consumer-centric (Harris et al., 2012) and editable (Kallinikos, Aaltonen, & Marton, 2013), largely shifting control to end users (Brenner et al., 2014; Lyytinen & Yoo, 2002). Hence, digital technologies have become a huge aspect of our daily lives and have fundamentally changed how we interact with such technologies (Fitzgerald et al., 2014). Consequently, both employees and consumers have significant access to and freedom in their use of digital technologies, making it increasingly challenging for organizations to determine and control desirable IT behaviour. To inform organizations on how to deal with such issues, we need to understand how, when, and why such changed patterns of digital technology usage enter the organization and interact with existing ways of operating.

The widespread adoption and use of digital technologies have concurrently provided access to data of increasing volume, variety, and velocity, enabling opportunities to better understand and predict, *inter alia,* consumer behaviour, market trends, and maintenance of assets. Such opportunities, however, are only valuable when the available data is processed into useful information. Hence, while data access, *per se*, can potentially be extremely useful for organizations, their high volume, velocity, and variety is characterized by an incomplete and unstructured nature (Clarke, 2016), requiring significant processing capabilities. Organizations, therefore, face a challenge for not only needing to obtain access to data and information to remain relevant, but also for ensuring that such information is actionable by being processed and used accurately.

Organizations that can harness the opportunities brought forward by digital technologies and leverage their access to data may completely transform the way they operate and reap significant benefits from doing so. Digital platforms, such as the Apple App Store, and the ride-sharing platform of Uber, represent well-known examples of organizations that harness the potential of digital technologies. Such platforms create value by facilitating interactions and transactions amongst a wide variety of dispersed and autonomous actors (e.g., Ghazawneh & Henfridsson, 2013; Jacobides, Cennamo, & Gawer, 2018). Platform owners do not have direct and formal control over such actors, yet they need to devise governance mechanisms that encourage engagement with their platform. Hence, besides governance challenges related to the adoption and use of digital technologies, such as the changing role of employees as IT consumers and data processing requirements, organizations that are successful in exploiting digital technologies face governance challenges related to the orchestration of increasing sets of interconnected yet autonomous actors (e.g., Chen, Tong, Tang, & Han, 2022).

Thus, in this doctoral dissertation, I explore three governance challenges related to i) the changed role of IT consumers, ii) dealing with data and information, and iii) orchestrating an increasing number of stakeholders. I do so in the context of meta-organizations, which are defined as comprising *"networks of firms or individuals not bound by authority based on employment relationships, but characterized by a system-level goal"* (Gulati, Puranam, & Tushman, 2012, p.573). Such organizations have a unique design that leverages communication and cooperation amongst various groups of autonomous actors that work towards a similar goal, which often revolves around complex social and economic settings to address market and institutional voids (Ahrne & Brunsson, 2005; Berkowitz & Dumez, 2016; Valente & Oliver, 2018). Meta-organizations demonstrate the growing importance of collective action to achieve specific goals (Berkowitz & Dumez, 2016) and are increasingly adopted as an alternative to more traditional organizational designs (e.g., Ahrne & Brunsson, 2008; Chen et al., 2022).

Meta-organizations are a particularly relevant context to explore IT governance challenges in the digital era, as their design and the economic relationships they resemble are increasingly common in practice, while academic literature on this specific organizational design is scarce. This recent rise in the number of meta-organizations can be partially explained by the wider societal adoption of digital technologies, which offer opportunities for more efficient knowledge production and dissemination (Gulati et al., 2012). In other words, both the meta-organization design and digital technologies are particularly well suited for managing a variety of dispersed and autonomous actors (Ahrne & Brunsson, 2008; Valente & Oliver, 2018). Given that meta-organizations can have access to the resources, capabilities, and knowledge of

their members, the opportunities for innovation through the use of digital technologies within such an organizational design are enhanced (Gulati et al., 2012). Moreover, as meta-organizations can facilitate interactions and transactions amongst a variety of actors, technologies that enable such interactivity can result in significant improvements in efficiency and effectiveness, as illustrated by the proliferation of digital platforms.

On the other hand, however, meta-organizations face inherent complexities in terms of coordinating, controlling, and governing coordination amongst a multitude of autonomous actors. Traditional ways of management and governance, including hierarchy and pecuniary incentives, are less efficient or even not applicable due to the unique, open, and less contractual nature of meta-organizations (Gulati et al., 2012). Moreover, diverse interests may be present, potentially creating difficulties for collective action. This represents a challenge for meta-organizations that want to digitally transform, as well as for those organizations that have successfully adopted digital technologies but need to further orchestrate the behavior of an even larger set of interconnected actors. Hence, a meta-organizational design can be metaphorically portrayed as a double-edged sword: on the one hand, it increases cooperation, offers flexibility, and provides opportunities for innovation, while on the other hand, it poses significant challenges in terms of managing and governing the variety of autonomous actors. In sum, the use of digital technologies often requires collaboration and coordination of a variety of different actors, for which a meta-organization design may be particularly useful. This research context can therefore offer a set of useful insights into how organizations in general can realize such collaboration and coordination.

While each chapter of my doctoral dissertation includes a synthesis of the literature relevant to answering a specific sub-question, in this chapter, I first present a general overview of the literature on IT governance and further introduce the research context to lay the foundation of my doctoral dissertation. Afterwards, I present an overview of the structure of the doctoral dissertation and summarize the primary purpose as well as findings of each essay.

2. IT Governance in the Digital Era

IT governance refers to *"the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT"* (Weill, 2004, p.3), and has long been a key theme in IS research and practice. Early research on the topic was mainly concerned with the use of enterprise-centric IT, as well as the relevant infrastructure, and project management to accommodate this (Sambamurthy & Zmud, 1999). This line of work was later expanded by the

seminal paper of Weill and Ross (2004), highlighting five major IT decisions, namely i) IT principles, ii) IT architecture, iii) IT infrastructure, iv) business application needs, and v) IT investments. A central objective of IT governance is to ensure that the IT activities and decisions of organizations are in line with their overarching strategy and objectives (e.g., Joshi, Bollen, Hassink, De Haes, & Van Grembergen, 2018; Sambamurthy & Zmud, 1999; Tiwana & Kim, 2015; Weill & Ross, 2004).

The development and widespread use of digital technologies, however, brings forward novel challenges for IT governance research and practice. Digital technologies have fundamentally changed the interactions between users and technology, including the control that users have over the deployment of such technologies (DeLone et al., 2018; Harris et al., 2012). Moreover, digital technologies are increasingly becoming fundamental for organizational performance, encouraging organizations to no longer treat IT as distinct from the organizational strategy (e.g., Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). In light of this, recent studies have started exploring how such technologies may transform IT governance mechanisms (e.g., Gregory et al., 2018), and how organizations need to purposefully adapt such mechanisms to remain effective (DeLone et al., 2018; Tiwari, 2022).

Recent studies have provided initial insights into the implications of digital technologies on what is governed, who is governed, how is governed, and when is governed. For instance, Vaia, Arkhipova, and DeLone (2022) show that when and at what speed to decide is becoming increasingly important now that consumer behaviors change rapidly due to the pace of technological developments. Gregory et al. (2018) argue, *inter alia,* that governance mechanisms surrounding what, who, and how decisions are changing from centralized, top-down decision-making to more democratized and platform-based decision-making due to IT consumerization. Relatedly, an increasing number of studies is paying attention to the governance of digital platform ecosystems, raising awareness and calling for more research on the governance challenges that are induced by both digital technologies as well as the meta-organizational design of such platform ecosystems (e.g., Chen et al., 2022; Kretschmer, Leiponen, Schilling, & Vasudeva, 2020).

Overall, recent studies signal that traditional theoretical insights on IT governance may not be applicable to organizations anymore in the digital era. The pervasiveness of digital technologies, access to huge amounts of data and information, and the increasing interconnectedness of a variety of dispersed actors warrant new insights into how organizations can make decisions to encourage desirable behavior. As such, we can distill valuable insights by studying IT governance challenges brought forward by digital technologies, contributing to

the body of work related to the transformation of IT governance in the digital era. I have, therefore, conducted research in the context of meta-organizations, covering insights from pre-digital organizations, such as multinational military organizations, and digital native ones, such as digital platforms.

3. Research Context

While digital technologies present IT governance challenges for all types of organizations, the context in which I explore such challenges is that of meta-organizations. Although meta-organizations have been around in various forms for many decades, the increasing adoption of such an organizational design over the past two decades has spurred interest amongst IS and management scholars (Ahrne & Brunsson, 2008; Berkowitz & Bor, 2018; Du, Pan, Zhou, & Ouyang, 2018; Spillman, 2018; Valente & Oliver, 2018). Whereas traditionally meta-organizations were predominantly defined as organizations consisting of organizations (Ahrne & Brunsson, 2005, 2008), such a definition has more recently been extended to include organizations consisting of a variety of autonomous actors, including not only organizations but also individuals (Gulati et al., 2012). The defining characteristic of meta-organizations, however, remains that the relationships amongst such autonomous actors are not based on formal employment contracts but rather on more informal mechanisms of command and control. In other words, the relationships involved in meta-organizations are *"neither as limited and specific as sport market contracts, nor as enduring and extensive as those within a hierarchical organization"* (Kretschmer et al., 2020, p.407).

I follow Gulati et al. (2012, p.7) in defining meta-organizations as comprising *"networks of firms or individuals not bound by authority based on employment relationships but characterized by a system-level goal".* Such a system-level goal can take a variety of forms, depending on the specific nature of the meta-organization. Examples of meta-organizations include trade unions and multinational military organizations, as well as more recent representations in the form of digital platform ecosystems (e.g., Gawer, 2014). Hence, meta-organizations may serve a variety of industries with different purposes, ranging from for-profit organizations that hugely impact our economy (e.g., Uber, Amazon) to public organizations that play a significant societal role (e.g., United Nations, North Atlantic Treaty Organization).

While the involved actors in a meta-organization collectively work towards a shared goal, their incentives for doing so may differ. Such incentives often include the need for some form of synergy or technological complementarities (Thorelli, 1986) or to become better

equipped for handling complexity (Valente & Oliver, 2018). As the incentives for participating in a meta-organization may differ for the various involved actors, so does their level of informal control or authority. Authority in such a setting is often linked to the extent to which actors bring in specific qualities, such as expertise, reputation, and key resources (e.g., Dahlander, O'Mahony, & Gann, 2016; G. K. Lee & Cole, 2003), thereby determining their bargaining power. In most cases, meta-organizations aim to generate a collective playing field, where decisions are made based on consensus amongst the various involved actors or those with sufficient bargaining power (Ahrne & Brunsson, 2008; Bor, 2014).

Hence, meta-organizations often lack contractual structures, resulting in a paradox of being structurally weak due to the dependence on their members, yet increasingly relevant and important in addressing collective issues (Ahrne & Brunsson, 2005; Berkowitz & Dumez, 2016). Rapidly emerging digital platforms often represent a combination of both organizational and market mechanisms (Constantiou, Marton, & Tuunainen, 2017) and are typically arranged in ecosystems, providing a core on which multiple autonomous actors can further develop, promote, and distribute their products and services and are increasingly conceptualized as meta-organizations (Chen et al., 2022; Kretschmer et al., 2020). In the case of Uber, for instance, value is created by matching supply and demand while coordinating the actions of members toward organizational goals (Möhlmann, Zalmanson, Henfridsson, & Gregory, 2021). Consequently, the members of a meta-organization are often competitors, while they can concurrently also compete with the meta-organization itself in certain areas (Ahrne & Brunsson, 2008). For instance, Amazon competes with some of its complementors in successful product spaces (F. Zhu & Liu, 2018). Hence, meta-organizations often face complex co-opetition patterns.

In sum, meta-organizations play an increasingly prominent role in society, addressing a variety of economical and societal voids (Valente & Oliver, 2018), increasingly by heavily relying on the use of digital technologies (e.g., Gulati et al., 2012). The organizing of meta-organization resembles the increasingly common collaborative relationships between organizations, including the organizing in digital platforms ecosystems and is likely to become increasingly common. In that sense, understanding how such organizations can address IT governance challenges brought forward by digital technologies is vital for the continuation of such organizations and our society.

4. Structure of the Dissertation

The main body of this dissertation consists of three essays (i.e., Chapters 2, 3, and 4), covering two empirical essays and one conceptual essay. Chapter 2 and 3 represent the empirical essays, for which I have conducted qualitative research at a multinational military organization engaged in digital transformation. Chapter 4 represents the conceptual essay and focuses specifically on platform ecosystems. Each chapter addresses a specific governance challenge brought forward by digital technologies, while the final chapter of this dissertation (Chapter 5) connects the findings of the essays and reflects on IT governance in the digital era in general, and in the context of meta-organizations specifically. In the remainder of this section, I provide a summary of the three essays (i.e., Chapters 2, 3, and 4) and a brief overview of their findings and contributions.

In Chapter 2, I explore how the widespread consumerization of digital technologies interact with existing organizational properties and may give rise to an organization-wide digital transformation. More specifically, I explore the role of workers as IT consumers (Gregory et al., 2018) by adopting a morphogenetic approach. Such an approach allows for clearly distinguishing culture, structure, and agency, enabling me to uncover generative mechanisms that explain how changes in patterns of digital technology usage affect the unfolding of digital transformation in organizations. In particular, I step away from the predominant focus on conscious and intentional digital transformation initiatives undertaken by managers, and foreground cultural changes that emerge through the consumerization of digital technologies. I show that digital transformation is heavily driven by agency at the level of workers who generate a cultural transformation versus agency at the level of managers who subsequently generate a structural transformation. This novel perspective complements existing insights that focus primarily on intentional and management-controlled initiatives, resulting in a more nuanced and realistic picture of digital transformation. The insights from this essay inform organizations on how to set up governance mechanisms that allow for flexible digital innovation on the level of workers while ensuring that such innovation is mobilized in a desirable manner on the level of managers.

The second essay (Chapter 3) revolves around governance challenges related to the increasing amounts of data and information available to organizations. The use of digital technologies for extracting information from various data sources can help organizations to reduce uncertainty and improve decision-making. The increasing availability in volume, velocity, and variety of data, however, can give rise to significant risks and challenges in

ensuring a high level of information quality. Pre-digital organizations can be particularly susceptive to such challenges due to their limited experience with digital technologies and data governance. In this essay, I adopt a theory-infused interventionist research approach to assist a multinational military organization in navigating its digital transformation endeavor by focusing on information quality. More specifically, I design and implement an information quality strategy by drawing upon organizational information processing theory and examine how the level of information quality can affect the balance between information processing requirements and capacity. I demonstrate that an information quality strategy that incorporates both technological and governance solutions can support organizations in setting their digital transformation scope, decreasing employees' resistance to change, increasing their satisfaction, and concurrently improving organizational efficiency. In particular, I stress the importance of information quality in the digital era and delineate how pre-digital organizations can navigate digital transformation by strategically addressing information quality.

In the third essay (Chapter 4), I explore governance issues surrounding the interdependencies of autonomous actors by focusing on digital platform ecosystems. Platform ecosystems have a meta-organization design in which actors comprise a platform owner, complementors that provide value-adding complements to the platform, and users. A key challenge that platform owners, as orchestrators of the platform, face is to ensure that complementors remain incentivized to contribute to value creation. If complementors do not capture an appropriate share of value, they may be unable or unwilling to keep engaging with the platform, which may be harmful to the ecosystem. Nevertheless, as we can observe in the context of platform ecosystems, not all actors respond similarly to the same value distribution mechanisms. I bring forward a novel theory of *value slippage* in platform ecosystems. Value slippage occurs when a part of the value created by a focal actor is captured by another at the cost of that focal actor (Lepak, Smith, & Taylor, 2007). Given the interdependencies of platform ecosystem actors and their value co-creation efforts, value slippage is inherently part of platform ecosystems. In this essay, however, I show *how* and *why* high levels of value slippage may result in adverse complementor responses. Moreover, I pay specific attention to complementor heterogeneity in explaining the variety of responses that complementors may show. In general, I argue that managing value slippage is a key governance challenge that platform owners should address to avoid costly negative responses to value distribution from complementors.

Finally, in Chapter 5, I synthesize the findings from the three essays and, by drawing on their insights, I provide an answer to the main research question of my doctoral dissertation.

Moreover, I discuss the meta-organization context and reflect on additional insights related to the research context. Based on this, I provide an overview of the overarching implications of my doctoral dissertation, making a distinction between its theoretical and practical contributions. Finally, I reflect on the limitations of my research and, based on these limitations and the findings of the essays, I draw an agenda for future research.

CHAPTER 2

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MAKING THE INVISIBLE VISIBLE: A MORPHOGENETIC APPROACH TO THE UNFOLDING OF DIGITAL TRANSFORMATION

1. Introduction

The extant IS literature has foreshadowed the presence of a novel digital culture, brought forward by the widespread consumerization of digital technologies. Such technologies are inherently consumer-centric, largely shifting control over their use to the end user (Harris et al., 2012). Recent studies address how such technologies may influence cultural schemata on various levels of analysis by, *inter alia,* looking at digital mindsets (e.g., Neeley & Leonardi, 2022; Solberg, Traavik, & Wong, 2020), institutional logics (e.g., Faik, Barrett, & Oborn, 2020; Tumbas et al., 2018), and organizational digital cultures (e.g., Hemerling, Kilmann, Danoesastro, Stutts, & Ahern, 2018). Regardless of the labeling, there is a consensus that the patterns, opportunities, and framing around digital technologies differ significantly from the more traditional enterprise-centric IT.

Despite such observations, only scant attention has been paid to how such novel cultural schemata interact with existing organizational cultures and structures and potentially generate an organization-wide transformation. While recent research has pointed to the importance of cultural elements in digital transformation endeavors (e.g., Faik et al., 2020; Tumbas et al., 2018), it remains unclear how such elements emerge and cascade throughout an organization, as well as how they interact with existing organizational culture and structures. Concurrently, the literature on digital transformation has predominantly focused on conscious and intentional initiatives, such as developing strategies (e.g., Bharadwaj et al., 2013; Kane, Palmer, Phillips, Kiron, & Buckley, 2015; Matt, Hess, & Benlian, 2015), primarily relying on top managers and organizational leaders to set the stage for change (Pedersen, 2022). While such work has elucidated the novel characteristics of digital technologies and unearthed various elements of digital transformation, it has overlooked important aspects of digital transformation that emerge *unintentionally* or *unconsciously* (Lanamäki, Väyrynen, Laari-Salmela, & Kinnula, 2020), in light of the changing role of employees as IT-consumers (Gregory et al., 2018).

Recent calls in the literature (e.g., Haskamp, Marx, Dremel, & Uebernickel, 2021; Lanamäki et al., 2020; Majchrzak, Markus, & Wareham, 2016) signal the need to elucidate further the emergent nature of this perceivably unintentional and unconscious process, rather than viewing change episodes exclusively as intentionally planned and consciously executed projects that constitute a transformation program (Gregory et al. 2015). In this paper, we complement existing perspectives of managing digital transformation and add a new perspective to the literature to account for the emergent process of change perceived by the collective group of organizational members as unintentional and unconscious. In doing so, we

address the following research question: *How, when, and why does digital transformation unfold in organizations?*

To answer this research question, we adopt a morphogenetic approach as our exploratory lens, which enables us to explain the *unfolding* of digital transformation by disentangling culture, structure, and agency and to identify generative mechanisms at specific places and points in time (Archer, 2020). Such mechanisms represent detailed explanations of the unfolding of digital transformation and consider the broader context in which they are embedded (Avgerou, 2013). Importantly, we build on the notion of unfolding to denote that digital transformation gradually becomes visible after having remained concealed. The empirical context of our study is a multinational military command, where we collected over ten years of organizational documents and conducted 62 interviews. Following the findings from our case, we bring forward a mid-range theory (Hedström & Swedberg, 1996), which provides two generative mechanisms that shape the unfolding of digital transformation, namely concealed experimentation mechanism and resource mobilization mechanism. We further explain when and why these mechanisms may be activated, depending on the organizational context in which they are embedded (Avgerou, 2013).

Our theory of unfolding suggests that digital transformation is catalyzed by cultural changes in pockets of the organization that may be lower in the hierarchy while their materialization remains concealed for the rest of the organization. During this critical period, there is a high degree of brainstorming, experimentation, and innovation based on workers' personal experiences with digital technologies without the restrictive control of executives and top managers. Once such small-scale initiatives reach a level of maturity, resource mobilization gives rise to broader transformation. Hence, cultural change is at the epicenter of digital transformation, which, as we showcase, is much more uncertain and much less management-controlled and strategic than one might assume based on the existing literature (Bharadwaj et al., 2013; Yeow, Soh, & Hansen, 2018).

Our paper contributes to the literature on digital transformation by offering a new theory of its unfolding, stepping away from the predominant focus on conscious and intentional initiatives undertaken by managers, and foregrounding cultural changes that emerge through the consumerization of digital technologies. By disentangling interactions between culture, structure, and agency, we show that digital transformation is heavily driven by agency at the level of workers who generate a cultural transformation versus agency at the level of managers who subsequently generate a structural transformation. This novel perspective complements existing insights that focus primarily on intentional and management-controlled initiatives,

resulting in a more nuanced and realistic picture of digital transformation.

The rest of our paper is structured as follows. The next section provides an overview of the extant literature on digital transformation and motivates our explicit choice to adopt the morphogenetic approach. We continue with a description of the case organization and our research approach, along with a presentation of our findings based on the two morphogenetic cycles we have identified. In the penultimate section of the paper, we present our mid-range theory propositions and conclude with a discussion of the theoretical and practical implications of our work, while we delineate an agenda for future research on the topic.

2. Conceptual Background

Digital Transformation

Digital transformation has become a buzzword in both practice and academia, and is often linked to the adoption of combinations of social, mobile, analytical, cloud, and internet of things technologies (Sebastian et al., 2017) that can fundamentally reshape the behaviors and interactions of people within and around organizational settings (Vial, 2019). Such technologies are often ambiguous, incomplete, and evolving (Faulkner & Runde, 2019), offering transformative possibilities for the recombination and extension of physical objects and boundaries (Kallinikos et al., 2013; Yoo, Boland Jr, Lyytinen, & Majchrzak, 2012).

Prior studies have explored the management of digital transformation endeavors, emphasizing intentional, conscious, and management-controlled processes over emergent ones (Lanamäki et al., 2020), highlighting the *strategic* nature of digital transformation (e.g., Yeow et al., 2018) during which an organization *"aims to improve"* operations (Vial, 2019, p.121). While this line of research has provided valuable insights into how digital technologies may improve organizational performance, as well as guidance for managers in how to navigate such endeavors, the focus on solely intentional and management-controlled initiatives may not provide a complete picture of digital transformation, and may lead scholars and practitioners alike to overlook the *"always already-changing texture of organizations"* (Tsoukas & Chia, 2002).

Earlier work on organizational and IT-enabled transformation has demonstrated the emergent nature of transformation processes, as well as the essential role that workers might play in such processes. Orlikowski (1996) for example shows how transformation emerges through the improvisation and innovation practices of employees as they are confronted with a new technology in their daily work practices. Similarly, Henfridsson and Yoo (2014) show how

innovation may emerge as institutional entrepreneurs face limitations in their daily work and seek to shift the organization into a new direction. In general, while there is an enduring understanding that transformation is indeed an *emergent* phenomenon (Markus & Robey, 1988), such a perspective has received scant attention, to date, in the context of digital transformation.

We argue, however, that digital transformation warrants further research from the perspective of an emergent and unfolding process for various reasons. An increasing number of studies point to the radically different nature of digital technologies (e.g., Faulkner & Runde, 2019; Yoo, Henfridsson, & Lyytinen, 2010), as well as novel patterns, opportunities, and framings surrounding such technologies (e.g., Faik et al., 2020; Tumbas et al., 2018). Importantly, digital technologies have become widely accessible, leading to their consumerization (Harris et al., 2012) that might alter how novel ideas enter organizations and materialize into digital innovation. For instance, employees might bring their personal digital tools to work settings, harnessing their potential and spreading their adoption within the organization before any organization-wide or structural changes formally take place (Niehaves, Köffer, & Ortbach, 2012). Such consumerization of digital technologies, while not limited to certain demographics, might be more prevalent amongst younger employees or those with a technical affinity (Fitzgerald et al., 2014; Kohli & Johnson, 2011), who might not traditionally be involved in the strategic development of the organization.

Concurrently, the use of digital technologies and their affordances give rise to significant differences compared to traditional ways of doing business, having implications for the scale, scope, and speed of transformations (Bharadwaj et al., 2013; Vial, 2019). There are often strong cultural and structural conditions that clash with the novelty of such technologies and represent a key barrier to digital transformation (e.g., Haskamp, Dremel, & Uebernickel, 2021). In failed digital transformation endeavors, existing resources and capabilities often represent a liability for organizations, as their transformation can be constrained due to high levels of path dependency (Srivastava & Shainesh, 2015). Hence, the unfolding of digital transformation can be influenced not only by agential actions, innovative ideas, and novel technologies but also by existing organizational structures and culture. Understanding the role that such existing conditions play in digital transformation could further elucidate why such endeavors unfold the way they do. As such, recent work calls for the need to adopt a perspective of emergence for understanding digital transformation (e.g., Lanamäki et al., 2020), and highlights the need for further examination of the underlying generative mechanisms of such endeavors (Haskamp, Dremel, et al., 2021).

A Morphogenetic Approach to Examine Digital Transformation

We adopt Archer's (1995) morphogenetic approach to explore how novel digital cultural schemata affect the unfolding of digital transformation. The morphogenetic approach offers an explanatory lens for elucidating emergent processes by disentangling the interactions amongst structure, culture, and agency and making explicit their underlying causal mechanisms. Building on critical realism, the morphogenetic approach posits that reality is emergent, existing independently of humans, and stratified with higher levels emerging from, yet not being reducible to, lower ones (Bhaskar, 1978). It captures the perspective that reality is transformational, meaning that people do not simply create new structures but rather transform or reproduce existing ones, being conditioned by existing structures and cultures (Archer, 1995). In light of this, the morphogenetic approach is especially suitable for thoroughly exploring the role of employees as IT consumers in the unfolding of digital transformation.

The importance of human action (e.g., Besson & Rowe, 2012; Orlikowski, 1996; Pettigrew, Woodman, & Cameron, 2001; Tsoukas & Chia, 2002) is not new in studies on IT-enabled or digital transformation, but has largely been incorporated in the IS literature by building upon structuration theory (M. R. Jones & Karsten, 2008; Poole, 2009). While foundationally speaking, both structuration theory (Giddens, 2014) and the morphogenetic approach (Archer, 1995) emphasize the role of human agency, the latter acknowledges that new social structures do not emerge spontaneously through human (inter)actions but are conditioned (yet not determined) by existing, traditional ones (Archer, 2020). The morphogenetic approach also takes the *temporal* dimension into account, allowing for the examination of *when* change occurs, thereby shedding light on the temporal order between, for instance, technology adoption and cultural change. As such, the morphogenetic approach has previously received attention in studies related to IT and IT change (e.g., Dobson, Jackson, & Gengatharen, 2013; Njihia & Merali, 2013), and can provide the needed lens for studying the complexities of digital transformation (Haskamp, Dremel, et al., 2021; Vega & Chiasson, 2019).

The morphogenetic approach focuses on processes of emergence through which structure, culture, and agency continuously (re)shape each other, possibly resulting in different outcomes over time (Njihia & Merali, 2013). *Structure* can be conceptualized as the distribution of power and material resources, while *culture* reflects the distribution of ideas and knowledge. Structure and culture both evolve through the (inter)actions of individuals that hold particular roles and positions, who act individually or as part of a group with the intention of achieving a specific result; this is referred to as *agency.* Individuals consider themselves in relation to the broader context (structural and cultural conditions) and act in a way that aligns with their

objectives (Archer, 2007, 2012). For instance, vested interests and opportunity costs can influence an individual's course of action (Archer, 1995)[1]. As a result of the actions of (a group of) individuals, wider transformation or reproduction of structure, culture, and agency may occur.

In the morphogenetic approach realm, transformation is described as *morphogenesis,* while reproduction is referred to as *morphostasis* (Archer, 1995). For instance, the same hierarchical structure of an organization over time would represent *morphostasis*, while flattening of a hierarchical structure would represent *morphogenesis.* Hence, such morphogenesis and morphostasis may occur in structure, culture, and agency and are depicted by *morphogenetic cycles* (**Figure 1**). *Structural morphostasis* occurs when the distribution of power and resources remains unchanged, *cultural morphostasis* occurs when the distribution of ideas and knowledge remains unchanged, and *agential morphostasis* occurs when individuals keep the same roles and intentions. Reversely, *structural morphogenesis* occurs when the distribution of power and resources is transformed, *cultural morphogenesis* occurs when the distribution of ideas and knowledge is transformed, and *agential morphogenesis* occurs when individuals' roles and intentions transform. By making such a distinction, we can tease out in which parts of an organization reproduction or transformation take place, understand the temporal order of transformation, and elucidate the generative mechanisms that produce the outcome.

Generative mechanisms can explain observable outcomes, representing the 'nuts and bolts' of mid-range theories (Elster, 2015), and entailing rich and comprehensive explanations of phenomena by cutting across different levels of analysis while considering the broader context in which they are embedded (Avgerou, 2013). Following the morphogenetic approach, such mechanisms represent causal powers that emerge from the interplay amongst culture, structure, and agency (Archer, 2020). Existing structures and cultures predispose – yet do not determine – individuals to take certain actions with the aim of realizing or discouraging change. For instance, incompatibilities between culture and structure may encourage individuals to strive for change. Hence, existing conditions often signal specific courses of action that individuals will likely adopt to realize a specific outcome.

[1] We provide a complete overview of concepts and definitions, as well as examples of their manifestations in our case, in Appendix A.

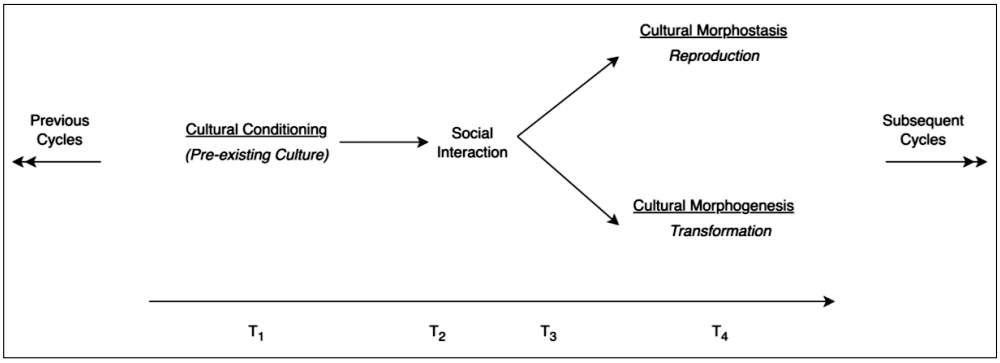

Figure 1 - *Morphogenetic Cycle of Cultural System (adapted from Archer, 1995)*

3. Methodology

Research Context

We conducted a longitudinal, in-depth case study at a AirTrans, a multinational military organization that was established 11 years ago to serve various nations by pooling together their air force transport resources and assets for effectively and efficiently planning and executing military as well as humanitarian air transport missions. Such missions include, *inter alia,* cargo transport, air-to-air refueling, and medical evacuations. The pooling of assets and resources that the operations incorporate entails, for instance, that military or humanitarian missions for nation A can be executed with resources of B, while also being able to carry cargo for C. The cost for such an exchange of resources is settled through a virtual currency. Hence, the organization represents a collaborative effort between the air forces of different participating nations.

AirTrans consists of three pillars: i) operations, ii) standardization, and iii) support. The operations pillar is responsible for planning and executing the missions, while the standardization pillar works on harmonizing the rules and regulations that apply to all participating nations. The support pillar includes all services required for daily operations, such as human resources, finances, and IT. The employees of the multinational command are deployed by the various participating nations and serve for an average of three years. The command receives strategic directives from a multinational committee represented by high-ranking officials from the participating nations. Hence, AirTrans has to satisfy many multinational stakeholders, is subject to multinational laws, rules, regulations as well as expectations, and is dependent on input and investments from various stakeholders.

Such a multinational dependency is also reflected in its IT architecture. The participating nation that hosts the multinational command offered a basic IT infrastructure that was deemed

sufficient at the beginning, while later was perceived as inadequate for addressing the multinational and complex structure of AirTrans, as well as the volatile environment in which it operates. Consequently, AirTrans experienced increasing pressures from internal and external stakeholders to optimize its IT infrastructure. Over the past 11 years, AirTrans underwent substantive reforms aimed at increasing the efficiency and effectiveness of its operations by optimizing its IT infrastructure. For instance, the organization transformed its operations to a more substantial focus on aeromedical evacuations and crisis situations as triggered by the adoption of cloud and mobile technologies.

While our case represents an extreme case in the sense that military organizations i) are often subject to strong structural conditioning in terms of political relationships and (inter)national dependencies, ii) are typically characterized by a strong top-down hierarchy that allows little room for bottom-up initiatives, and iii) the potential consequences of their malfunctioning can have disastrous broad-scale consequences (e.g., Klein, Bigley, & Roberts, 1995), such cases can be especially suitable for generalization and can reveal key dimensions that influence the unfolding of a specific phenomenon (Nissen, 2005; Yin, 1994). We adopt the morphogenetic approach to elucidate the complex interactions amongst culture, structure, and agency, as well as the generative mechanisms that have resulted in the current state of digital transformation.

Data Collection and Analysis

We were granted access to all organizational documents and were allowed to observe the daily operations of AirTrans for a period of four years. We reviewed all the available organizational documents of AirTrans from 2010 until 2021, which included a total of 1227 strategic directives, public (news) releases, and minutes of meetings. We identified 349 of these documents as relevant to our study, and they were used for subsequent analysis. The relevant documents included, amongst others, statements about IT, digital transformation, structure, ideas, objectives, performance indicators, and capabilities. The documents offered insights into changes in organizational structure, allocation of investments, emerging ideas, and the perceptions of interviewees regarding organizational success and appropriate behavior. We structured and coded all the relevant documents, which enabled us to develop a timeline and identify generative mechanisms that explain the unfolding of digital transformation to its present-day outcome.

We also conducted 62 semi-structured interviews (ranging from 20 to 126 minutes with an average duration of 51 minutes) spread out over 2019, 2020, and 2021, with 34 employees

from various organizational levels and divisions and observed employees during the same period.[2] We followed a purposive sampling approach to select interview participants, which enabled us to recruit employees from different organizational levels, backgrounds, and ranks (Thornhill, Saunders, & Lewis, 2009). We used semi-structured interview protocols that allowed us to ask predetermined questions while offering the opportunity for follow-up ones (Sekaran & Bougie, 2016). More specifically, we adopted a story-telling approach during the interviews (Czarniawska, 2004) to ensure that the interviewees could share their experiences without too much interference from the researcher. The interviews were focused on the digital transformation of AirTrans, similar endeavors at the interviewees' nation of origin, opportunities, threats, and major (historical) events, while we posed the questions in such a way as to enable an in-depth understanding of causal interactions and emerging events related to digital transformation (Brönnimann, 2021). We audio-recorded, transcribed, and analyzed the interviews, starting with exploring individual experiences, followed by the development of more abstract conceptual categories to understand the data and identify the emergent patterns.

Our examination was broad in scope but was primarily concerned with implicit and explicit change related to digital technologies. The *agents* in our research context concern workers and managers. Agents can act individually or as part of a group. The *structural system* is concerned with material relations between agents, such as the distribution of (IT) resources and the organizational structure. The *cultural system* reflects dominant ideas about IT upon which agents draw (Njihia & Merali, 2013). Following this line of reasoning, we focused our analysis on structural and cultural change related to digital technologies. We partially followed Njihia and Merali (2013) to develop an analytical history of emergence, which consisted of five steps. We first identified periods characterized by either stability or change and classified them as morphogenetic cycles. We looked at the structural system (e.g., distribution of organizational resources, control, and power), cultural system (e.g., distribution of ideas and knowledge), and agency (e.g., primary and corporate agents), and identified two morphogenetic cycles. We then identified whether the structural and cultural conditions at the end of each cycle were complementary or contradictory and necessary or contingent, to identify what situational logics emerged at the end of each cycle. Afterward, we uncovered the actual actions of agents based on these situational logics and we repeated these steps for different periods. Finally, we aggregated the insights from each cycle into higher-order constructs to capture the generative mechanisms that explain the unfolding of our case.

[2] A detailed overview of the interviewees and archival data is presented in Appendix B.

4. Cycle I: Structural Morphostasis and Cultural Morphogenesis

Structural and Cultural Conditioning

To understand the situations in which workers and managers found themselves and explain what courses of action were available, we first explored the initial structural and cultural conditions of AirTrans. Several structural properties related to the distribution of power and control over resources allocated to IT are especially worth mentioning. AirTrans is subject to complex external and internal governance structures. Regarding the former, a supervisory board of air chiefs represents the highest decision-making level that is accountable for political and strategic decisions, receiving input from a finance committee consisting of representatives of each nation. Besides that, a separate advisory board provides frequent strategic guidance to AirTrans.

As the member nations delegate employees to AirTrans, internal governance is represented by a significant number of high-ranked officers to level the political playing field, where one officer serves as the representative for each nation. Such representatives must unanimously approve all major strategic and operational decisions. High-level positions (e.g., commander, division head) rotate between the participating nations every couple of years. In general, power is distributed amongst high-level officers within AirTrans, that serve as managers who are accountable for the organization's performance and must satisfy the external governance committees. Relatedly, while AirTrans receives a yearly budget, they must account for their expenses, as well as request additional funding, through these external governance committees.

Besides the governance structure, AirTrans was subject to another structural dependency in terms of its IT infrastructure. Upon its establishment, AirTrans agreed to arrange its IT through the infrastructure and services of the host nation IT provider (i.e., the nation in which AirTrans' headquarters is located), paying the IT organization of the host nation. Importantly, however, given the multinational nature of AirTrans, the host nation provided a clone of its own IT infrastructure, denying access to the full range of IT services and applications available to employees of the host nation. Consequently, AirTrans had to make do with the applications provided by the host nation, was dependent on their services for updating applications, and had limited to no opportunities for innovation. One exception concerned the flight planning tool that was developed by AirTrans. Again, however, the details and functionalities of this tool had to be in line with the host nation, as the tool was hosted on their IT infrastructure as well.

In terms of cultural conditions, AirTrans primarily pursued operational objectives based on the dominant knowledge within the command and the broader field. For instance, strategic directives were mainly concerned with enhancing operational capabilities, where IT was mainly seen as a basic supporting element in doing so. The public statements of AirTrans indicated a strong desire to be regarded as a reference organization for all domains related to air transport, while there was a strong focus on physical assets and exploiting existing resources, assets, and capabilities for achieving this. Managers had no interest in adopting new technologies or altering the IT infrastructure, partly because they lacked ideas on the potential benefits of doing so, as well as the knowledge of how to approach this, and partly because it would likely lead to significant resistance from the host nation. During advisory board meetings, it was clarified that regardless of any issues or challenges in terms of the IT infrastructure, there were no opportunities for replacement and support, while its acceptance was required by all stakeholders: *"COM further explains and stresses that AirTrans IT tool is and will be the IT system of AirTrans; no alternative is in place, and we all have to support this tool to the utmost"* (Advisory board meeting, 2011).

Such necessary complementarities between structural and cultural properties had led to a reproduction of both the structural and cultural domains. Managers aimed to fulfill the strategic directives of AirTrans by relying on their operational knowledge and ideas, receiving little to no pushback for several years. Nevertheless, given their daily use of digital technologies in private settings, workers increasingly recognized opportunities to adopt such technologies for enhancing their work, strengthen the position of AirTrans, and add value for the nations.

Interaction

From the manager perspective, necessary complementarities characterized the *status quo* of AirTrans, predisposing them to protect the existing situation. After all, radically changing the IT infrastructure would mean altering the agreement with the host nation, with significant political and career-related risks involved. This strong ideational focus of managers with significant power and control hampered them from recognizing, understanding, and responding to functional requirements that emerged, on the one hand, from the day-to-day work routines and, on the other hand, from workers' personal experiences with digital technologies, who started discussing the limitations of the current situation, as well as potential opportunities for improvement. Hence, workers were increasingly dissatisfied with the IT environment and level of innovativeness. Consequently, a discontinuity emerged between powerful managers with access to resources and a group of workers that had become culturally differentiated.

Initially, workers started to express their concerns and opportunities for improvement to the management, mainly focusing on minor alterations. For instance, in one of the top-level meetings during that period, the need for innovating the flight planning tool was raised by one of the workers, with the objective of collecting and analyzing data for operational use: *"Assessment on the AirTrans IT tools potential is needed to stress AirTrans position in order to clarify which connectivity could add the most interesting data for operational use"* (Commander's meeting 1, 2012). Another worker reflected on his attempt to push for a simple digital solution: *"I proposed to the predecessor of [current head of section] to stop this paper archiving and implement a digital archive. [...] And that was hard for him to accept".* LCD-1 shared his thoughts on this: *"[...] they have the strong belief that it is working against them and not working for them"* and *"It is just one of those inheritances of the past, where people say that the books are the only ones that count. That is of course bullshit, that is one of those things where we had to break through old habits".*

Hence, workers faced resistance from managers, who, due to their structural power, were able to eliminate deviations from the structural *status quo.* While managers also had personal experiences with digital technologies, they were more distant from operations and had difficulties envisioning transformation through digital technologies. Especially ideas that were challenging the existing IT infrastructure were deemed unrealistic and impossible. Managers kept referring to the existing agreements with the host nation for a significant period. In a chief of staff meeting, for example, employees were again ordered to work together with the host nation regarding IT, regardless of any issues or different perspectives employees might have had: *"Chief of staff states that as of yet AirTrans is not allowed to commit a breach of contract with the host nation IT provider"* (Chief of staff meeting 10, 2014). Hence, structural changes remained largely absent.

Consequently, workers increasingly started to discuss and experiment with digital technologies. Workers reached out to the IT section, providing ideas in an attempt to push the organization forward. An IT worker explains: *"If you talk to the people [...], they also have ideas. They discuss a lot of things".* For instance: *"It would be nice to have more dynamic in the systems, and that we have a real logistical system behind it and that we can provide our customers a QR code, and a track and trace system".* The head of the IT section also reflects on this: *"If you look around on the streets outside, everybody's working with apps. Maybe it should be an idea that we develop apps to deliver our services".* Concurrently, workers started using private devices and technologies as workarounds. One worker reflects on such workarounds: *"Whatsapp is officially not allowed because of the data classification, just like*

SMS. But I have used such means to share data, and it helped. Look, if you are talking about, for instance, medical evacuations, every second counts".

Outcome

The social interactions led to the reproduction of the structural system while the cultural system was transformed. In other words, the distribution of ideas and knowledge had shifted due to workers' use of and experimentation with digital technologies, while the distribution of resources and control remained largely centralized around managers. Hence, we identified a situation of disjunction, as morphostasis occurred in the structural system, while morphogenesis occurred in the cultural system. We describe this phase as a 'great wave' (Archer, 1995), where cultural morphogenesis triggered changes in workers' (inter)actions and quietly prompted the differentiation of workers as a new interest group, which believed that moving forward, the organization had to radically change its way of operating and already started to deviate from the *status quo* in terms of IT usage. Consequently, we argue that, despite the strong structural conditions, this cycle is the start of digital transformation at AirTrans. We provide a detailed overview of this cycle in **Table 1**.

Table 1 *- Overview of Cycle I*

	Structural System	**Cultural System**	**Agency**
	Distribution of resources, control, and power	***Distribution of ideas and knowledge***	***Roles and positions: Workers and managers***
Conditions	The distribution of IT resources and power was primarily centralized around managers. The complete IT infrastructure was outsourced to the host nation, which had full control over the used technologies. AirTrans had a small IT section and a limited budget for IT, which was primarily allocated to the flight planning and allowed no room for digital innovation or IT beyond this tool.	The distribution of ideas and knowledge was primarily centralized around managers. The consensus was that legitimacy was gained through expertise and capabilities in air transport, with a short-term focus. The strategic directives clearly illustrated this focus, stating that the primary objective is to enhance combined operational capabilities. Ideas and knowledge of IT primarily resided with the host nation.	The management had a strong mandate for and interest in the structure and culture of AirTrans, being directed by the participating nations. The host nation was responsible for the full IT infrastructure, which had an outsourcing contract that provided no incentive for innovation. Workers had no formal role or say in IT-related decision-making and digital innovation.
Interaction	*Contingent Incompatibilities: Elimination* New ideas emerged from workers who diagnosed issues with the current dominant ideas based on their daily experiences in AirTrans and their personal use of digital technologies. Workers' identification of such IT opportunities and dissatisfaction with the status quo led to a divergence of ideas on the role of IT in AirTrans and the way		

	forward. Given the lack of power and control over resources, however, workers were unable to make structural changes in this period, for which they needed the support of managers. In turn, managers faced cultural and structural constraints in terms of participating nation demands and resources, as well as host nation dependency. Consequently, in interacting with workers, managers initially tried to eliminate new ideas.		
Outcome	*Morphostasis:* Distribution of resources, control, and power was largely centralized around managers. Lack of resources allocated to digital innovation.	*Morphogenesis:* New ideas emerged rapidly, strengthened by the use of digital technologies, both in workers' personal life as authorized inside the organization. The distribution of ideas and knowledge had shifted away from managers to workers	*Morphogenesis:* Workers started to assume new roles as IT experts and adopted digital technologies without the formal consent of managers.

5. Cycle II: Structural Morphogenesis and Cultural Morphogenesis

Structural and Cultural Conditioning

As a result of the cultural morphogenesis that took place in cycle I, the distribution of ideas and knowledge had become less concentrated around managers. Instead, workers brought forward innovative ideas based on their experiences with digital technologies. Consequently, managers, perhaps for the first time, were confronted with novel ideas of how AirTrans should operate in the digital age. Nevertheless, there was a disconnect between those individuals with ideas and knowledge (workers) and those with control over resources (managers). As in the previous cycle, structural conditions were still very much dependent on the involved nations and management of AirTrans. Hence, while workers had the objective to push for radical digital change, the existing structural conditions inhibit them from doing so. As a result, aside from vocalizing their dissatisfaction and innovation ideas, they started experimenting with digital technology without the awareness of managers. Such experimentation again resulted in more knowledge and ideas about the possibilities brought forward by digital technologies.

Interaction

Managers were increasingly exposed to the ideas brought forward by workers and gradually had to acknowledge the limitations of the existing IT infrastructure and solutions of AirTrans. Consequently, their traditional ideas of operating were no longer deemed 'automatic', forcing them to reconsider their prior ideas on operations and gradually making way for structural change. Being challenged to continue with the status quo without change, managers first

responded by creating new IT positions. For instance, a digital working group was established to explore more explicitly the possibilities of adopting digital solutions at AirTrans: *"Implementation information management: first, the digital working group is to define the requirements of a suchlike system. Also, the new study (future IT tools etc.) is to be incorporated into the information management system. Quality management suggests writing a strategy paper on the whole"* (Chief of staff meeting 11, 2015).

Consequently, the distribution of knowledge increasingly shifted from the managers and the IT provider of the host nation towards the workers, allowing them to pave the way toward future development. In doing so, they gained more power to negotiate and demand more resources, while the actual materialization of such resources remained concealed for a period due to the structural conditions that needed to be overcome. For instance, the existing IT infrastructure of AirTrans did not allow for digital innovation. In a top management meeting, it was officially recognized that this needed to change: *"Commander remarks that host nation IT provider cannot support the operations we need. Two options are left: hybrid or full control. With no host nation IT provider involvement, all telephones and computers will be removed. Commander wants to write to the Director of the host nation IT provider to inform him on the status and afterwards, depending on the answer of the host nation IT provider, write to the minister of defense. This to ensure that the host nation minister of defense is not feeling bypassed or ill informed. The alternative solution is to go for a civilian contract"* (Commander's meeting 1, 2017).

As a result, AirTrans officially started with the development of a new independent IT infrastructure alongside broader-scale experimentation with digital technologies. Some of the ideas that had emerged amongst workers, as well as technologies that they had personally and unofficially experimented with in the previous cycle, were officially implemented in this period, while others *"died because of, let's say, resources background"* (CG-2b). A cloud solution is an example of an idea that has materialized, which allowed for an innovative (especially for military organizations) means for sharing data with external stakeholders from a variety of dispersed locations.

Prior to this implementation, the related data and information of AirTrans were only accessible from other military bases of the participating nations, which caused difficulties when operating from a remote mission region, such as in the case of aeromedical evacuations. The new cloud solution offered AirTrans a radically different way to reach stakeholders, for instance, airbase ground handling procedures. This also allowed AirTrans to place much more emphasis on the execution of aeromedical evacuations, offering a valuable service to its

participating nations. The importance of aeromedical evacuations was stressed by one of the interviewees who explained: *"Change in the medical world, where the civilian world no longer has the capacity to do many medical evacuations"* (LCD-1).

Given the flexibility and options that such a solution provided, control over process and practices increasingly shifted from the top management to lower-level workers, as reflected in the following quote: *"Now they have clouds and other technologies. [...], the more they demand power over how things work. And that is what you see happening now"* (CG-2b). Concurrently, the distribution of knowledge also keeps shifting toward end users, making the top management of AirTrans realize that bottom-up initiatives are increasingly important and relevant. LCD-1 states: *"In an ideal world, digital transformation should be run by the stakeholders. They tell you what they want from you"*. The top management of AirTrans was periodically informed about the status of the digital transformation endeavor and encouraged the involvement of different functional units: *"Information management updates on the implementation of the digital transformation project. He reports achievements and risks and highlights the need to develop a concept of operations (CONOPS) to formulate full operational capability options, explaining in detail functionalities and connectivity required. The Chief of Staff encourages division heads to specify required functionalities within their divisions. Information management emphasizes that all IT initiatives should be processed through the hands of the tiger team before approval by the Chief of Staff"* (Commander's meeting 1, 2018).

Managers also increasingly incorporated digital technology when discussing long-term strategic objectives and goals by having different units collaborate on developing point papers on how to ensure that AirTrans would be ready for the coming decade: *"Operational division to develop a strategy in collaboration with information management about how to make the AirTrans IT ready for the future (next 10 years)"* (Chief of Staff meeting 6, 2018). The priorities of the management increasingly shifted to IT-related issues, realizing the need for providing additional resources to further develop the IT architecture of AirTrans: *"Our goal for IT developments is to make them future proof […] that means having access to more performant IT tools independently of location, sustainable in support and personnel cost. The backbone will be an AirTrans network and a renewed version of the operational tool, supported by the host nation and other contractors"* (Public statement 5, 2021).

Hence, the interaction in this cycle was characterized by contingent complementarities, as workers with ideas and managers with resources increasingly converged and shared similar objectives. In such cases, many stakeholders encourage innovation and experimentation, potentially breaking down knowledge barriers and radically changing traditional routines

(Archer, 1995). Whereas the cultural changes that occurred in cycle I were largely concealed from the organization in a broader sense, the structural materialization of such changes slowly became visible in this cycle. However, workers and managers did not always perceive that change was occurring – or were not in agreement with the pace of change – and started challenging the pace of transformation. Two workers, for instance, mentioned: *"I am not so confident about any changes within our organization, although I am convinced that a lot of users/members have very good ideas"* and *"Due to the pressures, we have not enough resources"*. Breaking through the existing structural conditions of AirTrans, thus, remains an ongoing challenge for the unfolding of their digital transformation. The hybrid situation where AirTrans still partially depends on the host nation, for example, disables full resource allocation to its independent IT infrastructure. Some workers were convinced that new managers are necessary to further push through structural conditions: *"Let's talk about this in two years, probably when people change, and maybe the situation changes, and they're more willing to spend money or manpower on these kind of ideas"*.

Outcome

The strong structural conditioning at AirTrans would suggest that it is extremely difficult for new ideas to gain enough traction to persist and result in structural transformation. Nevertheless, the creation of new positions and roles, the development of a new IT infrastructure, and the implementation of digital technologies represent structural morphogenesis at AirTrans. In light of this and the remaining structural conditions, we may expect similar developments in the future: the ideas that have emerged and evolved in this cycle and are being experimented with on a smaller scale will need to generate enough proponents in the cultural domain to mature enough to get broader resource mobilization and scale up. One worker, for instance, mentioned: *"I'm thinking way too far ahead. The countries are not ready for such radical changes. And especially not the operators that need to make decisions about this"*. An overview of cycle II is exhibited in **Table 2**.

Table 2 *- Overview of Cycle II*

	Structural System	**Cultural System**	**Agency**
	Distribution of resources, control, and power	***Distribution of ideas and knowledge***	***Roles and positions: Workers and managers***
Conditions	The distribution of IT resources and power was primarily centralized to the top management of	The distribution of ideas and knowledge was scattered amongst managers and workers, where workers	The management had a strong mandate for the structure of AirTrans, being directed by the

	AirTrans. The complete IT infrastructure was outsourced to the host nation, which had full control over the technologies used. AirTrans had a small IT section and a limited budget for IT, which was primarily allocated to the flight planning tool and allowed no room for digital innovation or IT beyond this tool.	formed an interest group that shared similar ideas on how AirTrans should operate in the digital age and vocalized their dissatisfaction with the existing IT resources and capabilities.	participating nations. The host nation was responsible for the full IT infrastructure, which had an outsourcing contract that provided no incentive for innovation. Workers had no formal role or say in IT-related decision-making and digital innovation yet started to assume new positions and roles by sharing their ideas and unofficially adopting digital technologies.
Interaction	*Contingent Complementarities: Opportunism* The idea of workers received increasing traction from managers. On the one hand, their unofficial experimentation with digital technologies increased their knowledge and made their ideas more robust. On the other hand, an increasing number of workers shared similar ideas, creating more bargaining power for such actors. As a result, managers acknowledged that radical digital change was necessary and gradually implemented structural changes, with a major one being the development and implementation of an independent IT infrastructure.		
Outcome	*Morphogenesis:* The distribution of resources and power was decreasingly assigned to the host nation, and instead, more resources and power were allocated to workers, primarily those working in the IT domain.	*Morphogenesis:* The distribution of ideas and knowledge increasingly shifted away from managers to workers, especially now that new digital technologies were adopted that were unfamiliar to managers.	*Morphogenesis:* New roles and positions were created for workers, as well as increasing cross functional collaboration between workers with different backgrounds.

6. A Mid-Range Theory on the Unfolding of Digital Transformation

The morphogenetic approach allows for theorization *"about where, when, and with whom transformational versus reproductive power lies"* (Archer, 1995, p.304). Based on our case analysis and the two morphogenetic cycles presented before, we identify two key generative mechanisms that explain the unfolding of digital transformation, considering existing cultural and structural conditions. We refer to those mechanisms as the *concealed experimentation* and *resource mobilization* mechanisms. **Figure 2** provides a visual overview of the generative mechanisms, structural and cultural conditions, and their interrelationships. More specifically, we show how a centralized distribution of both power and knowledge around managers reinforces a reproduction of the status quo, while concurrently–stimulated by IT consumerization–encourages workers to experiment with digital technologies. Such concealed

experimentation leads to a cultural transformation that predisposes managers to mobilize resources to scale up digital ideas that have received much traction in the organization. This, in turn, leads to a structural transformation, in which the distribution of power and resources becomes more distributed across managers and workers. It is important to note that digital transformation in this case illustrates an unintentional and unconscious process, rather than a process that is strategically initiated and enforced by managers.

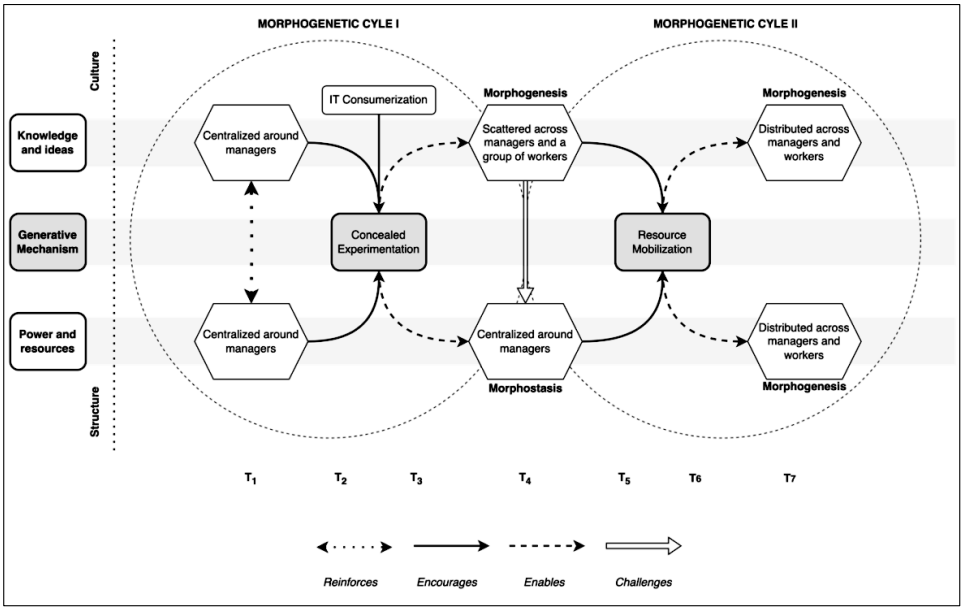

Figure 2 *- Visualization of Generative Mechanisms*

In the remainder of this section, we elaborate on the interplay between the mechanisms and delineate how different structural and cultural conditions may affect the unfolding of such mechanisms over time. In our explanations, we also consider the relative bargaining power and opportunity costs of the various involved stakeholders, which can influence the extent and speed with which a mechanism unfolds. While structural and cultural conditions differ amongst organizations, we can generalize our findings by theorizing when and with whom the different generative mechanisms come about in different contexts. In doing so, we first explain the distinct generative mechanisms and then explain how they may interact with each other and how they may be actualized depending on the bargaining power and opportunity costs of the involved stakeholders (Archer, 1995).

Concealed Experimentation

The digital transformation at AirTrans was triggered first and foremost by changes in the cultural domain that emerged as workers started bringing in ideas about the usefulness of digital technologies, as derived from their personal experiences with such technologies. Supported by the analysis of our case data, as well as observations from the literature (Harris et al., 2012), we argue that this may be explained by the phenomenon of IT consumerization, which refers to *"the process whereby the changing practices and expectations of consumers, shaped by the wide adoption of digital technologies in everyday life, will influence the IT-related activities of workers and managers in organizations*" (Gregory et al., 2018) and, following our organizational setting, focus on *consumer-workers.* Such digital technology consumerization manifested itself at lower levels of AirTrans, where workers recognized the benefits of digital technologies to change their daily work practices and spotted opportunities where AirTrans could fill a gap in the industry by implementing such technologies to span traditional military boundaries.

Such discussions took place in various pockets of AirTrans without being initially visible to all stakeholders. In fact, given the existing structural conditions, we observed that novel digital ideas were often discussed with workers on similar hierarchical levels, where the risk of adverse consequences was limited. The discussion of such ideas could then materialize in two ways: i) workers start experimenting with digital technologies in isolation, or ii) workers start experimenting with digital technologies by involving the IT section. In both cases, however, there was limited management involvement and control, resulting in flexibility and the possibility of assessing the feasibility of different ideas[3]. As increasing discussion and experimentation occurs, this generative mechanism can thus become positively self-reinforcing, potentially strengthening the feasibility of novel ideas through discussion and experimentation. Even when experimentation fails, new knowledge is obtained about the usefulness, feasibility, and necessity of a specific digital solution, potentially generating new ideas or prioritizing other ideas. Hence, the concealed experimentation mechanism is primarily related to cultural morphogenesis and is heavily driven by agency of workers. We define this mechanism as a *process by which users experiment with digital technologies, both in personal and work settings, and develop new ideas for their application in the organization based on their experiences.*

[3] In the case of AirTrans, cultural morphogenesis primarily emerged from lower-level workers. Naturally, IT consumerization also affects managers, thereby having the potential to shape the unfolding of digital transformation differently. We further reflect on this when we discuss the interplay between concealed experimentation and resource mobilization, as well as the interplay with structural and cultural conditions.

Resource Mobilization

While new ideas and knowledge resulted in the morphogenesis of the cultural system, structural changes needed to be made to scale up such ideas throughout the organization and for a transformation to be revealed. Consequently, a generative mechanism of resource mobilization explains how ideas may materialize and unfold throughout the organization. This mechanism stresses the importance of resources in the emergence and outcomes of the actions of certain individuals of groups of people. Specifically, this mechanism is triggered when an idea is deemed feasible and necessary by actors with access to and control over resources, thereby resulting in structural morphogenesis. In the case of AirTrans, the resource mobilization mechanism is observed when the distribution of resources is altered by creating new positions and deciding to step away from the full dependency on the host nation.

The resource mobilization mechanism, thus, results in structural morphogenesis and may reveal a broader organization-wide transformation through the implementation of (combinations of) digital technologies. This mechanism may prove to be self-reinforcing, as the bargaining power of individuals may change due to the altered distribution of resources and control. In such cases, increasing resources may be allocated to digital initiatives. We further reflect on this matter when we discuss the constraining and enabling effects of structural and cultural conditions. In sum, resource mobilization allows for the broad-scale implementation of digital technologies and, in contrast to the concealed experimentation mechanism, is heavily driven by the agency of managers. We define this mechanism as a *process by which resources are allocated to scale up feasible ideas and experiments with digital technologies.*

Interplay between Concealed Experimentation and Resource Mobilization

Both mechanisms may, both positively and negatively, mutually reinforce one another. The concealed experimentation mechanism triggers the resource mobilization mechanism once sufficient support for an idea has been reached to convince managers to allocate resources to the idea. Given such experimentation, knowledge is gathered about the usefulness, feasibility, and necessity of the novel idea, which either results in a solution that can be scaled up or that should be disregarded. As this mechanism is self-reinforcing, concealed experimentation will continue until a given idea is deemed feasible enough to materialize further. Once that happens, workers have gathered sufficient knowledge and evidence that an idea is necessary and should be scaled up. Hence, the concealed experimentation mechanism serves as a means to increase workers' bargaining power while simultaneously reducing the opportunity cost of managers by showing the feasibility of an idea.

In general, resource mobilization occurs once workers' bargaining power increases through a higher number of proponents (critical mass) or the support of a manager with significant control over resources. Such support can be gained by providing evidence of the feasibility and necessity of implementing a digital idea. As we observed in the case of AirTrans, the number of proponents and feasibility of digital ideas had matured in such a way that managers saw no other choice than to allocate resources for digital transformation. This entailed a shift in the distribution of control and power over resources, again increasing workers' bargaining power. For instance, resource mobilization allowed for developing an independent IT infrastructure, spurring additional opportunities for concealed experimentation. Moreover, the implementation and use of digital technologies increased the control and knowledge of workers regarding such technologies. Consequently, the cultural morphogenesis captured by the concealed experimentation mechanism may serve as a trigger and catalyst for the ongoing process of digital transformation.

This interplay between the two generative mechanisms reflects why digital transformation may remain concealed and why conceptualizing digital transformation as an *emergent and unfolding* process is essential, having implications for determining its "success" or "failure". There has been an ongoing debate in the literature about the nature and outcome of digital transformation (e.g., Chanias et al., 2019). Specifically, if we treat digital transformation as an ongoing process (Vial, 2019), then there might not be such a thing as digital transformation "success" or "failure". Our findings indicate that while digital transformation endeavors may be perceived by stakeholders as failed or as having stagnated, concealed changes might be occurring that may eventually materialize and reveal the (ongoing) transformation. The cultural morphogenesis triggered by digital technologies is, thus, at the heart of digital transformation.

The Constraining and Enabling Effects of Structural and Cultural Conditioning

As our findings indicate, existing structural and cultural conditions play a significant role in the unfolding of the generative mechanisms and, thus, digital transformation. Structural, and cultural conditions mediate different courses of action and may constrain some individuals while enabling others. Moreover, there is an interplay between structural and cultural conditions, as individuals with power and control over resources may or may not be the ones with dominant ideas and knowledge. Consequently, existing conditions represent causal powers that may influence the unfolding of a phenomenon. Together, individuals that try to retain structural and cultural conditions (knowingly or unknowingly) may reinforce morphostasis,

while those seeking to eliminate them (knowingly or unknowingly) may contribute to morphogenesis (Archer, 1995). Hence, explicating how structural and cultural conditions influence such mechanisms may reveal why they unfold differently in different organizational settings.

We first zoom in on structural conditions to theorize how they might influence the unfolding of the two mechanisms. Structural conditions shape opportunities for change by enabling or constraining them. First, the more access an individual has to resources and the more control (for instance, over other individuals in terms of employer-employee relationships), the higher the bargaining power of that individual. In addition, the more concentrated the distribution of resources, control, and power, the lower the likelihood that other, less powerful individuals can generate morphogenesis (Archer, 1995). Second, structural conditions shape individuals' opportunity costs, for instance, in terms of punishment or job security. For instance, a worker may be less inclined to vocalize ideas or dissatisfaction to a manager that has control over his or her future career opportunities. As such, structural conditions play a strong mediating role in the unfolding of generative mechanisms.

The structural conditions of AirTrans can be described as concentrated around the advisory board, managers, and, due to the contractual outsourcing of the IT infrastructure, the host nation. Moreover, given the strong hierarchical structure of military organizations, workers typically have significantly less power and control than managers. As such, while novel ideas emerged primarily from the lower levels, such workers had no immediate courses of action to materialize their ideas formally. Therefore, the apparent course of action was to discuss such ideas with workers from similar organizational levels and, in some cases, to proceed with experimentation if opportunity costs were deemed appropriate. For instance, the use of private devices could lead to punishment or, especially in the case of AirTrans, broader security consequences. Nevertheless, as shown in the case of using WhatsApp, workers make their own independent judgments of such opportunity costs and need not follow the predisposed course of action (Archer, 1995), given that the purpose and time sensitivity of the missions for which the technology was used justified the involved costs.

Moreover, while in the case of AirTrans, novel ideas primarily emerged from workers, this might not necessarily be *de facto*, as digital technology consumerization is a widespread phenomenon that affects all individuals. Therefore, the source of ideas can also be a manager with significant control over resources and power over workers, and there can be cases where cultural and structural change converge more rapidly. In such cases, the concealed experimentation mechanism might not unfold or might unfold much more rapidly, while the

resource mobilization mechanism may be initiated more quickly. Hence, while workers with limited structural power need to generate sufficient support to increase their bargaining power, this need not be the case for managers with structural power. In such a case, cultural morphogenesis (concealed experimentation) might not occur at all, and the distribution of ideas and knowledge could remain centralized around the top management.

However, such a concentration of ideas and resources may result in higher levels of resistance to change amongst workers due to a lack of experimentation (and, thus, potentially less feasibility of solutions) and a lack of involvement of other stakeholders. Moreover, concealed experimentation without restrictive control from top managers ensured significant flexibility in designing appropriate solutions. Hence, while skipping and shortening the concealed experimentation mechanism may speed up the implementation of digital technologies, it may result in the adoption of less feasible solutions that are not being used by workers. Managers may not always understand workers' daily practices and, as our case demonstrates, may not always be able to detect or prohibit the use of private digital technologies. In turn, the potential consequences of such inefficient resource mobilization may be costly in terms of (financial) investments and may reduce trust in management's future endeavors.

Finally, even when managers support the materialization of workers' ideas, structural dependencies may hamper the realization of such ideas. For instance, we observed that AirTrans could not realize all ideas due to a lack of resources, as the dependency on the host nation still represented a structural condition that constrained managers' and workers' potential courses of action. Moreover, significant control remained allocated to the advisory group (representing the participating nations) and receiving resources beyond the annually allocated budget to AirTrans involved obtaining support for ideas around digital technologies from the participating nations. This foreshadows how the two generative mechanisms work on various levels and imply that structural conditions may become especially visible once cultural morphogenesis unfolds more rapidly than structural morphogenesis.

Like structural conditions, cultural conditions may constrain or enable actions, thereby shaping the unfolding of the generative mechanisms. This distribution may depend on factors such as employee background, education, (political) relationships, and exposure to other organizations and work practices. A clear example of how cultural conditions may influence the unfolding of the generative mechanisms can be obtained by contrasting pre-digital and digital native organizations (e.g., Chanias et al., 2019). While pre-digital organizations were successful before adopting digital technologies, digital native ones often emerge due to the

opportunities that digital technologies offer. It is, thus, more likely that more managers and workers see the benefits of digital technologies and value risky experimentation in digital native organizations. Consequently, the opportunity costs for workers at digital native organizations wanting to push forward a novel idea may be lower, resulting in a more rapid unfolding of both mechanisms than would be the case in pre-digital organizations.

There is another situation pertaining to structural and cultural conditions that we need to acknowledge to understand how the two mechanisms may unfold. This situation concerns the miscalculation of opportunity costs. More specifically, when individuals wrongly estimate the costs associated with a certain course of action, morphostasis may endure and can even be reinforced (Archer, 1995). This may, for instance, occur when the materialization of an (experimented) idea does not yield the anticipated benefits or when the use of privately-owned digital technologies leads to a significant security breach, thereby discouraging people from undertaking similar actions in the future. Consequently, both mechanisms might unfold slower, as individuals' opportunity costs and bargaining power are affected, potentially resulting in less experimentation while concurrently needing more evidence that a digital solution is feasible and necessary to allocate resources.

While we have discussed the potential constraining and enabling effects of structural and cultural conditions from a rather static perspective, it is important to note that such conditions also change over time as the concealed experimentation and/or resource mobilization mechanism unfold. Hence, as we show in our findings, the cultural and structural conditions of a given morphogenetic cycle are determined by the morphogenesis or morphostasis that has occurred in a previous cycle, which in turn influences social interaction in the next cycle. Consequently, both mechanisms may unfold more rapidly over time as increasing bargaining power is assigned to workers.

Based on our theorizing and insights from the morphogenetic approach (Archer, 1995), we can infer several implications beyond our case findings, as presented in **Table 3**. Here, we describe different morphogenetic situations that may occur, when they are likely to occur, and what opportunities and risks they present in terms of digital transformation. The first two situations represent the morphogenetic cycles encountered in our case organization, while the last two represent two other morphogenetic situations that may occur. In case of structural morphogenesis and cultural morphostasis, the distribution of resources changes while the distribution of ideas and knowledge is reproduced. In such cases, managers may be aware of the lack of knowledge and ideas about digital innovation and, as a first attempt, hire dedicated personnel to generate a cultural transformation. On the other hand, it may also entail

investments in digital technologies without proper understanding of the impact and feasibility of such technologies in the organizational context. In that case, digital transformation resembles an intentional and conscious management-driven process, with a high likelihood that other stakeholders may resist change. In case of both cultural and structural morphostasis, the existing structure and culture are reproduced. Such reproduction may benefit organizations in terms of familiarity and cost savings and may especially be observed after cycles of significant change. When having constant morphostasis, however, it will be challenging for organizations to remain competitive and relevant in the digital era.

Table 3 *- Different Morphogenetic Situations for Digital Transformation*

Situation	**Likely to occur when (structural and cultural conditions)**	**Opportunities**	**Risks**
Outcome	***Structural and cultural conditions***	***Beneficial impact***	***Adversarial impact***
Structural Morphostasis and Cultural Morphogenesis[4]	An organization has many dependencies and rigid organizational structures, such as in the case of pre-digital organizations. This may be more likely to occur when a variety of individuals with different backgrounds are involved. Overall, there is a misalignment between individuals with resources and individuals with ideas. In other words, individuals with ideas do not have the capability to mobilize resources.	Concealed experimentation by workers may serve as a trigger and catalyst for digital transformation, where the likelihood of digital solutions being accepted on a broader scale is higher than when enforced solely top-down.	Concealed experimentation may lead to significant security risks with potentially costly consequences, as well as a lot of scattered and uncontrolled initiatives throughout the organization. When no structural changes follow, organization-wide digital innovation stifles.
Structural Morphogenesis and Cultural Morphogenesis[4]	Structural and cultural conditions encourage digital innovation, such as in the case of digital native organizations or when disabling conditions can be overcome, for instance because digital initiatives have received sufficient traction and support. May also be observed when managers signal a lack of knowledge and ideas about digital innovation.	When structural morphogenesis is in line with cultural morphogenesis, resource mobilization allows for the implementation of digital technologies in line with ideas in the cultural domain. Besides that, it may generate new ideas and knowledge about how to operate in the digital age.	When structural morphogenesis is not in line with cultural morphogenesis (e.g., speed, extent), resource mobilization may result in the adoption of digital solutions that are not supported by stakeholders.
Structural Morphogenesis and Cultural Morphostasis	When there are limited structural dependencies while the organization is less receptive to innovative ideas. This may be the case for smaller organizations, pre-digital organizations, and organizations with employees from similar backgrounds. In such cases, organizations may wish to attract knowledge and expertise from	Structural changes, such as hiring younger workers, setting up cross-functional working groups, or allocating additional monetary resources to IT spending, may spur innovative digital ideas and bring an impulse of digital knowledge.	If no cultural morphogenesis occurs or managers fail to take into account local initiatives by workers, structural changes may not be accepted within the organization. Structural morphogenesis may also entail changes that

[4] The shaded cells are based on our observations of AirTrans, while the other cells are informed by our further theorizing.

	outside to stimulate digital innovation or make structural changes that further limit digital transformation possibilities.		discourage digital innovation, such as limiting the resources assigned to IT.
Structural Morphostasis and Cultural Morphostasis	When there are strong and rigid structural and cultural conditions that cannot easily be overcome. This may, for instance, be the case when managers and workers face high opportunity costs in trying to push for change (e.g., risk-averse culture). May also be observed after periods of significant change.	Reproduction of the existing culture and structure may be beneficial for existing stakeholders, as there is no need to learn new capabilities.	Structural and cultural morphogenesis may hamper an organization from competing with other organizations that are actively engaged in digital innovation.

7. Discussion

The Unfolding of Digital Transformation

Our study responds to calls in the literature for phenomenon-driven theorizing, focusing on the *emerging* nature of digital transformation (e.g., Monteiro, Constantinides, Scott, Shaikh, & Burton-Jones, 2022) and specifically paying attention to the role of cultural change brought forward by workers as IT consumers (e.g., Gregory et al., 2018). By adopting the morphogenetic approach as our exploratory lens, we were able to analytically differentiate between culture and structure, allowing us to *"specify which is more influential for the other, when, where, and under what conditions"* (Archer, 1995, p.324). Based on our findings, we argue that cultural morphogenesis can be at the heart of digital transformation, triggered by digital technology consumerization. The speed and effectiveness with which such cultural transformation takes place in an organization is dependent on structural and cultural conditions. We go beyond existing insights in digital technology consumerization and digital transformation and elucidate how individual experiences with digital technology of workers may result in an organization-wide transformation. Specifically, we show that digital transformation is heavily driven by agency at the level of workers who create new ideas and solutions with digital technologies versus agency at the level of managers who make strategic change decisions.

Following other morphogenetic approach studies (e.g., Njihia & Merali, 2013), we addressed the "why" and "how" rather than the "what" questions of digital transformation. We have identified two generative mechanisms (concealed experimentation and resource mobilization), as well as structural and cultural conditions, that together explain why and how digital transformation may unfold unintentionally and unconsciously. The generative mechanisms we have identified especially stress the *ongoing* nature of digital transformation;

even when stakeholders perceive the digital transformation as 'failed' or being stagnated, there may be concealed brainstorming and experimentation necessary for the materialization of ideas. Simultaneously, there may be structural conditions that slow down the allocation of resources to digital technologies. In general, what is classified as a digital transformation failure at one phase, may result in accelerated change in a subsequent one.

Beyond addressing the specific findings of our case, we theorize about different organizational contexts and morphogenetic situations. As such, we provide a practical social theory of how digital transformation unfolds in practice, complementing existing perspectives of managing digital transformation by adding a new perspective to the literature to account for the emergent process of change perceived by the collective group of organizational members as unintentional and unconscious. By doing so, we respond to calls in the literature to treat digital transformation as an emergent process and examine its underlying mechanisms (e.g., Lanamäki et al., 2020; Haskamp et al., 2021).

The notion of *unfolding* is especially essential in the context of digital transformation, as it reflects that such transformations may not always be visible to the entire organization at all times. In fact, our findings showcase that there may be periods in which transformational processes are triggered and initiated in pockets of the organization while remaining concealed for other parts. When such processes emerge, they may become salient through experimentation and get the necessary attention and support from managers with control over resources necessary for materializing. As such, we find that the concealed experimentation mechanism enhances the likelihood of feasible digital technologies that can receive the necessary traction in the organization. Our findings show that once the resource mobilization mechanism is triggered, the broader transformation unfolds and reveals itself for all organizational members. Thus, similar to observations at the societal level (e.g., Lazega, 2015), we find that the transformational capacity of digital technologies is dependent on the interaction of employees with different structural and cultural positions.

Methodological Implications

While the morphogenetic approach has often been applied on a macro level (e.g., Njihia & Merali, 2013; Dobson et al., 2013), it can equally be applied on an organizational level. By doing so, our study differs from the extant literature on organizational change and transformation by taking the broader organizational context into account (Mutch, Delbridge, & Ventresca, 2006), as well as making an analytical distinction between culture, structure, and agency. We posit that such an approach may prove to be especially useful for further research

on digital transformation, for instance, by focusing on broader ecosystems where innovation may be a much more interorganizational endeavor (e.g., Berman & Marshall, 2014). While the same mechanisms we identified may apply in such settings, the way they unfold may be different due to specific cultural and structural conditions.

Such conditions stress the crucial role that organizational context plays in the unfolding of digital transformation. Based on our in-depth single case study at AirTrans, we illustrate how digital technology consumerization may generate a shift in the distribution of ideas and knowledge, empowering workers and strengthening their bargaining position within the organization. Given the strong structural conditions at AirTrans, however, it took time for such cultural transformation to lead to a structural transformation, leading to practices of concealed experimentation. This means that, as illustrated in **Table 3**, the way digital transformation unfolds is heavily shaped by the existing cultural and structural conditions of an organization, explaining why some organizations are further along in their digital transformation journeys than others. We encourage future studies to draw upon the morphogenetic approach to make the role of context more prominent (Avgerou, 2019) and pay attention to structural and cultural conditions beyond the ones we explored in this study. For instance, including consumers and suppliers may reveal additional insights into the unfolding of digital transformation.

Moreover, we have focused on high-level changes that occurred in terms of culture, structure, and agency and have, therefore, not zoomed in on the details surrounding the adoption of digital technologies. The morphogenetic approach offers opportunities to further explore the role of digital technologies by examining, for instance, how technological features are inscribed in structural features and *vice versa* (Mutch, 2010). While prior studies have examined how organizational roles were embedded in IT (e.g., Volkoff, Strong, & Elmes, 2007), digital technologies have a radically different nature that warrants further exploration. Ultimately, the synthesis of future studies on the topic following the morphogenetic approach can provide a more comprehensive understanding of how digital transformation unfolds (Archer, Bhaskar, Collier, Lawson, & Norrie, 1998).

The Role of Culture in Digital Transformation

While paying equal attention to structure and agency, we have deliberately opted for a research approach and theoretical lens that takes the role of culture into account. Although increasingly indicated as important in the literature (e.g., Faik et al., 2020; Tumbas et al., 2018; Hemerling et al., 2018), the exact role and importance of culture in digital transformation has remained an open question. Based on the findings from our case and observations in the literature (e.g.,

Harris et al., 2014; Gregory et al., 2018), we have argued that cultural morphogenesis emerges through digital technology consumerization. That is, the consumer-centric nature of digital technologies exposes individuals continuously to digital technologies, encouraging them to bring their experiences with such technologies to the organization in the form of discussions, brainstorming, or experimentation.

Such findings are counter-intuitive in our military context, where a strong hierarchical nature would suggest that digital transformation would be primarily management-controlled and driven top-down. On the contrary, however, despite the fact that the top management of AirTrans had full control over resources, we found that lower-level workers had a significant influence on the digital transformation by demonstrating their knowledge of and ideas about the potential usefulness of digital technologies. In that sense, the digital transformation endeavor was much less a strategic endeavor and much less management-controlled than one might expect by following the extant literature (e.g., Bharadwaj et al., 2013; Yeow et al., 2018). Our analysis shows the relative influence of cultural morphogenesis, by pointing out, for instance, the potential political consequences the top management was willing to bear to materialize ideas related to digital technologies.

Consequently, we see merit in further exploring the role of culture in digital transformation endeavors by potentially drawing on theoretical lenses such as institutional theory (e.g., Burton-Jones et al., 2020; Hinings, Gegenhuber, & Greenwood, 2018). More specifically, future studies may draw on the notion of 'institutional logics' to further explore the changing framing around digital technologies. Such logics represent broad prescriptions of "*how to interpret organizational reality, what constitutes appropriate behavior, and how to succeed*" (Thornton, 2004, p.40) and, therefore, seem to be closely related to the cultural system (e.g., C. Jones, Boxenbaum, & Anthony, 2013).

Governance Implications

Our in-depth examination of digital transformation as well as the mid-range theory that we bring forward, enables us to distill timely practical implications for organizations engaged in digital transformation. Understanding the generative mechanisms that explain how digital transformation unfolds may assist decision-makers in better governing and steering digital transformation.

First, we showcase that digital transformation was triggered by workers at the lower levels of the organization, who used their own digital technologies to go around issues they were facing in their day-to-day work-related activities. Whilst many organizations allow

policies of 'bring your own device' (BYOD), when the practices emerging from such policies are not explicitly controlled, they may result in detrimental security implications for the organization (e.g., Ou, Zhang, Angelopoulos, Davison, & Janse, 2022); especially when the organization is tasked with the stewardship of sensitive data (e.g., Angelopoulos et al., 2021). The recent pandemic has resulted in the exacerbation of such implications, as BYOD policies had to be relaxed for employees to work from home, making use of their own digital technologies to access corporate intranets (Barlette, Jaouen, & Baillette, 2021). Such practices, however, can result in broader transformations with positive organizational outcomes, and thus, need to be encouraged; especially in the context of pre-digital organizations that face increasing pressures to engage in digital transformation for remaining competitive in the digital era. There is merit, therefore, in encouraging employees to engage in experimentation with their own digital technologies, as well as in brainstorming for providing innovative solutions for issues they face in their day-to-day work-related activities. Concurrently, IT managers should ensure that such practices will not result in security threats to the organization and provide the necessary training to workers that experiment with digital technologies, as well as the needed hardening of the enterprise network.

Second, allowing employees to experiment with digital technologies can go beyond BYOD policies, considering the benefits that organizations can anticipate, as we demonstrate in our study. Pre-digital organizations can draw on best practices from digital-native ones in this aspect. Many digital-native organizations, for instance, allow their employees time for experimenting with innovative ideas and technologies, while actively encouraging and rewarding such practices when they lead to tangible positive outcomes for the organization. Google, for instance, encourages employees to spend 20% of their time working on what they think will most benefit the organization (Page & Brin, 2004), which is a practice that has famously led to the development of popular services like Gmail[5]. Policies should be in place, therefore, for encouraging employees to brainstorm and experiment with new ideas related to digital technologies, and organizational processes should be embedded to take the best ideas forward, along with incentives for rewarding innovative employee, and encouraging the rest. Furthermore, organizations could encourage managers at all levels to bring forward ideas of their team members, and even organize events that will inspire brainstorming and experimentation[6].

Third, as we show, after the small-scaled concealed experimentation of employees with

[5] https://time.com/43263/gmail-10th-anniversary/
[6] https://9to5mac.com/2023/02/19/apple-event-ai-employee-summit/

digital technologies, resource mobilization is what gives rise to the broader transformation initiative. Beyond putting processes in place to encourage employees to brainstorm and experiment with digital technologies, therefore, organizations should be prepared to enable the transfer of the necessary resources for solutions to be materialized. In doing so, top managers should also be able to make the needed decisions that will enable the proliferation of innovative solutions related to the adoption of digital technologies throughout the organization, and the broader transformation initiatives to take place. We demonstrate in our study, for instance, that the top-management of AirTrans had to make difficult political decisions, which in practice, resulted in the formal initiation of the digital transformation endeavor. Whilst the transfer of resources to such innovative projects might seem a risky investment by some top managers, the findings of our study demonstrate that the expected outcomes will benefit the organization in the long run.

Finally, the findings of our study and **Table 3** can provide decision-makers that navigate digital transformation endeavors with novel understandings regarding their status and specifically when to classify such an endeavor as *failed*. We showcase that when a digital transformation endeavor might be perceived as failed, there may be concealed processes necessary for speeding it up at a later stage, or structural conditions that slow down the allocation of resources to digital technologies. Before labeling a digital transformation endeavor as failed or stagnated, therefore, decision-makers should carefully take into consideration the culture and structure condition of the organization, identify the morphogenetic situation they might be in, and accordingly enable experimentation and transfer of recourses to enable digital transformation. Following our approach, organizations may benefit from identifying the cultural and structural constraints that slow down or disable the unfolding of digital transformation.

8. Conclusion

Consumer-centric digital technologies differ inherently from enterprise-centric IT and, therefore, have implications for how organization-wide transformation unfolds. Current theoretical understandings and practical intuitions on digital transformation are derived predominantly from a top-down perspective, overlooking aspects that might emerge unintentionally or unconsciously and failing to consider the role of employees as digital technology consumers. Insights on such aspects, however, can enable us to unearth digital transformation mechanisms that are founded on the widespread consumerization of digital

technologies. We explore the unfolding of digital transformation endeavors in practice, being shaped by the interplay among culture, structure, and agency, and unearth generative mechanisms by adopting the morphogenetic approach. In doing so, we bring forward a mid-range theory, which illustrates two generative mechanisms that shape the unfolding of digital transformation in practice, namely a concealed experimentation mechanism and a resource mobilization mechanism. Contrary to predominant theoretical understandings on the topic, our theory of unfolding suggests that digital transformation is catalyzed bottom-up by cultural changes in pockets of the organization that may be lower in the hierarchy while their materialization remains concealed for the rest of the organization until receiving structural support. We portray, therefore, that digital transformation endeavors need to be better understood as an ongoing process that goes beyond intentional and conscious strategic initiatives; cultural change is at the epicenter of digital transformation, which is more uncertain and less strategic than one might have expected based on existing theoretical insights.

CHAPTER 3

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NAVIGATING DIGITAL TRANSFORMATION THROUGH AN INFORMATION QUALITY STRATEGY: EVIDENCE FROM A MILITARY ORGANIZATION[7]

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1. Introduction

Information is vital for decision-making and, consequently, organizations increasingly aim to collect and process large amounts of data from various sources by adopting novel digital technologies (e.g., Bharadwaj et al., 2013; Günther, Mehrizi, Huysman, & Feldberg, 2017). Processing large amounts of data can, in theory, result in valuable outcomes; in practice, however, there are various relevant risks associated with data governance. For instance, data of high volume, velocity, and variety is characterized by its incomplete and unstructured nature, posing threats to the level of information quality[8] (Clarke, 2016). The potential that data and information encapsulate for organizations, however, can be fully unleashed only when these are of high quality (e.g., Hazen, Boone, Ezell, & Jones-Farmer, 2014; Wahyudi, Kuk, & Janssen, 2018). Information quality, thus, becomes an increasingly important element of data governance (e.g., Khatri & Brown, 2010), with significant implications for organizations and their stakeholders, affecting *inter alia* their ability to respond to crises (Alamsyah & Zhu, 2022), purchasing intentions (Wu, Xiong, Yan, & Wang, 2021), and employee satisfaction (Haug, Zachariassen, & Van Liempd, 2011).

Although organizations, in general, are becoming increasingly aware of their information quality issues (Madnick, Wang, Lee, & Zhu, 2009), their solutions often seem to not address how information, organizational processes, and IS interact (Katz-Haas & Lee, 2005) and the literature provides few insights on how to ensure a high level of information quality (Işık, Jones, & Sidorova, 2013). Novel digital technologies and techniques (e.g., artificial intelligence), however, may hold great potential for improving the level of information quality (e.g., Côrte-Real, Ruivo, & Oliveira, 2020; Janssen, Brous, Estevez, Barbosa, & Janowski, 2020; Taleb, Serhani, Bouhaddioui, & Dssouli, 2021), and organizations increasingly engage in digital transformation endeavors to gain access to more and higher quality information (Chanias, Myers, & Hess, 2019; Vial, 2019).

Such endeavors, however, primarily lead to failure due to their complexity (De la Boutetière et al., 2018). Especially pre-digital organizations that have been successful in the past without relying on digital technologies (Chanias et al., 2019; Sebastian et al., 2017) may experience additional challenges in adopting combinations of technologies that could radically

[8] Consistent with prior research (e.g., Knight & Burn, 2005), we use the terms data quality and information quality interchangeably and refer to both as information quality. Following organizational information processing theory, we consider information quality issues as those related to collecting data, transforming data into information, and understanding, storing, and exchanging that information. This is also supported by our data and analysis, since the interviewees of our study referred to both data quality and information quality issues as information quality ones, mentioning that in their opinion the term better encompassed all the data and information challenges they were experiencing in the focal organization.

change the way they operate. While such pre-digital organizations could benefit significantly from improved access to high-quality information, they tend to have limited experience with processing (large amounts of) data and are rarely capable of readily incorporating novel and advanced technologies. It, thus, becomes timely and topical for pre-digital organizations to acquire insights on how they can navigate their digital transformation to fully exploit the opportunities of increased access to data and information.

To address that lacuna, we conduct canonical action research at a multinational military organization in Europe (henceforth AirTrans, a pseudonym) that had reported challenges related to its digital transformation endeavor over a period of two years. As a pre-digital organization, AirTrans had been successful in its air transport operations without relying on digital technologies, yet experienced increasing pressures to engage in digital transformation. We thoroughly diagnosed the challenges that AirTrans faced and implemented, as well as evaluated an information quality strategy in collaboration with its top management, which allowed them to further navigate their digital transformation. In doing so, we conducted 43 semi-structured interviews with 22 employees of AirTrans and analyzed a total of 204 relevant organizational documents.

Our diagnosis revealed that improving the level of information quality was an implicit driver for the digital transformation of AirTrans, while the poor information quality *status quo* was a barrier to its effective execution. AirTrans had been primarily focused on implementing digital technologies, paying scant attention to governance solutions related to such technologies. To understand how we could improve the situation at AirTrans, we adopted the theoretical lens of organizational information processing theory (Galbraith, 1973), stressing the importance of realizing a fit between information processing requirements and information processing capacity, and acknowledging that increased amounts of information can reduce uncertainty and improve decision-making. Our analysis of the *status quo*, however, elucidates the crucial role that information quality plays in obtaining a fit between information processing requirements and capacity. We then developed and implemented an information quality strategy, through which we show that a focus on both technology and information quality governance has significant implications for organizational information processing, and for effectively navigating digital transformation.

Our work brings forward novel insights and has timely and topical implications for both IS theory (Struijk, Ou, Davison, & Angelopoulos, 2022) and practice (Davison, 2022). Concerning the former, we contribute to the research agenda on digital transformation, as well as to organizational information processing theory, and elucidate the critical interrelationships

among digital transformation, information quality, and organizational information processing. First, we extend traditional organizational information processing theory by examining the implications of *quality*, rather than quantity of information, for the fit between information processing requirements and capacity. More specifically, we show that poor information quality can increase information processing requirements, thereby influencing the fit between information processing requirements and capacity and hampering operations as well as processes. Such insights are especially valuable in the digital era, as data and information are vital for organizations, and increasing amounts of data and information from multiple sources can give rise to challenges in ensuring a high level of information quality (e.g., Abraham et al., 2019). Moreover, the absence of sophisticated IS and existing information quality issues, make it especially complex for pre-digital organizations to improve their level of information quality and adopt digital technologies.

Second, we go beyond the familiar sources of digital transformation barriers cited in the IS literature (Vial, 2019), and show that poor information quality can represent a key barrier to the digital transformation of pre-digital organizations. As illustrated by our findings, digital transformation might not yield its desired outcomes if organizations primarily focus on technology, neglecting solutions and activities focused on governing information quality. The extant literature on digital transformation, however, has largely overlooked the importance of data governance and, more specifically, the importance of information quality during such endeavors. Finally, we contribute to the broader digital transformation research agenda by establishing that pre-digital organizations can set the scope for their digital transformation by designing and implementing an information quality strategy consisting of targeted initiatives. By balancing both technological as well as information quality governance solutions, organizations can navigate their digital transformation and improve the balance between information processing requirements and capacity accordingly. By adopting a theory-infused interventionist research perspective, we largely illustrate the practical implications of our work and assist pre-digital organizations in better navigating their digital transformation by strategically addressing information quality.

The rest of the paper is organized as follows. In the next section, we discuss the background of our study on information quality and digital transformation, before proceeding with a detailed description of the theory, research approach, as well as the setting of our study. The penultimate section presents our findings, while we conclude the paper with a discussion of our work and its implications for both theory and practice, delineating an agenda for future research on the topic.

2. Background

Data Governance and Information Quality

Data governance is concerned with data accountability and decision rights (e.g., Khatri & Brown, 2010), approaching data and information as key strategic assets (e.g., Abraham et al., 2019). Organizations, thus, need to have adequate data governance solutions in place for ensuring the quality of data and information (Khatri & Brown, 2010), and, as such, information quality becomes one of the key data governance elements. Information quality focused data governance, thus, is concerned with improving information quality management and monitoring (e.g., Malik, 2013; Weber, Otto, & Österle, 2009).

Information quality is a multidimensional construct, often defined as information that is fit for use by information consumers (R. Y. Wang & Strong, 1996). In line with the literature (Madnick et al., 2009), we approach information quality from a unified perspective, looking at both data as well as information issues, and dimensions. The literature identifies various information quality dimensions, some of which have been adopted widely, while others have received less attention. Such dimensions can help to generate a better understanding of information quality-related issues (Fox, Levitin, & Redman, 1994). Whilst there is a lack of consensus regarding which set of information quality dimensions to apply, almost all relevant prior studies have used variations of *accuracy*, *completeness*, *consistency*, and *timeliness* (Sebastian-Coleman, 2012). In doing so, prior studies have demonstrated the link between information quality dimensions and organizational outcomes (e.g., Gharib, Giorgini, & Mylopoulos, 2018; R. Y. Wang, Storey, & Firth, 1995). For instance, business processes rely on information quality, and information should be treated as a product for managing and improving processes (R. Y. Wang et al., 1995), since poor information quality might threaten their effective execution (Gharib et al., 2018). Concurrently, information quality issues can lead to i) mistrust on the tactical level, ii) adverse effects on strategy-making on the strategic level, and iii) stakeholder dissatisfaction and increased cost on the operational level (Redman, 1998).

Besides their direct implications for organizations, information quality and system quality have been extensively linked to IS success (DeLone & McLean, 1992). In this study, we approach information quality not as the mere output of IS (DeLone & McLean, 1992), but as a broader concept that can address different types of information from various sources (e.g., fit for purpose). Whilst we acknowledge the significance of system quality for organizational outcomes, we adopt the notion of information quality since digital transformation goes beyond mere IT adoption and implementation (Kane et al., 2015). As information quality is influenced

by both technical (e.g., the failure to integrate data from various sources) as well as organizational aspects (e.g., the lack of strategic information quality initiatives) (Madnick et al., 2009), it can better address changes to both technical and organizational properties during digital transformation. We do, however, take system aspects into account, recognizing that system quality can potentially influence the level of information quality (e.g., Xu, Benbasat, & Cenfetelli, 2013) and that to address information quality issues can involve improving existing as well as adopting new IS.

To address and improve the level of information quality, organizations first need to evaluate their information quality *status quo*. The level of information quality can be evaluated from both subjective and objective perspectives. Objective information quality measures the extent to which information conforms to quality specifications and references (Ge & Helfert, 2013), while subjective information quality is concerned with the expectations of the collectors, custodians, and consumers of information (Ballou, Wang, Pazer, & Tayi, 1998; R. Y. Wang, 1998). Even if information meets objective requirements, it can still be perceived as of poor quality due to delivery problems or differences in expectations (Price & Shanks, 2016). Many information quality assessment frameworks have been developed, which take either a subjective or objective perspective, focus on technical or organizational issues, and provide organizations with an understanding of their current information quality level. While there are various frameworks for assessing the level of information quality, there are limited instructions for how to subsequently improve it, providing limited actionable directions for organizations (Nielsen, 2017), leaving such a timely topic largely unexplored in the extant IS research agenda (Petter, DeLone, & McLean, 2013).

The information-intensive nature of organizations, however, requires a strategic approach to information quality to ensure that the appropriate information is available to the right people, at the right time, while preserving privacy and conforming to laws and regulations (Kerr, Norris, & Stockdale, 2007). An information quality strategy aims to address information quality-related issues and improve the level of information quality. Organizational responses to information quality-related issues, however, are not always successful, since such issues often involve accumulated, lengthy, and hidden processes, and signal root conditions that can lead to difficulties with using information (Y. W. Lee, Pipino, Funk, & Wang, 2006). Initiatives for improving the level of information quality, therefore, must define a plan with the goals to be improved (Caballero, Gómez, & Piattini, 2004), which can be described as a strategy for understanding the information quality *status quo* and how to improve its level for meeting the strategic goals of the focal organization (Jugulum, 2014). The goal of an information quality

strategy, thus, is to reduce the misalignment between information quality and the organizational strategy. The alignment of information quality and organizational objectives can increase the synergy among the various functional units (Akter, Wamba, Gunasekaran, Dubey, & Childe, 2016) and, consequently increase organizational efficiency (Sebastian-Coleman, 2012). In the context of information quality, Dravis (2004, p.28) defines strategy as "*a cluster of decisions centered on goals that determine what actions to take and how to apply resources*". Without an information quality strategy, organizations might suffer from an inability to integrate, poor performance and availability, little accountability, as well as the general feeling that things are out of control.

To realize the benefits of IT investments, thus, organizations need an understanding of their information quality, and assessing the information quality *status quo* is one of the most critical aspects of an information quality strategy (e.g. Kerr et al., 2007; Sebastian-Coleman, 2012). Most of the existing information quality assessment frameworks include similar steps but use different activities and measurements. Assessing the level of information quality, however, largely depends on the context, and the existing frameworks do not have a universal fit with organizational requirements. With the gamut of possible requirements, organizations may be forced to select an existing framework, which may not be suitable for their needs, leading to undertaking unnecessary activities or omitting essential ones (Woodall, Borek, & Parlikad, 2013). Developing an assessment framework tailored to the specific needs of an organization is, thus, a better solution. We take these research perspectives further in our empirical work.

Digital Transformation of Pre-Digital Organizations

Organizations in all industries are increasingly pressured to engage in digital transformation for a gamut of different reasons, while mostly including initiatives aimed at collecting and analyzing increasing amounts of data from various sources to improve their processes and operations (e.g., Dremel, Wulf, Herterich, Waizmann, & Brenner, 2017). Digital transformation is a process that revolves around the adoption of digital technologies that trigger significant changes to organizational properties (Vial, 2019). Such a process requires significant changes in, *inter alia,* strategy making (Bharadwaj et al., 2013; Matt et al., 2015), organizational processes, culture (Karimi & Walter, 2015), and value creation paths (Vial, 2019). Digital transformation endeavors often relate to the implementation of applications related to social media, mobile, business analytics, cloud, and internet of things (Sebastian et al., 2017), as well as novel digital technologies and techniques (e.g., artificial intelligence), which can

significantly enhance collecting and processing information (Aben, van der Valk, Roehrich, & Selviaridis, 2021; Bharadwaj et al., 2013; Setia, Setia, Venkatesh, & Joglekar, 2013; Vial, 2019).

Digital transformation, thus, can enable organizations to significantly enhance their capacity of processing data of high volume, velocity, and variety (H. Li, Wu, Cao, & Wang, 2021). Social media platforms, for instance, can be used to collect large amounts of data related to the preferences and opinions of consumers (e.g., Georgiadou, Angelopoulos, & Drake, 2020), which can be then further exploited through advanced business analytics approaches (Angelopoulos et al., 2021; Kretschmer & Khashabi, 2020). Gleaning such insights into stakeholder demands as well as expectations is vital for navigating digital transformation, and for understanding how organizations can pursue novel ways of creating value and enhancing their operations in the digital era. While such technologies, thus, offer great potential for improving the capacity of organizations to process information, the effects of poor information quality might be exacerbated by the increased reliance on digital technologies in our information-intensive and knowledge-based economy. As organizations have access to data of increasingly high volume, velocity, and variety, ensuring their quality becomes more complex and requires more attention (Abraham et al., 2019; Clarke, 2016). For instance, a high number of different data sources can make the monitoring of data provenance an increasingly complex and tedious process (Buneman, Khanna, & Wang-Chiew, 2001).

Such challenges might be especially present in the context of pre-digital organizations, which have been operating successfully for many years without using digital technologies. Pre-digital organizations often belong to traditional industries and are now threatened by the rise of digital-native ones (Ross et al., 2016). While organizations in general experience extremely high levels of digital transformation failure due to the complexity and comprehensiveness of actions they attempt to undertake (De la Boutetière et al., 2018; Singh & Hess, 2017), such levels might be higher for pre-digital organizations that lack the knowledge and experience to digitally transform (e.g., Bharadwaj et al., 2013; Sebastian et al., 2017; Siachou, Vrontis, & Trichina, 2021). Digital transformation represents ongoing structural changes that balance the exploitation of existing capabilities and the exploration of new ones (Sebastian et al., 2017). This means that pre-digital organizations need to not only understand their business needs, but also their technological needs and how novel technologies work (Loonam, Eaves, Kumar, & Parry, 2018). While they tend to have increased access to large volumes of data (Klievink, Romijn, Cunningham, & de Bruijn, 2017), they experience challenges related to ensuring their level of information quality and establishing formal programs (Nielsen, Persson, & Madsen,

2018). Such findings lead to arguments that pre-digital organizations may be unable to navigate their digital transformation (Siachou et al., 2021). Such organizations, thus, face significant digital transformation challenges, offering an opportunity for IS scholars to examine how such organizations can navigate their digital transformation effectively and efficiently.

3. Methodology and Theoretical Framework

Research Context

We conducted our study at a multinational military organization responsible for the air transport missions of participating Air Forces. The aim of AirTrans is to combine resources and assets from the participating Air Forces and utilize them in such a way that improves the efficiency and effectiveness of air transport missions. AirTrans had been successful without relying on any advanced digital technologies and, therefore, can be classified as a pre-digital organization (Chanias et al., 2019). Besides its limited experience with digital technologies, AirTrans is subject to various stakeholders, cultures, security requirements, and (inter)national laws. Apart from the participating nations, the relevant stakeholders also include, *inter alia,* other multinational military organizations, broker agencies, and hospitals. Employees working at the headquarters of AirTrans come from the participating nations, having a variety of cultural, educational, and functional backgrounds, which makes the harmonization of rules, processing, and operational procedures a challenge. Another significant challenge is related to security and regulations, as AirTrans must deal with both national, supra-national, and international laws.

Moreover, the IT architecture of AirTrans is largely dependent on both the host and the participating nations. As a result, AirTrans must deal with significant environmental turbulence, resulting from the collaboration between the participating nations, as well as political, social, and crisis events. To improve operational efficiency and continuity, the top management of AirTrans officially indicated the need for digital transformation in 2017, after experiencing increasing pressures from stakeholders to incorporate new digital technologies. AirTrans needed a new, modular IT infrastructure with high fault tolerance, supported by redundant, highly available services. Such an infrastructure had to be complemented by certified gateways, allowing secure information exchange from various (mobile) locations. Concurrently, the top management of AirTrans desired to incorporate mobile, cloud, and analytical tools to enhance its operations.

AirTrans, however, failed in its digital transformation attempts and reached out for support in assessing the reasons behind such failure, as well as in delineating a path to

successfully navigate its digital transformation. After an introductory meeting and some trial work, we were allowed access to employees, organizational documents (e.g., meeting minutes, strategic directives, standard operating procedures) of the past ten years, and necessary resources. Our first engagements with AirTrans revealed that it mainly initiated the digital transformation endeavor to resolve issues they were experiencing, which were related to the level of information quality. As decisions made in a military context can have far-reaching consequences, the exploitation of high-quality data and information becomes critical. Moreover, military organizations can be especially susceptible, since they face more prominent issues related to preparing infrastructure, changing mindsets, sensitivity, and security (Haridas, 2015). While digital technologies can play a crucial role in increasing the level of information quality, the use of new technologies can concurrently significantly increase the information-related vulnerability of such organizations. Although military organizations increasingly engage in digital transformation (Heltberg, 2021), increased reliance on technical systems for processing information might make failures significantly more disruptive (Alberts, 2002).

Research Method

Our preliminary meetings with the top management of AirTrans and its Communication and IS (CIS) branch pointed us towards action research as a viable approach for investigating and addressing their problems. Compared to a case study, action research involves an intervention in which the research team is directly involved in the change process. As the digital transformation endeavor of AirTrans was extremely challenging but the top management was determined to continue with it, the situation represented a unique opportunity to explore how organizations can navigate digital transformation in practice. While a case study would only enable us to examine actions from the past, action research further enabled us to examine and evaluate how interventions would contribute to navigating digital transformation. Prescriptions of how organizations can successfully navigate digital transformation in practice are seldomly encountered in the literature yet are sorely needed by IS scholars and practitioners.

We have specifically chosen to guide our study based on the theory-infused interventionist approach of canonical action research, since it requires researchers both to investigate as well as to change an organizational situation, while emphasizing the role of theory for guiding the research project and for providing relevant and efficient outputs. We focused on the digital transformation and information quality situation at AirTrans, engaging in change through interventions, thereby generating both practical and scholarly knowledge (Davison, Martinsons, & Ou, 2012). Compared to other action research approaches (e.g., Avison, Lau,

Myers, & Nielsen, 1999; Davison, Martinsons, & Malaurent, 2021), canonical action research is characterized by its iterative, rigorous, process-oriented nature in which collaboration with the case organization is key (Susman & Evered, 1978), covering five major phases (Davison, Martinsons, & Kock, 2004): i) diagnosis, ii) action planning, iii) intervention, iv) evaluation, and v) reflection. Moreover, canonical action research offers a comprehensive set of principles and criteria for ensuring the relevance and rigor of a research project (Davison et al., 2004; Davison et al., 2012). Canonical action research adheres to a set of five principles, namely i) the researcher-client agreement principle, ii) the cyclical process model principle, iii) the theory principle, iv) the change through action principle, and v) the learning through reflection principle (Davison et al., 2004). To assess the quality of our study, a comparison was made with these principles together with the project champions, *viz*., The Chief Operations Officer and the Senior Information Manager at AirTrans. We theorize and contextualize the five cyclical phases of canonical action research in our research and demonstrate them visually in **Figure 3**, with further explanations in the following sections.

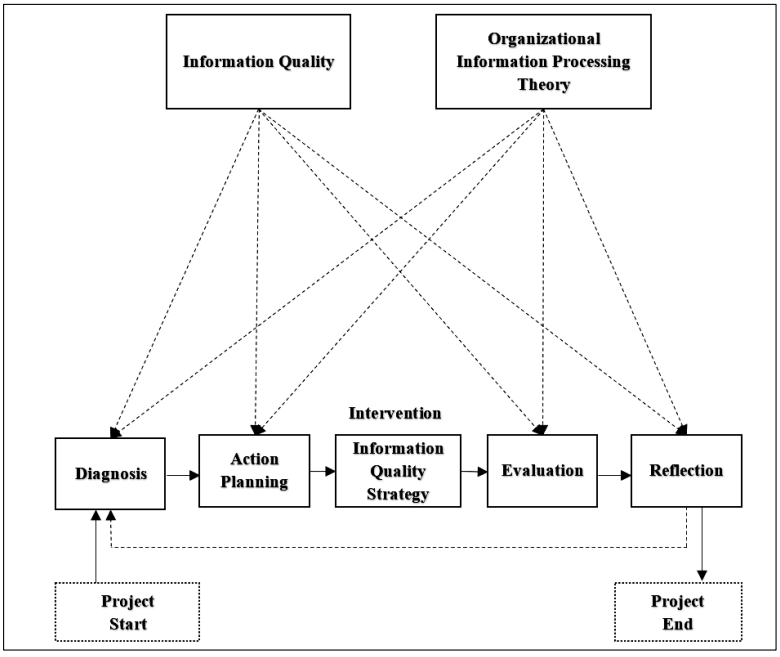

Figure 3 *- Canonical Action Research Process (adapted from Davison et al., 2012)*

During diagnosis (phase i), we assessed the environment independently and identified a focal theory for the action plan that followed (Davison et al., 2012). The overall implementation

consisted of action planning (phase ii), and intervention (phase iii) in the form of the development and implementation of an information quality strategy. Action planning is the process of specifying actions that can improve the problem situation (Lindgren, Henfridsson, & Schultze, 2004). Afterward, the identified actions were applied during implementation. The proposed actions were designed to improve the identified problem and causes, and the team of researchers must be able to explain these planned actions (Davison et al., 2004). The information quality strategy intervention was developed based on the information quality assessment and insights from the literature (action planning) and implemented on-site in collaboration with AirTrans. The last two phases were aimed at measuring the result of the implemented actions and determining the success and clarity of the digital transformation directions (Davison et al., 2012). The evaluation phase (phase iv) involves measuring the result of the implemented actions and determining their success. In collaboration with the top management, we determined if the intended effects of the solution were realized (phase v), and critically questioned whether the undertaken actions could be identified as the only cause of success (Baskerville, 1997). We evaluated the implemented actions, and reflected upon them, while AirTrans can repeat this phase to evaluate whether the actions have been implemented effectively by undertaking another canonical action research cycle in the scope of the digital transformation.

Instrumental Theory

Canonical action research emphasizes the role of theory for guiding the research project and for providing relevant and efficient outputs. In doing so, a focal theory is introduced to generate change and guide the research project, while instrumental theories are used to establish the focal theory as well as to facilitate the various canonical action research phases (Davison et al., 2012). As instrumental theory, we adopted the hybrid approach of Woodall et al. (2013), which presents guidelines for developing an information quality assessment framework tailored to the requirements of the focal organization. The first step is to determine the goal of the assessment, which can vary depending on the intentions of the organization. Afterward, organization-specific requirements related to the information quality assessment must be identified. To ensure the relevance of the requirements, it is useful to check that each requirement is induced from the identified goals (Woodall et al., 2013). The next step focuses on selecting relevant activities associated with the level of information quality, where a distinction is made between critical activities and optional ones. Hereafter, the activities that need to be included in the assessment for a specific organization can be configured by arranging them in a sensible order

and incorporating any activity dependencies (Woodall et al., 2013). Thus, based on the identified activities that are important for an organization, an approach toward assessing information quality can be developed.

A critical step of our assessment was to measure the information quality *status quo*. We focused on subjective information quality, as perception is a key indicator of the level of information quality in practice, since it represents an actual use-based evaluation (Price, Neiger, & Shanks, 2008). To evaluate the information quality *status quo*, we also used as instrumental theory the widely accepted subjective measurement approach established by Y. W. Lee, Strong, Kahn, and Wang (2002), which measures the level of information quality through various dimensions. We further reviewed the literature on information quality to identify more relevant information quality dimensions and included questions about these dimensions in the interview protocol. Our final information quality assessment framework included 14 dimensions as indicated in prior information quality studies (e.g. Stvilia, Gasser, Twidale, & Smith, 2007; R. Y. Wang & Strong, 1996), namely: timeliness, completeness, consistency, reputation, relevancy, ease of understanding, conciseness, accessibility, security, accuracy, objectivity, believability, interpretability, and appropriate amount (see **Table 4**).

Table 4 *- Overview of Information Quality Dimensions*

Dimension	Definition	References
Accessibility	The extent to which information is available, or easily and quickly retrievable. It is concerned with the speed and ease of locating and obtaining data or information relative to an activity.	Pipino, Lee, and Wang (2002) Stvilia et al. (2007)
Accuracy	The extent to which information is correct, reliable, and certified. It is a measure of whether the value of information is correct and reflects the real world.	R. Y. Wang and Strong (1996) Jugulum (2014)
Appropriate amount	The extent to which the volume of information is appropriate for the task at hand. When too much or too little information is available, organizational decision making becomes harder.	Pipino et al. (2002) Samitsch (2014)
Believability	The extent to which information is regarded as correct, true, real, and credible. Users' knowledge, experience, and uncertainty influence the level of believability.	Pipino et al. (2002) Fisher, Lauría, and Chengalur-Smith (2012)
Completeness	The extent to which core information elements are present for completing a specific business process. It is often connected to the ability of an IS to represent every meaningful state of the real-world.	Wand and Wang (1996) Jugulum (2014)
Concise representation	The extent to which information is compactly represented. In other words, information should be well formatted on the one hand and clear and complete on the other hand.	Pipino et al. (2002) Zaveri et al. (2016)

Consistency	The extent to which the logical relationship between correlated information is correct and complete. Consistency can be regarded as the absence of variety or change or the extent to which information is presented in the same format.	Pipino et al. (2002) Sebastian-Coleman (2012) Cai and Zhu (2015)
Ease of understanding	The extent to which information is clear without ambiguity and easily comprehended.	R. Y. Wang and Strong (1996)
Interpretability	The extent to which users understand information and perceive information to be in appropriate languages, symbols, and units.	Pipino et al. (2002)
Objectivity	The extent to which information is unbiased, unprejudiced, and impartial.	R. Y. Wang and Strong (1996)
Relevancy	The extent to which information is applicable or appropriate for the required task.	Tee, Bowen, Doyle, and Rohde (2007)
Reputation	The extent to which information is highly regarded in terms of its source or content.	Pipino et al. (2002)
Security	The extent to which access to information can be restricted and, hence, protected against its illegal alteration and misuse.	Zaveri et al. (2016)
Timeliness	The extent to which information represents reality from the required point in time. In other words, it refers to the extent to which information is up to date for the required task.	English (1999) Wand and Wang (1996)

Focal Theory

Following the principles of canonical action research, we incorporated a focal theory to understand the *status quo* at AirTrans and to guide us in developing as well as implementing an appropriate solution. Consequently, we looked for a theory that could explain the operational efficiency and effectiveness of organizations by primarily looking at the role of information. The basic premise of organizational information processing theory is that resolving uncertainty is the key task of organizations, where uncertainty is caused by a lack of information about, *inter alia*, tasks and the environment, and hampers the operations of organizations (Galbraith, 1974). Consequently, organizations can reduce such uncertainty by balancing their information processing requirements and capacity. We used this conceptualization to understand the information processing requirements and capacity *status quo,* how the level of information quality affects the balance between information processing requirements and capacity, and how we could design and implement an information quality strategy to optimize the balance between information processing requirements and capacity.

Information processing has always been a key success factor for organizations (Galbraith, 1973), and consequently, organizations are constantly trying to exploit the advantage of having access to real-time information by implementing novel, digital

technologies that support them in doing so (Srinivasan & Swink, 2018). In terms of the broader information management practices of organizations, information processing is arguably the most critical valuation point, as it determines whether the available information meets the needs of the organization (Kettinger & Marchand, 2011). It includes activities focused on collecting data, transforming it into information, and ultimately communicating and storing it. While such activities can take place at both individual and organizational levels, the latter is more than the sum of the former, since individual diversity, information asymmetry, and disagreements can make organizational information processing more challenging (e.g., Daft & Lengel, 1986). If organizations manage to balance their information processing requirements and capacity, however, they can significantly enhance the effectiveness of their processes.

Information processing requirements refers to the information that is necessary to perform tasks, while information processing capacity refers to the ability to collect data, transform it into information, and store it in such a way that it is accessible to those who need it. Hence, the extant literature has primarily defined information processing requirements in terms of the quantity of information, referring to it as the "necessary *amount* [emphasis added] of information required to satisfy decision-making for a particular set of objectives" (S. Zhu, Song, Hazen, Lee, & Cegielski, 2018, p.49). Information processing requirements, thus, represents the level of uncertainty, which can be defined as the difference between the information required and possessed (Galbraith, 1973), and can have various causes, such as the complexity of the tasks to be performed or exogenous events such as crises. Moreover, information processing requirements can vary among organizations and subunits (Gattiker & Goodhue, 2004), and can have different underlying root causes, such as task ambiguity, market changes, the complexity of organizational activities, and technological changes. Thus, the more uncertainty organizations face, the more information they need to process to deal with such uncertainty. As such, one of the main objectives of organizations is to deal with their changing information processing capacity needs, which result from external uncertainties and internal complexities (Egelhoff, 1991).

Prior studies have identified various means for bringing balance between information processing requirements and capacity. Different modes of coordination can be exploited by organizations to deal with different levels of uncertainty and information processing requirements. For example, standard operating procedures are more effective when uncertainty is low, while IS can be especially beneficial when uncertainty is higher (Galbraith, 1974). To deal with the uncertainty associated with customers and suppliers, organizations can increase their information processing capacity by investing in vertical IS (Srinivasan & Swink, 2015).

One assumption here is that increasing information availability will improve organizational decision-making. To summarize, organizational information processing theory posits that activities should either try to enhance information processing capacity or lower information processing requirements, reducing their gap and enhancing organizational decision-making (Srinivasan & Swink, 2018).

Although we were pointed to the relevance of information quality during digital transformation and the usefulness of organizational information processing theory during our data collection, prior studies have already loosely pointed to the importance of, and links between, the different concepts included in our study. During our study, we reviewed the literature again to see what relationships had been proposed before, and how our findings ultimately contributed to those streams of the literature. We mapped the core elements of our study and their proposed relationships (Watson & Webster, 2020; Webster & Watson, 2002), as presented in **Figure 4**, where we include illustrative examples of prior studies that point towards a relationship and provide further explanations of such relationships.

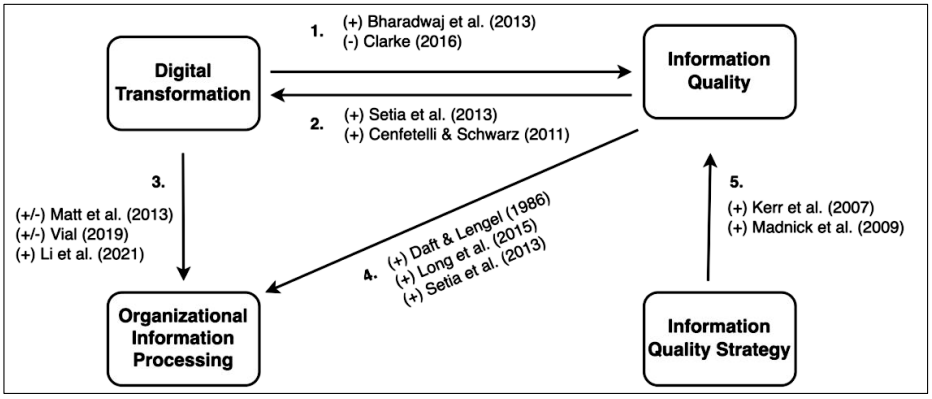

Figure 4 *- Map of Concepts in the Literature and their Relationships*[9]

[9] The (+)/(–) signs indicate whether the existing literature has pointed to a negative or positive relationship between the different elements. (1) The literature points to two opposing effects of digital transformation on information quality: i) new technologies can increase information quality, and ii) huge amounts of data and information present new risks with regards to ensuring information quality. (2) High-level information quality through digital technologies can result in improved capabilities, while poor information quality may lead to reduced technology usage. Hence, although focusing primarily on the technology aspect of digital transformation, higher levels of information quality seem to be beneficial for digital transformation. (3) We induce two different effects of digital transformation on organizational information processing, namely i) that digital technologies can increase information processing capacity and ii) that digital transformation leads to high levels of internal and external uncertainty (and, hence, higher levels of information processing requirements). (4) Higher levels of information quality facilitate the effective processing of information and richness of information decreases uncertainty. (5) By implementing an information quality strategy, organizations can manage and improve their information quality.

Data Collection and Analysis

Our data collection was focused on available organizational archival data as well as interviews with employees of AirTrans. The archival data comprised top and middle management meeting minutes, as well as strategic directives between 2010-2019, resulting in 204 documents (see **Table 5**). During the diagnostic phase, we reviewed and coded the archival data, specifically focusing on digital transformation and information quality, to identify related themes. When the relevance of organizational information processing theory became clear, we went through the data again to further identify missed themes related to information processing requirements or capacity. We also conducted three rounds of interviews, two during the diagnostic phase, and one during the evaluation phase, resulting in 43 semi-structured interviews over a period of six months in 2019, with 22 employees from various organizational levels and divisions.

Table 5 *- Overview of Archival Data*

Source / Year	Strategic directives	Top management minutes	Middle management minutes	Total
2010	1	0	5	**6**
2011	1	5	24	**30**
2012	1	4	16	**21**
2013	1	3	24	**28**
2014	1	2	18	**21**
2015	0	4	16	**20**
2016	1	1	10	**12**
2017	0	2	10	**12**
2018	1	2	22	**25**
2019	1	4	24	**29**
Total / Source	**8**	**27**	**169**	**204**

We followed a purposive sampling approach to select the most relevant participants for our interviews, both at the strategy as well as the operational levels, from different backgrounds, with different functions and different ranks, thereby increasing the validity of our findings (Thornhill et al., 2009). The function, rank, and nationality of the interviewees in our study, which were all based at the headquarters of AirTrans, are presented in **Table 6**. We incorporated semi-structured interview protocols, enabling us to follow a predetermined list of questions, allowing for follow-up ones, and offering the opportunity to clarify difficulties as well as to elaborate on specific elements of the interview (Sekaran & Bougie, 2016). The first interview round served as an initial diagnosis to identify challenges, objectives, and drivers of digital transformation, followed by a second round for the information quality assessment, and a third

one to evaluate the information quality strategy, and validate our findings. After each interview round, the interviews were transcribed and coded. Our analysis started with individual interviewee experiences, and we then developed more abstract conceptual categories to explain and understand the data and identify patterns.

Table 6 *- Details of Interviewees*[10]

Function	Position in chain of command	Nationality	Code	Round
Chief Operations Officer	High	A	BGG-1	1,2,3
Director of Policy	High	B	CI-1	1,2,3
Deputy Director of Policy	High	C	CF-1	1
Director of Operations	High	D	CB-1	1,2,3
Director of Support	High	E	CD-1	1,2,3
Senior Information Manager	Medium	E	LCD-1	1,2,3
Executive Secretary	Low	D	CIVB-1	2,3
Head of Quality Management	Medium	C	LCF-1	2,3
Head of Training	Medium	C	LCF-2	2,3
Head of ICT Helpdesk	Low	C	ACF-1	2
Head of Data Analytics	Medium	B	LCI-1	2
Legal Affairs	Medium	E	LCD-2	2,3
Quality Management Assistant	Low	A	CG-1	2,3
Operations Desks	Medium	A	LCG-1	2
Head of Medical Support	Medium	A	CDG-1	2,3
Head of ICT	Low	A	CG-2	2,3
Senior Technician	Low	A	WOG-1	2
Head of Finance (predecessor)	Medium	E	MD-1a	2
Head of Finance (successor)	Medium	E	MD-1b	3
Head of Operations Desk	Medium	A	CG-3	2
Head of Security	Medium	E	MD-2	2,3
Medical Support	Medium	F	LCDS-1	2
HR Management	Medium	D	LCB-1	2,3
Logistic Support	Medium	F	LCS-1	2

The data was first divided into different overarching subjects, which we referred to as labels determined based on the themes that reoccurred during the interviews. Based on our initial conversations with the top management of AirTrans, we focused our interviews on the concepts of digital transformation and information quality, while we identified the relevance of organizational information processing theory based on the interviews and the archival data. We further compared the interview data with the archival data on the standard operating procedures

[10] To preserve anonymity of participants, functions are generalized to comparable civil organizational functions.

and business processes to thoroughly understand and evaluate the *status quo*. After our preliminary analysis, we carried out a detailed analysis of i) the challenges of digital transformation, ii) the drivers and objectives of the digital transformation endeavor, iii) the information quality *status quo*, iv) the factors that influence the level of information quality, and v) the implications for organizational information processing. We divided the data into overarching labels based on the recurrent themes and then assigned them to definition coding schemes. To visualize our findings, we created a data structure with first- and second-order concepts, as well as aggregate dimensions, as depicted in Appendix C.

The first interview round as well as preliminary meetings with the top management were open-ended and focused on digital transformation, information flows, responsibilities, services, and processes of AirTrans. Our second and third interview rounds specifically incorporated the concept and dimensions of information quality to further explore the issues we identified in the first interview round. Although such a predetermined focus on specific concepts might lead to biased findings, we ensured that our semi-structured interviews allowed room for topics that the interviewees felt were important. To achieve this, all our interviews started with an open dialogue, which enabled the interviewees to share their experiences, rather than immediately putting the focus on information quality. The first author spent one year at the case organization and conducted all the interviews, while the second and third authors also attended some of the meetings, and the last author participated in the reflection and theorization (Davison, 2020). Since all the interviews were recorded and transcribed, the first two authors reviewed the data and the emergent codes and themes, thereby increasing the validity of the findings we present in this study. In the following section, we describe the details and findings of this canonical action research according to the five-phase cycle.

4. Action Research Cycle

Diagnostic Phase

The diagnostic phase was officially initiated when the researcher-client agreement was finalized (see Appendix F). Before finalizing the agreement, members of our research team had exploratory meetings with the top management and the CIS branch of AirTrans to i) obtain an initial understanding of the problem they were facing, and ii) identify the most suitable approach to explore and address the problem. These meetings revealed that AirTrans had been attempting to incorporate various digital technologies to transform its processes and operations. When we asked why they felt the need to engage in digital transformation, we were first

implicitly pointed toward problems related to information quality, as their digital transformation attempts thus far had focused on solving information quality issues and improving information processing. We further explored the successive digital transformation challenges as well as the role of information quality in the first round of interviews, during the diagnostic phase of our study.

Our independent diagnosis aimed at providing a thorough understanding of the *in situ* organizational context and identifying a full set of problems and their causes, as AirTrans had already identified some problems during our exploratory meetings but could not make sense of their nature and exact causes. Hence, we conducted the first round of interviews with the top management of AirTrans to determine their intentions as well as the issues they experienced. The first round of interviews highlighted that information quality was the driver of digital transformation. LCD-1 provided an example of why the command group had initiated the endeavor: *"Asking for a standard operating procedure, people are very helpful, so within a day you have all of them on your table. However, I did it once and I asked seven people or eight people. And at the end of the line, I had five different versions on my table. That is why they are not happy, and I must agree, that is what has to change"*. CD-1 adds: *"Especially the last step of actually doing something with the data leading to changes in the world and making things more efficient or effective, we miss that"*. The chief operations officer (BGG-1) further mentions one of the objectives hoped to be achieved by engaging in digital transformation: *"If we would be able to match different data so that we are not working with different data. Because we have different sources, and one is not knowing that the other one is working with different data on the same topic"*.

The interviews further revealed that the prior digital transformation initiatives were subject to inertia, resistance to change, a lack of transparency, and the absence of a clear vision. Inertia is not only rooted in the daily operations of AirTrans, but also stems from the policies, regulations, and routines of the participating nations: *"But especially in the old systems […] people are so stuck in their own little knothole that they just don't want to see that the world is changing"* (LCD-1). Such inertia led employees to resist change, fearing that new technologies would make their work harder. By discussing with employees during our visits, and analyzing the provided organizational documents, we unearthed that there was a lack of vision and transparency regarding their digital transformation, as it was unclear for both the employees as well as the top management where the organization was heading and what the benefit would be of incorporating digital technologies. Specifically, most interviewees felt that the information they had received regarding the digital transformation of AirTrans was incomplete, hard to

access, and not regularly updated. In other words, poor information quality was also experienced concerning the actual digital transformation endeavor. This resulted in increased uncertainty amongst the employees, who indicated their need for more information on digital transformation. BGG-1 for example mentions: *"I thought [code-name of digital transformation initiative] was the big new thing. But it's not really defined. I thought it should have been implemented now for two or three years already".* Moreover, technologies were implemented without comprehensive complementary guidelines on how to use them, their associated responsibilities, or the opportunities they provide for collaboration. The lack of digital transformation progress also caused employees to question the ability of AirTrans to change: *"If you can change something, I will cross my fingers, because [...] we are discussing the same problems since 2010"* (CG-3). Consequently, the past challenges have led the employees to lack both confidence in and a sense of credibility for digital transformation-related information, invoking more information quality issues.

As such, we followed the hybrid approach of Woodall et al. (2013) for developing a tailored information quality assessment framework to assess the information quality *status quo* of AirTrans (see **Figure 5**). First, in collaboration with the top management, we determined the processes that had to be examined, which guided us to focus on the functional and supporting processes, while the operational ones (e.g., flight scheduling) were not directly included as a focus in our assessment. In the second step, we identified the main problems experienced by the employees. Our interviews with the top management revealed nine information quality-related problems, two of which were regarded as the most critical by the top management, namely that the available information was i) generally not easily and quickly retrievable, and ii) frequently not up to date for the required task/decision. While we examined if these problems were also shared by the rest of the employees, we did not limit our investigation solely to these two problems. The interviewees were allowed to discuss the problems that they were experiencing. The information items depicted in step three represent the relevant information values, attributes, tables, IS, paper files, etc. which were subject to the information quality assessment (Woodall et al., 2013). These items included all information required, created, stored, and exchanged as part of the functional and supporting processes of AirTrans.

Then, in step four, we included in our analysis all information quality dimensions (**Table 4**). Based on the initial discussions with the top management, we chose to focus on subjective metrics. Hence, we built on a widely-accepted subjective information quality measurement tool (Y. W. Lee et al., 2002), that we adapted to a semi-structured interview protocol. Our motivation to use interviews instead of a survey for identifying the information quality *status*

quo was to i) shed light on how information was being processed, ii) what information quality issues existed and why, iii) what consequences and costs they resulted in, iv) what solutions had been tried to overcome such issues, and v) what were employees views for moving forward. Hence, our measurement as portrayed in **Figure 5** (step six) did not include any objectification of subjective constructs but was rather aimed at understanding how employees perceived the level of information quality. Based on the interviews, we created *status quo* process models (step eight), and compared them with existing models that AirTrans had created.

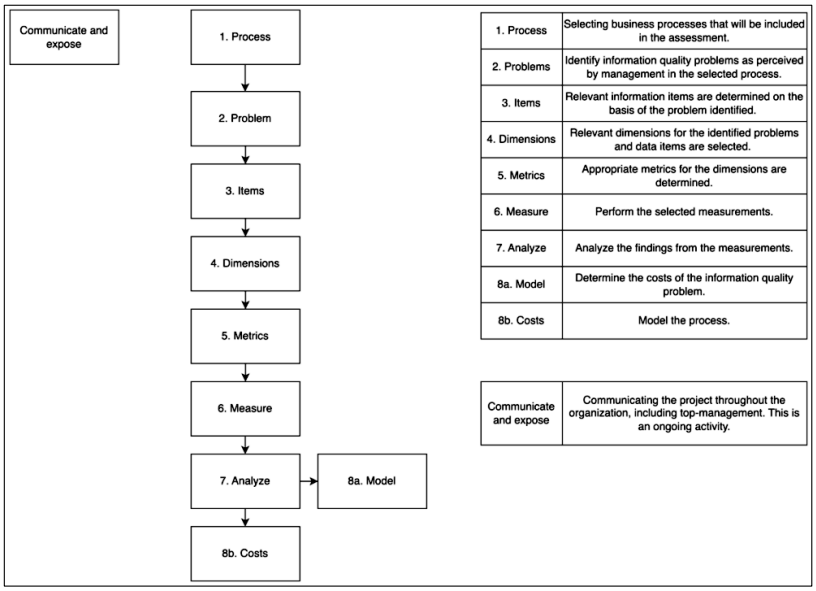

Figure 5 *- Information Quality Assessment Framework (based on Woodall et al., 2013)*

As information quality issues can affect the entire organization, we included interviewees from all divisions of AirTrans in our assessment. In doing so, we found that *timeliness, accessibility, and accuracy* represented the three main information quality issues hampering information retrieval and processing for the tasks at hand. Most of our interviewees indicated that finding information was difficult and time-consuming, especially for newcomers. Novel digital technologies were largely absent at the point of our diagnosis, while processes and activities related to information processing were conducted manually, such as data analyses. Some technological solutions, like a central intranet for storing and sharing information, were implemented to enhance the ability to process information and improve information quality, yet in practice did not yield the desired results. The lack of a clear

assignment of responsibilities, as well as the absence of clearly defined processes, policies, and guidelines, were identified as major causes. Moreover, AirTrans lacked an overall approach towards information management, giving rise to various practices and routines in the branches of the organization. This, in turn, led to the creation of information silos that made it almost impossible for employees to understand key information outside of their silos. CIVB-1 explains: *"Well, my honest opinion is that we still have too many islands. People do not communicate enough with each other, or they do not follow the chain of hierarchy".*

The processes, practices, and routines that were part of such silos, as well as the perception of the level of information quality, were influenced by both organizational and individual characteristics. One clear individual characteristic that affects subjective information quality is the national background of employees. For example, when considering written information, there is a different perspective of conciseness; while some employees considered elaborate pieces of information to be of high quality, others perceived the same pieces of information to be of poor quality. The different backgrounds of employees, along with the high turnover experienced in military organizations (on average three years per employee), further contributed to inertia, resistance to change, and the creation of information silos. LCD-1 explains: *"Especially since every two- or three years people go home and you get a new group of people, who are brought up in their own country, with their own rules, their own culture, and all of a sudden they have to change".*

Moreover, the clear hierarchy and command-and-control structure of such a military organization can affect how employees perceive the level of information quality, since information coming from lower-ranked levels of the organization is perceived to be of lower quality than information coming from the top. Specifically, employees in the lower ranks of AirTrans assume and trust that all information shared by the command group is of high quality. CF-1 mentions that quality is determined by the top management: *"For our division, the quality is always judged by the command group".* Consequently, employees spend more time on processing information coming from lower levels due to perceived information quality problems, which was seen as a challenge for the top management since it increases information processing requirements. CDG-1 elaborates on dealing with information from subordinates: *"This is always in a military hierarchy. You have to consistently look after [lower ranking officers] until you know that a guy is disciplined enough to do it correctly by himself".* Bearing in mind the short tenure periods, once newcomers are fully accustomed to the way of working at AirTrans and the top management can eventually trust that the information they produce and share is of high quality, their tenure period is already nearly coming to an end.

In summary, we find that the level of information quality affects organizational information processing, and its requirements were influenced by how employees perceived information quality. Such perceptions affected how much time and energy the employees spent on processing information. Moreover, differences in information quality perceptions amongst employees can lead to disagreements during decision-making. Hence, our interviews reveal that perceptions of poor information quality invoke uncertainty and, thus, affected information processing requirements. We find that the information quality issues had implications for the necessity and intensity of three main information processing tasks, namely i) retrieving, ii) storing, and iii) sharing information. More specifically, the information quality issues increased information processing requirements, as time and resources had to be invested to promptly gain access to all necessary information. In turn, the information quality and information processing issues affected the performance of the organization through: *"[b]udget loss, insufficient use of available air assets, and with that loss of capacity" (LCD-1).* To address some of these information quality-related issues, AirTrans had incorporated (or had attempted to incorporate) various technologies to enhance information processing and improve the level of information quality, but no improvements were harnessed in practice. Such challenges were linked to the absence of activities concerned with governing information quality. Founded on organizational information processing theory as our focal theory, we aimed to increase the fit between information processing requirements and capacity to address the information quality-related issues through an information quality strategy, thereby supporting AirTrans in effectively navigating its digital transformation.

Action Planning Phase and Intervention Phase

Based on the results of the diagnostic phase, we developed an information quality strategy in collaboration with the top management and implemented it as a business case. Canonical action research enabled a close collaboration with the top management, while the employees provided us insights from various organizational levels. By collaborating primarily with the CIS branch, we created drafts of the information quality strategy before agreeing on the final one to be developed and implemented. As alignment with organizational strategy and objectives is crucial, we reviewed organizational documents to ensure that the information quality strategy would contribute to the overall objectives of AirTrans. The overall strategy of AirTrans consists of short- and long-term objectives and tasks, most of which cover operational processes, such as optimizing air-to-air refueling and aeromedical evacuations. The main priority, however, was to increase efficiency, enhance internal processes, and improve standardization amongst

stakeholders. The top management, therefore, indicated from the beginning of the project their will to proceed with a digital transformation endeavor, even though they had experienced significant challenges.

Based on our findings from the diagnostic phase, we divided the information quality strategy solutions into *technology* and *information quality governance* ones. Hence, some of the solutions included in the information quality strategy consisted of IT adoption, while others were focused on system quality improvement, such as a cloud solution, and organizational improvements, such as process improvements (Appendix E). The appropriate technologies were derived from the *status quo* assessment as well as insights from the literature, a brief description of which was included in the information quality strategy. This description touched upon the prior digital transformation failures and their causes, as well as the identified information quality issues, and their effects on information processing capacity. Besides IT adoption, our solutions revolved around governing information quality (Appendix D), as we found that the prior incorporation of technologies at AirTrans should, in theory, have resulted in an increase of information processing capacity and information quality but were not experienced as such in practice by the interviewees. Consequently, the information quality strategy we developed and implemented, explicitly mentioned, for instance, who should be responsible for which information, processes, and tasks to improve and sustain information quality. The data governance-related solutions are expected to influence information processing requirements, through their direct impact on information quality.

While we present an overview of all solutions in Appendix D and Appendix E, for illustration purposes we briefly elaborate on one specific technological solution as well as the related information quality governance solution; specifically, the implementation of a cloud solution (technology) and the related governance activities (assigning accountability and responsibility, defining policies, etc.). As identified during the diagnostic phase, AirTrans was experiencing information quality challenges due to the absence of adequate controlled access to information from outside its headquarters. This was especially vital for aeromedical evacuations, as well as the development of air-traffic manuals and rules involving extensive information exchange with external stakeholders, which lacked a single point of entry. Innovative solutions had not been identified due to the rigid and restrictive environment of military organizations, causing a mismatch between information processing requirements and capacity. Information quality issues related to accessibility, timeliness, and accuracy increased the efforts necessary for processing information, causing an increase in information processing requirements. In collaboration with AirTrans and their civilian IT supplier, we identified a way

in which a cloud solution could be implemented to resolve these challenges. Based on our diagnosis of prior digital transformation failures at AirTrans, we ensured that we had an equal focus on the necessary information quality governance mechanisms that needed to be put in place. Consequently, we expected that the technological solution would increase information processing capacity, and together with the focus on information quality governance, it would improve information quality and information processing requirements.

Besides a description of the solutions, the information quality strategy included a separate information quality mission and vision statement to ensure that its importance and objectives were known and understandable, and to justify the need for certain changes throughout the organization, to reduce resistance to its implementation. We further explained how the solutions were expected to affect information processing requirements and/or capacity; the two critical aspects of organizational information processing theory. The implementation of the information quality strategy consisted of a presentation of the business case and the implementation of various solutions (e.g., defining accountability, promoting the use of the intranet, and implementing a cloud solution), whereas the other solutions are in progress. AirTrans has, for instance, initiated close collaboration with a civilian engineering company to further ensure access to its information from various dispersed geographical locations. The implementation activities were executed by members of our research team and the CIS branch, supported by the top management of AirTrans.

Evaluation Phase

The information quality strategy was evaluated through a third round of interviews with employees and the top management (**Table 6**). The interviewees from lower ranks acknowledged that an official order from the top management regarding the implementation of the information quality strategy was indeed necessary and addressed the role of the division heads, as indicated *"we are lucky because we are in a military system, so once somebody gives you an order, you have to obey, so that is going to be easy for us. If the order is given by the chief of staff to adopt this strategy, it is going to be easy"* (CI-1). The third round of interviews further revealed that the information quality strategy increased the satisfaction of employees at all organizational levels, as they were satisfied with their participation in the project and the paid attention to the issues they were experiencing: *"I am happy that such things are taken into consideration. Because since I am here, these have been continuous issues"* (CF-1). While AirTrans had tried to address these information quality issues through their digital transformation endeavor in the past, this had failed. The employees appreciated that they were

involved in the digital transformation process and were able to better understand what the organization is trying to achieve and move towards. Moreover, the interviewees agreed that the information quality strategy was needed and that it could continue to improve the level of information quality by addressing information processing, the satisfaction of employees, and the operational efficiency of AirTrans. As such, the interviewees recognized the need for adopting the information quality strategy, since it addressed their most pressing issues.

By implementing a number of the proposed solutions, we were able to ask interviewees for an evaluation. Focusing again on the cloud solution and the related information quality governance solutions, the interviewees agreed that the cloud solution enabled effective and efficient information-sharing and, hence, increased information processing capacity. In the case of a medical emergency, for example, external parties can now quickly and securely share information that can immediately be processed. LCD-1 adds to this: *"The cloud solution works extremely well for AirTrans. Especially when you look at training and exercises and the functional division, you see that the cloud solution is perfect".* It was further acknowledged in an interview that a focus on information quality governance, in collaboration with the employees, who would be the end-users of the implemented digital technologies, enabled the exploitation of the information quality benefits that the cloud solution offered: *"[…] more formalizing, even putting more or better processes in place, that there is not so much possibility of misunderstanding, that you have straight information to deal with, […] everything's probably simply implemented and [AirTrans] can simply start working. Not having to request additional information".* By assigning responsibility and accountability to the cloud solution, as well as providing omplementary guidelines, we ensured the improvements in information quality and decrease in information processing requirements. As a result, the fit between information processing requirements and capacity was enhanced, which was the ultimate objective of our information quality strategy. LCD-1, for example, mentions: *"Requirements went down in terms of physical meetings, briefings, and reporting due to improved availability of information that can be retrieved from the cloud and can easily be distributed by the originators".* Moreover, some interviewees from the functional division of AirTrans mentioned that the implemented solutions enabled them to complete projects together with the participating nations within three months on average, compared to eight months before the information quality strategy.

When asked about the impact of the information quality strategy on daily tasks, CB-1 answered: *"I will now have more time to do my job as many people are at my desk asking for information that got lost in transition".* Finally, the information quality strategy we developed

and implemented provided a clear digital transformation vision, and the involvement of employees was seen as a transparent move, decreasing, thus, resistance to change. For instance, LCD-1 mentioned that: *"[the employees] keep on going and they even go in those areas where they normally would have refused to make some changes".* The top management considered this a major gain and was a trigger to set change in motion: *"If we do not do this, we do not have to go to the next step. Because if we keep on messing around, then every tool we are going to bring in is going to be less effective than it should be"* (LCD-1).

Reflection Phase

During the reflection phase, we evaluated our intervention together with the top management of AirTrans, based on the principles of Davison et al. (2004), as supplemented by Davison et al. (2012). During our final meeting with the top management, we determined if the research project resulted in a positive outcome and further reflected on the strengths and weaknesses of our implemented approach. As indicated by the top management, one of the major strengths of our approach was the involvement of employees from throughout the organization, which provided transparency and reduced resistance to change concerning the digital transformation endeavor. A quote from CF-1 highlights this: *"Exactly what we needed, external eyes to really stress on all the issues that we have. I am not surprised, but it is nice to have clearly mentioned all the issues that we are facing […]"*. Whilst we could only observe the short-term effects, AirTrans has fully adopted the information quality strategy and continues with the navigation of their digital transformation accordingly.

We also reflected upon organizational information processing theory, which was chosen as our focal theory after the second round of interviews. Whilst other frameworks or theories including information quality (e.g., DeLone & McLean, 1992) might have been suitable as well, we found that the context and process of digital transformation require a perspective that goes beyond the mere success or failure of IS implementation. This was confirmed in the diagnostic phase of our study, where we identified that prior technological solutions had been implemented that could have improved information quality but in practice did not. Hence, we built upon organizational information processing theory as a theoretical framework that explains why and how information is crucial for organizational performance, and how organizations can engage in digital transformation to realize this.

One drawback of the organizational information processing theory literature is that it conceptualizes information quality primarily through the richness of information (e.g. Daft & Lengel, 1986), paying scant attention to its other inherent characteristics. One of the key

assumptions of organizational information processing theory, however, is that organizations need high-quality information to deal with environmental uncertainties and to improve decision-making (Galbraith, 1973). Our first analysis associated with the issues faced at AirTrans revealed that both objective and subjective aspects of information quality can significantly influence information processing in organizations. Although there might be other ways to improve the level of information quality, and consequently successfully navigate digital transformation, an information quality strategy was deemed the most appropriate way for bringing balance between information processing requirements and capacity and was specifically instrumental in the case we explored in our study. We present a reflection of the complete canonical action research project in Appendix F.

5. Discussion

Key Findings

Our study provides a unique opportunity to explore the role of information quality during digital transformation and examine in practice how pre-digital organizations can effectively navigate them. When it comes to our key findings, we bring forward three main contributions to the extant IS literature, as our study elucidates i) the implications of the level of information quality for organizational information processing, ii) the role of information quality in digital transformation endeavors, and iii) how an information quality strategy can help pre-digital organizations navigate digital transformation. In the case of AirTrans, we identified issues related primarily to three information quality dimensions, namely: *accessibility*, *timeliness*, and *accuracy* of information. Employees throughout the organization were facing difficulties in retrieving appropriate information and determining whether it was up-to-date and accurate. Our findings indicate that employees had a lot of freedom in managing information, and consequently information was managed per unit, leading to information silos. Concurrently, employees from different nations had varying perceptions of what entails high-quality information, which affected the information processing requirements at AirTrans, and led to differences in managing information per unit. Such information quality issues, therefore, gave rise to uncertainty and primarily increased the required effort in retrieving, storing, and sharing information, ultimately affecting information processing. While technological solutions had been implemented in the past to improve information processing as well as the level of information quality, these did not yield the desired results in practice. We find that a lack of focus on governing information quality had played a major role in such a failure, which

corresponds with the notion that digital transformation entail much more than the mere implementation of digital technologies (Kane et al., 2015; Vial, 2019).

Hence, we also demonstrate that improving the level of information quality can serve as an implicit driver, problematic enabler, and beneficial outcome of digital transformation. On the one hand, therefore, we offer novel insights into digital transformation challenges caused by information quality issues, while on the other hand, we unearth digital transformation opportunities for increasing the level of information quality. As a pre-digital organization, AirTrans had no digital technologies in place and experienced significant information quality issues. Such issues also affected the effectiveness of their digital transformation endeavor, causing a lot of uncertainty amongst employees and resistance to change. AirTrans lacked a clear strategic view of information quality, as well as a clear digital transformation vision, and was not transparent enough about its digital transformation motives and approach. Such obstacles, thus, were largely reflected by the information quality-related issues experienced by the employees at AirTrans, although the top management did not identify them as such initially.

Third, as a response to the identified issues, we designed and implemented an information quality strategy, aiming at aligning information processing requirements and capacity. Our information quality strategy derived technological and information quality governance solutions from a tailored *status quo* assessment, which, as demonstrated during the evaluation phase, ultimately enhanced information processing, and supported AirTrans in navigating its digital transformation. Overall, the employees were satisfied with the attention that was paid to their issues, as well as with the concrete plan that we developed and implemented for overcoming them. The implementation of various solutions did not result in resistance from stakeholders, thereby showing how an information quality assessment followed by the development of an information quality strategy that balances both technological solutions and information quality governance can contribute to successful digital transformation.

Linking Digital Transformation, Organizational Information Processing, and Information Quality Strategy

While the concepts of digital transformation, organizational information processing, and information quality have been previously examined in isolation, the unique opportunity to conduct a canonical action research project at AirTrans revealed that they are closely related and have an influence on each other. Our canonical action research approach, therefore, further resulted in a conceptual model, which we visually depict in **Figure 6**. First, we elucidated the

implications of information quality for information processing requirements, as poor-quality information results in increased levels of uncertainty. We found that the implementation of technology, as indicated in the literature (e.g., S. Zhu et al., 2018), indeed results in improved information processing capacity. For technology to result in improved information quality, however, information quality governance mechanisms need to be in place. While prior research states that governance mechanisms directly influence information processing capacity rather than information processing requirements (Oshri, Dibbern, Kotlarsky, & Krancher, 2019; Tushman & Nadler, 1978), our findings indicate that appropriate information quality governance mechanisms decrease information processing requirements by improving information quality. That is, the incorporation of technological solutions allows for potential improvements of the level of information quality, while information quality governance ensures that these improvements can be exploited. By systemically addressing both technology and information quality governance, an information quality strategy sets the scope for digital transformation and contributes to achieving a fit between information processing requirements and capacity, thereby supporting organizations in effectively navigating their digital transformation.

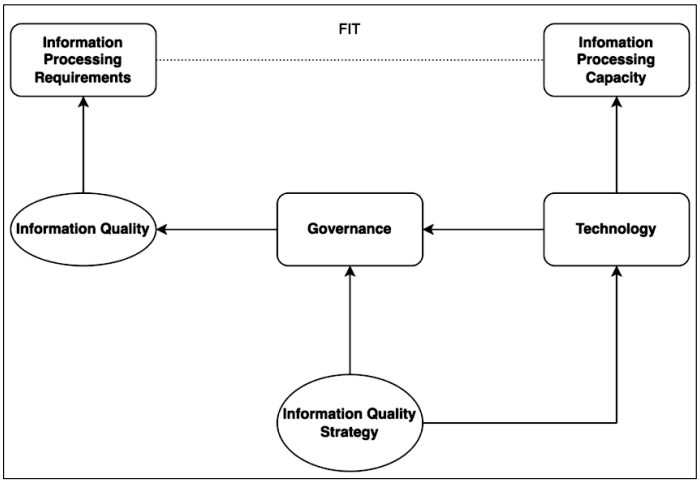

Figure 6 *- Conceptual Model*

Implications for Theory

When it comes to the theoretical implications of our work, we identify novel links amongst the concepts of digital transformation, information quality, and organizational information processing in the context of pre-digital organizations. While prior studies have started

unravelling some of the complexity associated with the successful navigation of digital transformation (e.g., Verhoef et al., 2021; Vial, 2019), and are beginning to focus specifically on pre-digital organizations (Chanias et al., 2019; Sebastian et al., 2017), most digital transformation endeavors still fail in practice (De la Boutetière et al., 2018) and the topic, therefore, remains timely for IS research. We demonstrate how pre-digital organizations can set a digital transformation scope and navigate their endeavors by implementing an information quality strategy focused on both technology as well as governing information quality. The literature indicates that access to information is a key enabler of, and a driver for digital transformation (Chanias et al., 2019; Vial, 2019) while pointing to the potential implications of digital technologies for improving information quality (e.g., Setia et al., 2013) as well the potential risks (Clarke, 2016). Considering these insights, including the difficulties of navigating digital transformation in practice (De la Boutetière et al., 2018) as well as addressing the level of information quality (Işık et al., 2013), we further examined the role of designing and implementing an information quality strategy in the context of digital transformation.

In doing so, we first demonstrate the implications of information quality-related issues by adopting organizational information processing theory as our theoretical lens (Galbraith, 1974). Although the extant literature acknowledges the importance of obtaining a fit between information processing requirements and capacity to increase organizational effectiveness (e.g., Premkumar, Ramamurthy, & Saunders, 2005; Srinivasan & Swink, 2018) and has started examining organizational information processing in the context of digital transformation (e.g., Aben et al., 2021), the majority of organizational information processing theory studies have focused solely on the quantity of information (e.g., Tushman & Nadler, 1978; S. Zhu et al., 2018), neglecting the implications of quality. Nevertheless, Daft and Lengel (1986) have pointed early enough to the crucial role of information quality, which at the time they conceptualized solely as information richness. In line with other scholars (e.g., Abraham et al., 2019), we argue that information quality is becoming increasingly crucial since contemporary organizations can have access to more data from a variety of different sources.

We have incorporated the multidimensional nature of information quality and examined its implications for organizational information processing. We show that poor information quality increases information processing requirements, thereby affecting the fit between information processing requirements and capacity. Moreover, we elucidate differences in perceived information quality related to employees' positions in the organizational hierarchy. More specifically, information is perceived to be of higher quality when it is shared by employees with a higher rank. Such differences in information quality perceptions might also

exist in terms of data originating from sources outside the organizational boundaries. Novel insights into information quality are especially valuable considering that the increasing access to large amounts of data from a variety of sources can pose threats to the level of information quality (Abraham et al., 2019; Clarke, 2016). As such, the *quality* of information, rather than the quantity, is increasingly becoming a key concern for organizations, which is also evident by calls in the literature to examine the role of information quality in organizational information processing (e.g., Hazen et al., 2014).

Second, while digital transformation offers opportunities for organizations to improve their level of information quality (e.g., Côrte-Real et al., 2020; Janssen et al., 2020; Taleb et al., 2021), we show that the information quality *status quo* of pre-digital organizations can give rise to additional complications by causing uncertainty and increased information processing requirements. Indeed, having access to high-quality information can be an implicit driver for digital transformation, yet generating access to such information requires, in the first place, the successful implementation of digital technologies. Prior studies have established that poor information quality can hamper the effective execution of processes (e.g., Gharib et al., 2018), and we confirm this in the context of digital transformation. As illustrated in our case, such endeavors might be less effective when organizations primarily focus on technology, neglecting solutions and activities focused on governing information quality. The extant literature on digital transformation, however, largely neglects the importance of information quality and data governance. Our findings demonstrate that if organizations want to fully harness the possibilities that digital technologies can offer for information quality improvement and aim to increase their chances of successfully navigating digital transformation, they need to strategically address information quality.

Third, we provide concrete insights into how organizations can successfully navigate their digital transformation by designing and implementing an information quality strategy. While organizations are becoming increasingly aware of the importance of information quality (Madnick et al., 2009), prescriptions as to how they can strategically address information quality-related issues are scarce in the literature (e.g., Petter et al., 2013). We, therefore, contribute to the extant digital transformation research agenda by establishing that organizations can set the scope for digital transformation by designing and implementing an information quality strategy consisting of targeted initiatives. Considering that, in practice, resistance to change is a major barrier to the success of digital transformation (e.g., Fitzgerald et al., 2014; Vial, 2019), we show that such an information quality strategy can immediately assist employees in understanding the digital transformation efforts of the organization, thereby

reducing uncertainty and leading to increased employee satisfaction as well as their decreased resistance to change in digital transformation-related initiatives. By focusing on both information quality governance as well as the underlying technology, organizations can ensure that the potential of information quality improvements, as enabled by digital technologies, can be indeed harnessed.

Implications for Practice

In this study, we explore the role of information quality during digital transformation of pre-digital organizations. As organizations are increasingly relying on data and information from a variety of sources, ensuring a high level of information quality becomes a significant challenge that requires pre-digital organizations to understand information quality-related issues, assess their information quality *status quo*, and strategically approach information quality to remain relevant in the digital age. Our findings demonstrate that digital transformation can be driven by the implicit need to improve the level of information quality, which in turn can improve organizational information processing. Simultaneously, however, the information quality *status quo* of pre-digital organizations might hamper the effective execution of digital transformation. As such, our findings offer novel insights and valuable recommendations for practitioners who need to successfully navigate digital transformation and avoid pitfalls. More specifically, we illustrate that digital transformation challenges can be attributed to a lack of a clear vision, inertia, uncertainty, and resistance to change, while such barriers can be linked to a poor level of information quality, since information about the digital transformation endeavor can, for instance, be hard to access or understand, or might not be updated regularly. Such issues might primarily exist in the context of pre-digital organizations that do not have any digital technologies in place and have limited understanding of and experience with the implementation of such technologies. To improve the level of information quality through the adoption of digital technologies, however, there is a need to design and implement targeted information quality interventions that include both technological and governance solutions.

Such interventions should be part of a broader information quality strategy incorporating both digital technologies as well as information quality governance solutions. The latter should not be overlooked, as pre-digital organizations, such as AirTrans in our case, might focus solely on digital technologies and their potential, but information quality governance solutions can ensure that these can be exploited. Hence, practitioners should be aware that a sole focus on technology will not yield the desired results, as our findings show. To design and implement an information quality strategy, organizations must be aware of their

information quality *status quo* and identify information quality issues and their causes. As we show, the development of a tailored information quality assessment framework can yield important insights into what information quality issues are experienced, what causes them, and what consequences they have. Such a tailored approach is necessary, as unique organizational characteristics can influence the level of information quality and, thus, the appropriate solutions. While organizations are becoming increasingly aware of the value of information quality, we urge practitioners to pay more attention to the level of information quality in their organizations. Our findings indicate that poor information quality has direct implications for organizations (e.g., budget loss), and increases the requirements for processing information. Considering the importance of fit between information processing requirements and capacity for organizational effectiveness, an imbalance can have adverse effects on operations.

Consequently, practitioners can choose to focus on reducing information processing requirements, enhancing information processing capacity, or both, to address the higher level of information processing requirements caused by poor information quality. Digital technologies offer opportunities for both enhancing information processing capacity as well as reducing information processing requirements through their impact on information quality, making digital transformation especially relevant. As most digital transformation endeavors fail in practice, organizations must become aware of how they can successfully navigate them. Our findings indicate that an information quality strategy can help pre-digital organizations to set the scope for digital transformation, thereby enhancing the chances of digital transformation success. A detailed information quality strategy that addresses the information quality issues identified through both technological and information quality governance solutions leads to an improved level of information quality, reduced information processing requirements, and enhanced information processing capacity.

Additionally, our study provides rich insights regarding the engagement of an external team of researchers in an organization during digital transformation. Together with the top management of AirTrans, we reflected on the added value of the canonical action research approach and the engagement of the research team, and we identified the strengths of our approach for all phases of the research project. During the diagnostic phase, the independence of the researchers helped to generate a thorough and detailed understanding of the *status quo*. Whereas managers are often consumed by work and cannot always find the time to communicate with many stakeholders, the researchers were able to interview employees from various levels of the organization. Especially the military context of our case allowed the employees from throughout the organization to speak freely without fear of potentially adverse

consequences. Considering that most digital transformation endeavors are perceived as failures (De la Boutetière et al., 2018) and resistance is a key cause (e.g., Vial, 2019), such open conversations with employees can facilitate a more thorough understanding of why prior initiatives had failed, and why external involvement might indeed be beneficial for pre-digital organizations (Siachou et al., 2021).

Besides that, the top management of AirTrans indicated that it was hard for them to understand theories that might have been useful, whereas the research team was able to i) use instrumental theories to thoroughly understand the situation at AirTrans, and ii) apply a focal theory that guided action planning and intervention. While also generating scholarly knowledge and contributing to theory, the involvement of an external research team can bring valuable knowledge to the organization through the application of theoretical insights. Such a systematic approach can further induce confidence in the findings and the strategy for improvement amongst stakeholders, thereby reducing resistance to digital transformation in the organization.

Limitations and Future Research Directions

Although we followed a structured and thorough research design, as indicated by the canonical action research approach, some limitations need to be acknowledged that concurrently can present avenues for future research on the topic. The first limitation of our study naturally emerges from its research context. While AirTrans is a pre-digital organization, it represents a unique organizational setting of significant operational complexity, and our findings might relate to factors that influence the level of information quality primarily in the broader context of military organizations. Our study portrays factors that can influence the level of subjective information quality, namely employees' background, tenure, organizational culture, and hierarchy. We uncover, for instance, that information originating from higher levels of the focal organization is perceived to be of higher quality than information originating from lower in the hierarchy. To this end, we encourage future research endeavors on the topic to focus on other organizational settings, for confirming our findings, as well as for identifying other factors that could have an impact on the level of subjective information quality. Differences in information quality perceptions might be more prevalent, for instance, when data comes from a wide variety of different sources and could have significant implications in settings such as inter-organizational data exchange (Nicolaou & McKnight, 2006).

We also encourage future research to further examine how such differences can affect aspects of organizational performance, such as decision-making. Besides that, in organizations where the command-and-control hierarchy is less prevalent, it might be necessary to seek a

consensus regarding the depth and breadth of the incorporated information quality dimensions, which can also motivate future studies. Navigating digital transformation and dealing with information quality-related issues, however, can give rise to challenges for any organization, and our approach to assessing and addressing the level of information quality can be applied in settings beyond military or pre-digital organizations. The idiosyncratic nature of AirTrans, therefore, does not hinder the generalizability of our findings, and we encourage future research to further explore the topic within both non-profit as well as for-profit organizations to further confirm as well as expand the findings of our study.

Other limitations related to our approach should be acknowledged as well. Action research is often, even if inaccurately, criticized for its lack of rigor and repeatability (e.g., Avison, Davison, & Malaurent, 2018). Following Davison et al. (2012), we have paid attention to the application of theories to guide our intervention, and we extensively documented all the steps of our process, which can enable other researchers and organizations to replicate it. Moreover, whilst we demonstrate how dimensions other than information quantity or richness affect organizational information processing, we do so within an arguably short timeframe, which might be considered a limitation. Relatedly, given that the digital transformation of AirTrans is ongoing, additional implications and insights might be unearthed through further canonical action research cycles. The use of a single canonical action research cycle, thus, represents another limitation. A long-term project has, however, already been agreed upon with the top management of AirTrans to further assess the influence of information quality strategy on digital transformation and organizational information processing, and we, thus, suggest that future research could also examine this relationship further in a different context.

Considering that organizations aim to gain access to increasing amounts of data that often have an unstructured nature (Clarke, 2016), we believe that future research should re-examine the different information quality dimensions, and whether potential trade-offs between different information quality dimensions exist in light of new digital technologies and techniques. Our focus on pre-digital organizations that have no experience with using digital technologies has led us to mainly use widely known information quality dimensions while asking open questions to the interviewees about any other dimensions they may deem important. We believe, however, that new information quality dimensions might emerge, or existing dimensions might change in light of digital technologies. Our examination does not include an exploration of such new dimensions and, therefore, we encourage future research to re-evaluate the existing information quality dimensions. Relatedly, future research can further examine how data governance should be set up in organizations that are already more mature

in their digital transformation. Moreover, different digital technologies might have different implications for information processing requirements and capacity, which could be further explored in future studies. In general, our study unearths information quality-related insights for organizational operations and, more specifically, digital transformation endeavors, and we see merit in this being further pursued by IS scholars in future studies.

6. Conclusion

Organizations increasingly engage in digital transformation to gain access to increasing amounts of data from various sources, posing threats to ensuring a high level of information quality. Especially pre-digital organizations face difficulties in navigating digital transformation due to their limited experience with, and knowledge of digital technologies. We explore the critical, yet limitedly examined role of information quality for organizational information processing and delineate how the design and implementation of an information quality strategy can support pre-digital organizations in navigating their digital transformation. We conduct canonical action research at a military organization and elucidate how poor information quality increases information processing requirements, thereby serving simultaneously as an implicit driver as well as a barrier to the successful navigation of digital transformation. We further develop and implement an information quality strategy that focuses on both technology as well as information quality governance, aiming to enhance the fit between information processing requirements and capacity. Our findings delineate that such an information quality strategy can support pre-digital organizations in successfully navigating their digital transformation. Our work is timely and topical for both IS research and practice and delineates opportunities for future research.

CHAPTER 4

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VALUE DISTRIBUTION IN PLATFORM ECOSYSTEMS: EXPLORING THE PROBLEM OF VALUE SLIPPAGE

1. Introduction

Platform ecosystems offer a setting in which complementors can develop, promote, and distribute their offerings (Jacobides et al., 2018). Such ecosystems rely heavily on network effects, in which the involved interconnected actors would not be able to capture any value without the participation of others. Hence, to increase the total value of an ecosystem, platform owners need to continuously incentivize complementors to remain engaged with the ecosystem. Consequently, a key premise in the platform ecosystem literature is that the longevity of such an ecosystem depends on the distribution of value in such a way that makes it worthwhile for all interdependent actors to participate (e.g., Cusumano, Gawer, & Yoffie, 2019; Parker, Van Alstyne, & Jiang, 2017).

Understanding how complementors can be incentivized has, thus, become a core governance assignment for platform owners. Value distribution is typically skewed in favor of the platform owner (Gawer, 2022) and, in most cases, held equal for all complementors - regardless of their input and output on the platform (Oh, Koh, & Raghunathan, 2015). What constitutes appropriate value capture, however, is different for each ecosystem actor (Hein et al., 2020), making it vital for platform owners to be able to predict and understand the reaction of each complementor to their value distribution mechanisms. However, the existing literature on platform governance has predominantly focused on the platform owners (Ceccagnoli, Forman, Huang, & Wu, 2012; R. Kapoor & Agarwal, 2017; Rietveld & Schilling, 2021), largely overlooking the responses of complementors to value distribution mechanisms (K. Kapoor et al., 2021; Rietveld & Schilling, 2021). Recent studies have started empirically examining value distribution mechanisms (e.g., Bhargava, 2022; Bhargava, Wang, & Zhang, 2022), but this line of research has yet to explore the heterogeneity in the reactions of complementors to the value distribution mechanisms of platform ecosystems (Rietveld & Schilling, 2021).

Such insights are timely and topical, as complementors seem to increasingly challenge platform owners with regard to their value distribution mechanisms. For example, Epic Games filed a lawsuit against Apple in August 2020, objecting to the 30% commission that Apple charges complementors for distributing games (e.g., Fortnite) on its platform. Such challenging behavior is usually extremely costly for both the complementor and platform owner, where the latter also faces the risk of a contagion effect in which more complementors might start reacting similarly. For instance, a collective of smaller complementors has started a class-action lawsuit against the platform owner. Hence, treating the responses of complementors to value distribution mechanisms as homogenous, as is predominantly done in the literature, does not

accurately reflect contemporary industry practices and overlooks complex challenges in platform ecosystems.

One particular challenge in the value distribution of a platform ecosystem that may dissuade certain complementors from remaining engaged with the platform is *value slippage,* which occurs when a portion of the value created by a focal actor is captured by another at the cost of the focal actor (Lepak et al. 2007). As value creation is largely distributed amongst all ecosystem actors, while value capture is mainly centralized around the platform owner (Gawer, 2022), value slippage is likely to occur in platform ecosystems and, therefore, it offers a useful theoretical lens to explain the heterogeneity in the responses of complementors to value distribution. Hence, building upon the concept of value slippage, we theorize why different complementors may experience different levels of value slippage despite operating under given value distribution mechanisms of a platform, and, consequently, how they respond to such mechanisms. We, therefore, address the following research question: *How and why do complementors exhibit heterogeneous responses to value distribution mechanisms in platform ecosystems?*

In doing so, we bring forward a theoretical model, which extends the literature on platform governance (e.g., Chen et al., 2022; Cutolo & Kenney, 2021; John & Ross, 2021; Kretschmer et al., 2020; Rietveld, Ploog, & Nieborg, 2020; Rietveld & Schilling, 2021), and provides sorely needed insights into how and why the value distribution mechanisms of a platform may elicit different responses from different complementors. In particular, our model explains why larger complementors may be subject to a higher risk of value slippage and, contrary to current industry practices and theoretical insights, suggests that platform owners may benefit from the adoption of value distribution mechanisms that cater to such complementors. In practice, however, platform owners are inclined to subsidize smaller complementors, for which larger complementors may actually pay the price (Bhargava et al., 2022). As we propose, such an approach may be harmful to the platform owner and the ecosystem. The insights from our theory development can provide fruitful implications for our understanding of how platform owners can better design value distribution mechanisms that mitigate adverse responses from complementors.

The rest of our paper is structured as follows. We first provide a general overview of the literature on value distribution in platform ecosystems, followed by an exploration of why value slippage may especially pose a problem in such a setting. In the penultimate section, we present our theoretical model and the associated propositions, while we conclude the paper with a discussion of the theoretical and practical intuitions of our work.

2. Value Distribution in Platform Ecosystems

Platform ecosystems comprise sets of actors that transact and interact with each other through a (digital) platform that provides the core on which complementors can further develop, promote, and distribute their own offerings to a mutual set of end users (Adner, 2017; Cennamo & Santaló, 2019; Gawer & Cusumano, 2014; McIntyre & Srinivasan, 2017). Hence, platforms create value for end users by facilitating interactions and transactions amongst dispersed actors that provide complementary, and ideally highly innovative, services and products (e.g., Ghazawneh & Henfridsson, 2013; Jacobides et al., 2018). Similar to markets, actors in platform ecosystems are autonomous in the sense that they do not operate under the formal control of the platform owner (Gulati et al., 2012). Concurrently, however, platform owners can exercise significant control over the rules of the platform, including architectural and governance decisions such as access control and pricing mechanisms, allocating rewards and resources, as well as information provision (Tiwana, Konsynski, & Bush, 2010).

In this regard, the platform owner's decisions can influence the actions of complementors and, as such, has some authority over ecosystem actors, while the level and means of authority are less formal than in traditional organizational settings (Gulati et al., 2012). Consequently, management and strategy scholars increasingly approach platform ecosystems as meta-organizations as an alternative to "firm-versus-market" (Chen et al., 2022, p.148). Gulati et al. (2012, p.573) define meta-organizations as comprising *"networks of firms or individuals not bound by authority based on employment relationships but characterized by a system-level goal"*. A meta-organizational lens stresses the connections between multiple autonomous actors that are not bound by contracts as extensive as employment ones nor as limited as spot market contracts, yet they work towards a system-level goal (Gawer, 2014; Gulati et al., 2012). Taking such a perspective, the relationships of platform owners and complementors are central to the functioning of the ecosystem (Chen et al., 2022).

In general, the more complementors a platform attracts, the more attractive the platform gets (De Reuver, Sørensen, & Basole, 2018; Helfat & Raubitschek, 2018; F. Zhu & Iansiti, 2012), meaning that complementors' likelihood of capturing value from engaging with a platform depends, to some extent, on the engagement of other complementors—even those with which they compete (Gawer & Cusumano, 2002; Rietveld, Schilling, & Bellavitis, 2019). The total value of a gaming platform, for instance, increases when a larger variety of games from various developers is available (Cenamor, Usero, & Fernández, 2013). Hence, the source of value creation does not depend just on the organization (Lepak et al., 2007) but rather on the

interdependencies between various ecosystem actors that, without each other, would not be creating the same value, if any value at all (e.g., Pagani, 2013; Schreieck, Wiesche, & Krcmar, 2021).

Value creation in platform ecosystems is a much more open and complex process that involves multiple actors. For instance, the SAP Cloud Platform was established to create generativity by exploiting the innovations of complementors, who could offer their software-as-a-service solutions efficiently to all users in the ecosystem (Schreieck et al., 2021). The platform allows complementors to create and offer their solutions to SAP users without significant sales investments while allowing SAP to benefit from the innovative capabilities of third parties. Hence, exchanges in platform ecosystems occur and create value because no single actor in isolation possesses all the necessary resources but need other actors for complementary goods and services (e.g., Frow, Nenonen, Payne, & Storbacka, 2015).

Such interdependencies for value creation, as well as the role of the platform owner, also have implications for value capture. Contrary to value creation, however, value capture in platform ecosystems has received less attention (Hein et al., 2020), which is a limitation as value creation only manifests itself when it is captured by at least some actor (Pitelis, 2009). Especially in the context of platform ecosystems, value capture is inherently more complex due to cooperation and competition tensions, as well as the distribution of value by the platform owner (Adner, 2017). Similar to alliance settings, we define value capture as an actor's ability to extract individual benefits and appropriate relational rents through engaging with the platform (Lavie, 2007). Contrary to value creation, where cooperation and complementarity are key, value capture involves some degree of competition between actors that try to extract individual benefits that make engaging with the platform worthwhile.

However, as Gawer (2022, p.113) states: *"[w]ith platforms, value creation is distributed but value capture is centralized"* due to the central role that platform owners have in the distribution of value. As self-interested actors, platform owners try to design platform governance in such a way that allows them to capture as much value as possible, often at the expense of the overall value creation process and the value captured by complementors (e.g., Cusumano et al., 2019; Parker et al., 2017). Platform owners can capture value, for instance, by using commission rates for transactions and interactions, as well as through advertisements. Yet, as suggested in prior studies, too much value capture by the platform owner may de-incentivize complementors to engage with the platform, potentially harming the platform and, thus, the platform owner's potential for value capture in the long term (e.g., John & Ross, 2021). A balanced distribution of value amongst ecosystem actors is, thus, key to sustained value

creation in platform ecosystems.

In general, the distribution of value is a complex puzzle in which platform owners need to balance value creation and capture of different ecosystem actors. Platform owners need not only secure their own revenue streams by directly capturing a significant share of value created through the platform but also need to ensure that complementors are rewarded fairly for their contributions to the created value. As such, they need to carefully design and implement governance mechanisms around the distribution of value in the platform (e.g., Rietveld et al., 2019). Platform owners need to signal that complementors can profit from engaging with the platform (Miric, Boudreau, & Jeppesen, 2019) and continue to facilitate appropriate value capture for each actor, once value has been created, to ensure that complementors remain engaged with the platform and keep innovating (Nambisan & Sawhney, 2011; West & Wood, 2014).

Given that the value of a platform ecosystem is largely dependent on network effects, platform owners need to make significant investments in the early stages of a platform to attract both complementors and users. Consequently, they often act against their own interests in the short term (Rietveld et al., 2020). Nevertheless, for a healthy platform ecosystem, platform owners need to capture a sufficient share of value to sustain the platform and, thus, often switch to capturing a large proportion of the created value at a later stage, thereby reducing the share of value that complementors may capture (e.g., Jacobides et al., 2018; Rietveld & Schilling, 2021). Increasing the value captured by the platform owner, however, may discourage complementors from keeping engaged with the platform.

Hence, platform owners need to strive for a balance between value creation and capture for all ecosystem actors (e.g., Chen et al., 2022). Platform owners can decide how to share value, for instance, by adopting a non-linear revenue distribution structure (Bhargava et al., 2022). Although being extensively criticized, revenue sharing mechanisms are often held constant for all complementors regardless of their contributions to the ecosystem to avoid costly negotiations (Oh et al., 2015; Shiller & Waldfogel, 2013), which increasingly leads complementors to challenge platform owners' value distribution mechanisms (Oh et al., 2015; Rietveld et al., 2020). What constitutes appropriate value capture is, however, different for each ecosystem actor (Hein et al., 2020), making it difficult for platform owners to predict and understand complementors' reactions to value distribution.

Supported by the anecdotal evidence in mainstream news outlets and academic literature, the appropriate distribution of value is perceived to be key for the health and well-functioning of platform ecosystems (Franke, Keinz, & Klausberger, 2013; Huber, Kude, &

Dibbern, 2017; Van Alstyne, Parker, & Choudary, 2016; J. Zhang & Liang, 2011), yet it remains unclear why ecosystems actors may respond differently to the same value distribution mechanisms. Specifically, while understanding complementors' responses is crucial for platform success (Boudreau & Jeppesen, 2015; K. Kapoor et al., 2021), the platform ecosystem literature has been predominantly focused on platform owners (Ceccagnoli et al., 2012; R. Kapoor & Agarwal, 2017; Rietveld & Schilling, 2021). Similarly, the literature has paid significant attention to how governance decisions of platform owners can lead to beneficial outcomes for them and the ecosystem, largely overlooking complementors' reactions to ineffective governance mechanisms (K. Kapoor et al., 2021; Rietveld & Schilling, 2021).

In sum, while acknowledging the importance of value distribution for sustained platform ecosystem success, it remains unclear how and why value distribution in platform ecosystems can lead to adverse complementor responses. Gaining insights into this can support platform owners in devising appropriate governance mechanisms for value distribution, ensuring the sustained success of the platform. Below, we introduce the concept of value slippage to explain how and why value distribution may lead to adverse behavior.

3. The Problem of Value Slippage

To explain complementors' responses to value distribution, we draw on the concept of value slippage as introduced by Lepak et al. (2007). In their seminal paper on value creation and capture, they coin the concept to explain the process in which value that is created by one source is (partially) captured by another source, endangering the continuation of the value creation efforts by the focal source. In the context of platform ecosystems, where a delicate balance between value creation and capture for the various ecosystem actors is key to the well-functioning of the ecosystem (e.g., Chen et al., 2022), we suggest that value slippage can be useful in elucidating how and why value distribution can lead to adverse responses of complementors. In what follows, we introduce the concept of value slippage and explain its application in the context of platform ecosystems.

Value slippage occurs when the value created by an actor is not fully captured by that same actor but slips partially to other actors (Lepak et al., 2007). With the multitude of actors that cooperate and compete with each other, as well as the significant governance control of the platform owner, value slippage is likely to occur in platform ecosystems. The monetary amount exchanged for an offering is, thus, usually not fully captured by the complementor providing the complement. Naturally, as the platform offers access to resources, knowledge, and a larger

potential user base (Helfat & Raubitschek, 2018; McIntyre & Srinivasan, 2017), complementors can expect a degree of value slippage by engaging with the platform.

Value slippage, however, can become significantly problematic as it may discourage complementors from contributing to value creation given that they do not reap the full benefits of their offerings (Lepak et al., 2007). Value slippage can be experienced by complementors in two ways, namely i) the complementor captures a share of value that is insufficient to continue engagement with the platform (costs outweigh benefits) or ii) the complementor captures a share of value that is sufficient to continue their engagement with the platform yet perceived as unfair compared to the share of value captured by other ecosystem actors. When value slips to other ecosystem actors, complementors may perceive this as unfair and react accordingly (Oskam, Bossink, & de Man, 2021).

Value slippage can largely be attributed to the governance decisions of platform owners. In traditional buyer-supplier relationships, actors can influence value slippage through competitive and isolating mechanisms related to knowledge, physical, or legal barriers that can prevent replication of offerings (Lepak et al., 2007). In platform ecosystems, however, such mechanisms are largely influenced by platform owners and their value distribution mechanisms. As complementors have much less control over the distribution of value in an ecosystem and, therefore, fewer opportunities to influence value slippage directly, they might resolve in taking corrective action to safeguard their interests, such as fighting the platform owner or switching to another platform. Hence, given the reliance of platform ecosystems' success on complementors (e.g., Boudreau, 2012), as well as the autonomy of complementors to make decisions about their positions, offerings, and behavior (e.g., Gulati et al., 2012), value slippage becomes a key governance consideration for platform owners.

In sum, we argue that value slippage provides a possible explanation for how and why value distribution may lead to adverse responses of complementors to value distribution mechanisms. The essence of achieving a balance between value creation and capture in platform ecosystems is, thus, inherently linked to managing the degree of value slippage within the ecosystem. To substantiate this, we develop a framework that addresses the antecedents and consequences of value slippage in platform ecosystems.

4. A Framework for the Problem of Value Slippage in Platform Ecosystems

We illustrate our theoretical model of value slippage in platform ecosystems in **Figure 7**. In the following sections, we propose why and how value slippage may occur in a platform ecosystem,

as well as how this, in turn, shapes complementors' responses. We argue that the risk of value slippage is affected by the value distribution mechanisms that a platform owner adopts but is moderated by the business model of a complement. The degree of value slippage, in turn, affects complementors' responses to value distribution, where we distinguish two responses to a platform's value distribution, namely conforming or challenging. We posit that a 'conforming' response contributes to joint value creation (e.g., Bridoux & Stoelhorst, 2016), while a 'challenging' one may jeopardize the continuity of the platform. By 'challenging', we refer to responses such as fighting the value distribution by, for instance, lawsuits or leaving the platform. We further propose that the relationship between value slippage and complementor responses is moderated by the alternatives that a complementor has for offering its complement. Taking this model into account, platform owners could redesign their governance accordingly to avoid or mitigate adverse complementor responses to value distribution.

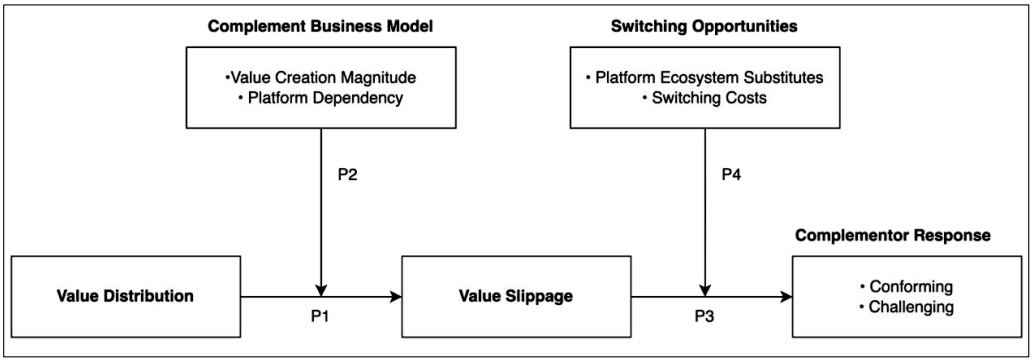

Figure 7 *- Model of Value Slippage in Platform Ecosystems*

Our model is based on a set of assumptions and boundary conditions. First, following our discussions above, as well as the relevant literature, we treat value creation and capture as distinct processes (Lepak et al., 2007). We assume that actors can capture the value that is distributed in the ecosystem, and value capture is, thus, implicitly part of our theoretical framework. We do, however, take value creation through a given complement into account (proposition 2a). Second, we focus on platforms that are organized as meta-organizations (e.g., Gulati et al., 2012) and, thus, assume that a platform owner acts as an orchestrator and largely determines the rules of the game. That is, we assume that there is at least some form of value distribution on the platform. Third, we focus on the risk of value slippage in a single platform rather than the totality of a complementor's offerings over a number of different platforms. We

do consider, however, how a complementor's ability to engage with different platforms (or alternative sales channels) may affect their response to value slippage.

Value Distribution

We first zoom in on the relationship between value distribution and value slippage. We focus specifically on revenue structures that platform owners adopt in the form of transaction fees and subscription fees[11]. For instance, in mobile application platforms, complementors retain full control over their applications and sales prices, while for every transaction, the platform owner charges a transaction fee to the complementor (Avinadav, Chernonog, Meilijson, & Perlman, 2022). Management and IS scholars have started examining revenue structures in the context of platform ecosystems, relying mostly on formal models to explore the potential consequences of different revenue structures for platform owners and complementors (e.g., Bhargava et al., 2022; Oh et al., 2015; Panico & Cennamo, 2022).

Such research is useful and necessary, as revenue structures significantly determine the value that each platform ecosystem actor is able to capture. That is, some revenue structures may favor certain actors at the expense of others. John and Ross (2021), for instance, elucidate that specific value capture strategies may be optimal for the platform owner to capture a larger share of value but can become harmful to value creation in the ecosystem. Platform owners may be more inclined to switch to such aggressive value capture strategies for themselves once the platform matures (Rietveld et al., 2020; Rietveld & Schilling, 2021).

Focusing on the distribution of revenue across different complementors, Bhargava et al. (2022) highlight that subsidizing smaller complementors may potentially lead to a win situation for all actors but is, in most cases, beneficial to the platform owner, often resulting in a situation where the subsidy for smaller complementors is provided by larger ones instead of the platform owner. While in theory, most platforms would opt for a constant revenue structure across all complementors (Oh et al., 2015), in practice, some are seen to consider other revenue structures. Both Google and Apple, for instance, recently adopted revenue structures that benefit smaller complementors[12].

While the literature around such revenue structures is still in its infancy, the consensus is that higher value capture by the platform owner generally leads to a reduction in the value

[11] Platform owners may also implement other value distribution mechanisms. We, however, focus specifically on transaction and subscription fees, as it involves a direct transaction between the platform owner and the complementor and thus allows us to theorize about the implications for value slippage. We therefore call for future research to explore other value distribution mechanisms and their implications for value slippage.

[12] https://www.apple.com/uk/newsroom/2020/11/apple-announces-app-store-small-business-program/

captured by a complementor, and *vice versa* (Panico & Cennamo, 2022). We can take the Google Play Store as an example, where paid apps have to pay, on average, 15-30% service fees to the platform owner. Hence, part of the value that could be captured by a complementor slips to the platform owner. The platform owner can incorporate other mechanisms to increase their share of the value captured, such as the exclusive use of their own in-app payment application[13].

As a basic premise, ecosystem actors need resources to innovate and ensure high-quality offerings. The less value actors can capture from their offerings, the less resources are available to them for subsequent innovation. Hence, when platform owners capture larger shares of value at the expense of complementors, the latter have less resources and incentives to invest in research and development, potentially leading to a less attractive offering that further reduces their ability to capture value in the long term. In such cases, value that could be captured by a complementor slips over to the platform owner, which leads us to the following proposition:

Proposition 1: The more the value distribution of a platform favors the platform owner, the higher the risk of value slippage.

Complement Business Model

While the value distribution mechanisms that a platform owner adopts can directly influence the risk of value slippage, we argue that the business model of a complement moderates this relationship. Here, a complement refers to one specific offering of the focal complementor on the platform. For instance, Match Group provides multiple applications via the Apple App Store and Google Play Store, including Tinder and Hinge[14]. Tinder and Hinge, thus, represent two different complements of the focal complementor. Given that different complements may adhere to different business models as well as perform differently, complements of a focal complementor may become subject to different levels of value slippage.

By focusing on a single complement rather than a complementor, we can disentangle the effects of different business models and performance outcomes on the relationship between value distribution and the risk of value slippage. This also means that while complementors may be subject to the exact same value distribution mechanisms in a given platform, they can still be subject to different degrees of value slippage. For instance, two complementors may be paying the same subscription fee of $99 per year as well as paying 15-30% for each transaction

[13] Match Group/Google lawsuit, 2022
[14] https://www.forbes.com/companies/match-group/

in the Apple App Store[15], yet the degree of value slippage experienced on the platform may be different for both complementors. Similarly, different platforms may adopt the same revenue structure, while the value slippage of a complement may be higher in one than the other. To explain this, we look at the business model of complements and specifically focus on the dependency of the business model on the focal platform, and the value creation magnitude of a given complement. We elaborate on the former first.

There are a variety of ways in which a complement can be offered to users in terms of a specific business model[16]. In some cases, complementors can decide the business model, while in other, restrictions may apply[17]. Examples of different complement business models include one-time purchases, in-app purchases, freemium models, and advertising. Studies increasingly explore the implications of the various business models in terms of complement performance. In general, there seems to be a consensus that advertising and freemium business models result in a lower willingness amongst users to pay, having consequences for the revenue generated by such complements (Ghose & Han, 2014; Rietveld, 2018). Tidhar and Eisenhardt (2020) provide a compelling framework of different high-performing business model configurations and highlight the complexities and core activities associated with advertising (third party)[18], paid, and freemium business models. In terms of revenue generation and performance, complementors, thus, need to carefully consider how to offer their complements.

While the aforementioned line of research provides insights into the consequences of the various complement business models, scant attention has been paid to their platform dependency. We argue that such a dependency represents a key factor in value slippage that may explain why different complementors respond differently to a platform's value distribution mechanisms. Take, for instance, Snapchat[19] and Tinder[20], that both operate on the Apple (and Google) platform. The business model of Snapchat relies heavily on advertisements (third-party) and, therefore, avoids a charge on transactions to Apple. Tinder, on the other hand, builds

[15] https://developer.apple.com/support/compare-memberships/
[16] We explicitly refer to a complement's rather than a complementor's business model here. Given that we explore value slippage on a focal platform (rather than all platforms that a complementor may engage with), our focus is on a specific complement offered on the focal platform. Naturally, value slippage may occur for all complements that a complementor offers via the focal platform. A complementor's business model in general, however, is much broader in scope, and may include multihoming or alternative sales channels.
[17] We acknowledge that complementors do not have the autonomy to decide how to generate revenue in all platforms. In such cases, the platform owner controls the business model of a complement. Nevertheless, our argumentation still applies to such situations.
[18] We refer to advertising business models where complementors directly capture the value created (Tidhar & Eisenhardt, 2020). In the cases where advertising is charged by the platform owner, the effects would be similar to complements that are charged a transaction fee by the platform owner (Bhargava, 2021).
[19] https://www.investopedia.com/articles/investing/061915/how-snapchat-makes-money.asp
[20] https://fourweekmba.com/how-does-tinder-make-money/

on a freemium business model, where users are encouraged to upgrade their membership level or pay for additional in-app services. For such transactions, Tinder pays a transaction fee to Apple and, as such, is much more dependent on the value distribution mechanisms of the platform. Consequently, a higher degree of value created by Tinder slips to the platform owner than is the case for Snapchat. Hence, each of these business models results in different degrees of dependency on the platform in terms of value capture. We, therefore, propose the following:

Proposition 2a: The more dependent the business model of a complement is on the platform, the stronger is the relationship between value distribution and the risk of value slippage.

Although prior research has explored the relationship between complement business models and complement performance (e.g., Ghose & Han, 2014; Rietveld, 2018), a given business model need not determine whether a complement is successful and, thus, creates value. If no value is created (i.e., if no transactions occur), value cannot slip to other actors. Hence, we need to further consider the value created by a given complement. There are a variety of factors that influence the success of a complement, including its quality (e.g., Cennamo, 2018), specialization (e.g., Tavalaei & Cennamo, 2021), the installed user base of the platform (e.g., Boudreau & Jeppesen, 2015), and timing (Rietveld & Eggers, 2018).

Given that the large majority of platforms charge transaction fees as a percentage of the total transaction cost (i.e., the price charged to the user) (e.g., Bhargava et al., 2022) or a fixed price per transaction, the higher the number of transactions, the more value slips to the platform owner. We refer to the number of transactions a complement generates as *value creation magnitude.* In other words, the more transactions a complement generates, the larger the value creation magnitude of that complement. Hence, while a higher value creation magnitude of a given complement, naturally, implies a larger share of value capture for the complementor, it simultaneously increases the risk of value slippage in favor of the platform owner.

Moreover, complements that are successful tend to face higher threats of platform owner entry (e.g., Jiang, Jerath, & Srinivasan, 2011), potentially enabling platform owners can capture even more value from the specific niche market (F. Zhu & Liu, 2018)[21]. In such cases, platform

[21] The literature reports mixed findings regarding the influence of platform owner competition on complementors (entry and performance) (e.g., Cennamo, Ozalp, & Kretschmer, 2018; Edelman & Lai, 2016; Wen & Zhu, 2019; F. Zhu & Liu, 2018). These results are, however, primarily short-term focused and provide limited insights in long-term consequences (F. Zhu, 2019). Thus, while platform owner entry may benefit the value capture possibilities of certain complementors on the short-term by increasing overall user demand, the long-term effects remain largely unexplored (e.g., Foerderer, Kude, Mithas, & Heinzl, 2018; Z. Li & Agarwal, 2017). Our

owners often have a stronger competitive position as they can better understand the technological requirements which may allow them to produce higher-quality complements, they have more resources to and control over promotion on their own platform, and they also have access to more granular information about user demands and requirements (e.g., F. Zhu & Liu, 2018). When complementors perceive just a threat, they are inclined to shift their focus to short-term profitability by increasing complement prices (Wen & Zhu, 2019), having implications for the demand of the complement and the value they are can capture in the long term (Ghose & Han, 2014). In sum, complements with a higher value creation magnitude need to share a significant amount of value with the platform owner, while simultaneously being exposed to higher risks of platform owner entry, which leads us to propose the following:

Proposition 2b: The higher the value creation magnitude of a complement, the stronger is the relationship between value distribution and the risk of value slippage.

Such a proposition can be perceived as counterintuitive, as one could argue that the larger the share of value a complementor captures, the less likely it is to challenge the value distribution of the platform. As we show below, however, in such instances value slippage can become a problem, and may encourage complementors to challenge the platform owner.

Value Slippage

Following the discussion on factors that influence the risk of value slippage, we proceed to understanding the potential consequences of value slippage in terms of complementors' responses. In other words, we now turn to the problem of value slippage in platform ecosystems. While complementors expect some degree of value slippage, we argue that the extent to which they experience such slippage can influence their response to the value distribution mechanisms of the platform. While, as discussed earlier, value slippage[22] has received minimal attention in the broader management literature to date, we draw on a number of studies on value slippage in other contexts to explore the effects of value slippage on complementors (e.g., Bacq & Aguilera, 2022; Lepak et al., 2007; Oskam et al., 2021) as well as the broader literature on

argumentation here hinges on the ability of complementors to compete with a platform owner given the available resources and control each actor has, where the platform owner in virtually all cases can take the upper hand (e.g., Zhu & Liu, 2018). Moreover, even if complementors decide to enter a new product niche, similar success as in the previous product niche is never guaranteed (Cennamo et al., 2018).

[22] Value slippage is different from value spillover, which refers to "*a phenomenon in which one party benefits from the actions of another party without incurring significant costs*" (Han et al., 2012, p.4). In such instances, it need not be the case that one party benefits from the actions of another at the expense of the first.

platform ecosystems (e.g., Cenamor, 2021; Rietveld & Eggers, 2018). In general[23], value slippage refers to a *negative* event for the focal actor, as they lose a part of the value that they have created and could have otherwise capture. Value slippage, thus, can discourage (e.g., insufficient incentives) or disable (e.g., insufficient resources) the focal actor from contributing to (joint) value creation on the platform, as the costs might outweigh the benefits, or because the value slippage is perceived as unfair (Lascaux, 2019; Oskam et al., 2021).

To prevent value slippage, actors develop both competitive and isolating mechanisms (Lepak et al., 2007), representing physical, legal, resource, or knowledge barriers with the aim of avoiding imitation and reducing competition (e.g., Barney, 1991; Newbert, 2008). While such mechanisms can be effective in more traditional buyer-supplier settings, they may be more difficult to obtain for complementors and potentially prove to be less effective in platform ecosystems due to the limited control of complementors over the value distribution mechanism. Hence, while they can influence competition, for instance, by choosing when and what product niches to enter (e.g., Cenamor, 2021; Rietveld & Eggers, 2018), the amount of value captured by the platform owner largely remains a governance decision by the platform owner itself.

Consequently, we distinguish two types of complementor responses to value slippage, namely conforming with or challenging the given value distribution mechanism. The latter may take various forms, such as leaving the platform or fighting the platform owner by initiating lawsuits, trying to find ways to bypass the value distribution mechanisms, or (temporarily) boycott a platform. Responses that challenge the value distribution mechanisms of a platform may be costly for both the platform owner and the complementor. To illustrate the potential costs related to a challenging response, we can look at the example of Epic Games (the developer of the popular game Fortnite Battle Royale) and Google Play Store[24].

Epic Games disagreed with the value distribution of Google Play Store and decided to move away from the platform and instead offer their complement independently. Although exact numbers are not available, it can be estimated that such a response leads Google to miss out on millions of dollars in transaction fees, and Epic Games to miss out on a number of users as downloading their game would require more effort and not be subject to Google's security

[23] The study of Bacq & Aguilera (2022) represents an exception in the sense that value slippage is approached as both a negative and positive phenomenon. The authors argue that actors may intentionally let value slip to other actors to reach a higher-level goal, such as societal grand challenges. Similar argumentation could apply in the context of platform ecosystems, where, on the short term, actors might act against their own interests. In the early stages of a platform, platform owners might allocate a larger share of value to complementors (e.g., Rietveld et al., 2020) and/or complementors accept a larger share of value slippage to build a long-term relationship. Nevertheless, on the long term, value slippage provides little incentive for actors to continue with value-creating activities (Lepak et al., 2007).

[24] Fortnite Battle Royale is no longer available via Google Play Store.

protocols[25]. Moreover, such a response could induce a 'contagion effect' where more complementors may feel encouraged to undertake similar action[26]. Hence, challenging the value distribution of a platform may be harmful to the ecosystem as a whole on the long term.

In sum, we argue that lower levels of value slippage predispose complementors to conform to the value distribution mechanisms of a platform, while higher level of value slippage are more likely to lead to a challenging response from complementors. According to our theorizing in the previous sections, complementors with more successful complements are likely to experience higher levels of value slippage and, thus, may be more inclined to challenge the value distribution mechanisms of a platform. Concurrently, given their success, such complementors may have substantive resources allowing them to undertake actions against the platform owner. In sum, we propose that the degree of value slippage influences complementors' responses to the value distribution mechanisms of a platform and, thus, can explain why complementors may react differently to the same value distribution mechanisms.

Proposition 3: The higher (lower) the value slippage, the more likely a complementor's response is to challenge (conform to) the value distribution of a platform.

Platform Ecosystem Substitutes

While we have so far argued that the degree of value slippage can directly affect a complementor's response to the value distribution mechanisms of a platform, there are instances in which it does not make sense for the complementor to challenge value distribution. To further explore such instances, we turn our attention to substitute platforms and alternative distribution channels. Distribution channels refer to any alternative means through which a complementor can provide offerings to potential users, which could range from a physical rather than digital offering, such as a physical book instead of an e-book on Amazon Kindle (R. D. Wang & Miller, 2020), to an alternative platform, such as Apple Music instead of Spotify, or the development of an independent distribution channel such as the download website of Epic Games. In explaining how platform substitutes moderate the relationship between value slippage and complementors' responses, we look at the number of platform ecosystem substitutes, and the involved switching costs. We elaborate on the former first.

A platform ecosystem substitute represents an alternative option for a complementor to

[25]https://techcrunch.com/2018/08/10/google-will-lose-50-million-or-more-from-fortnite-bypassing-the-play-store/

[26] https://www.theverge.com/2021/8/6/22612921/google-epic-antitrust-case-court-filings-unsealed

provide its offering. In general, the higher the number of platform substitutes, the larger the autonomy of a complementor in deciding whether or not to leave the focal platform. Due to network effects, however, often only a few dominant platforms survive, leading to a "winner-takes-most or -all" situation, narrowing complementors' choice of available substitutes (e.g., F. Zhu & Iansiti, 2012; F. Zhu & Liu, 2018). The asymmetrical distribution of power and control between platform owners and complementors, along with such a "winner-takes-most or -all" situation further increases platform owners' ability to capture a larger share of value and shift the terms of engagement in their favor (Cutolo & Kenney, 2021). Moreover, even if platform substitutes exist, platform owners may design governance mechanisms that prevent complementors from distributing their offering via other channels, for instance by developing exclusive agreements with complementors in return for more favorable conditions (e.g., Eisenmann et al., 2009). Application developers that offer their complements only via the Apple platform, for instance, are more likely to be featured by the platform owner (Tavalaei & Cennamo, 2021).

In general, a complementor's bargaining power increases with the number of substitute platforms available (e.g., R. D. Wang & Miller, 2020), reducing the risk of lock-in by focal platform owners (e.g., Chen et al., 2022; Tavalaei & Cennamo, 2021) and leading to increased incentives to challenge the value distribution mechanisms of the platform for reducing value slippage. Similarly, the less platform substitutes are available, the more a complementor is dependent on the focal platform ecosystem, decreasing their ability to negotiate value distribution with the platform owner (Malherbe & Tellier, 2022). Hence, when there are no or limited substitute platforms, a complementor is more likely to conform to the value distribution of the platform. Given the argumentation that we provided, we propose the following:

Proposition 4a: The more (less) platform substitutes are available, the higher the likelihood a complementor's response to value slippage is to challenge (conform to) value distribution.

While a higher number of platform substitutes increases the available options that a complementor has and enhances their bargaining power, there may be significant switching costs involved that discourage complementors from challenging value distribution. The technological architecture as well as governance mechanisms of platform substitutes may differ significantly (Cennamo & Santaló, 2019; Claussen, Kretschmer, & Mayrhofer, 2013), requiring a complementor to gain knowledge about the platform and, in some cases, make adjustments to their offerings. As Jacobides et al. (2018) explain, there are certain investments related to

participating in a given platform ecosystem that are not fully fungible, meaning that *"the investment, or asset in place, cannot be easily redeployed elsewhere without cost"* (p.2265)[27]. Such costs may, for instance, be related to incompatible technological requirements that require adjustments (e.g., Cennamo et al., 2018; R. Kapoor & Agarwal, 2017). Moreover, the degree of autonomy that complementors have relative to the business models of their complements may differ per platform, sometimes requiring them to make complements available at a lower price.

Hence, along with the number of available platform substitutes, the possible switching costs can determine the extent to which a complementor is dependent on a specific platform (Cennamo et al., 2018; Jacobides et al., 2018). Consequently, platform owners have an incentive to increase the switching costs to ensure complementors' dependence on their platform. For instance, specific boundary resources offered by platform owners may increase complementors' efficiency while simultaneously increasing complementors' switching costs by reducing redeployment possibilities (Karhu & Ritala, 2021; Leong, Pan, Leidner, & Huang, 2019). Consequently, we propose that lower switching costs can incentivize complementors to challenge the value distribution mechanisms of a given platform.

Proposition 4b: The lower (higher) the switching costs, the higher (lower) the risk that a complementor's response to value slippage is to challenge the value distribution of a platform.

5. Discussion

Intrigued by the variety of complementor responses to the value distribution mechanisms of platforms, we set out to answer how and why value distribution leads to different complementor responses in platform ecosystems. In answering this question, our research contributes to the literature on platform governance (e.g., Chen et al., 2022; Cutolo & Kenney, 2021; John & Ross, 2021; Kretschmer et al., 2020; Rietveld et al., 2020; Rietveld & Schilling, 2021), with a particular focus on complementors whom, in the extant literature, have received scant attention (e.g., Jacobides et al., 2018; R. Kapoor & Agarwal, 2017; McIntyre & Srinivasan, 2017). Insights into complementor decision-making and behavior are especially scarce (Boudreau & Jeppesen, 2015), which can be problematic, as complementors are vital for platform ecosystem

[27] For a full discussion of how different complements may lead to different switching costs, see Jacobides et al. (2018).

success (e.g., Parker et al., 2017). Platform owners, as orchestrators of the platform ecosystem, need to devise and implement appropriate governance mechanisms to ensure that complementors remain incentivized to contribute to value co-creation in the ecosystem without acting opportunistically (Chen et al., 2022).

One of the key challenges of platform governance concerns the distribution of value in the ecosystem. Inappropriate distribution of value may be harmful to the platform if complementors start fighting the platform owner or leave the ecosystem (Cusumano, Gawer, & Yoffie, 2019; Dhanaraj & Parkhe, 2006; G. Parker, Van Alstyne, & Jiang, 2016). However, much remains to be explored regarding the distribution of value and its implications for platform ecosystem actors (Rietveld & Schilling, 2021). We contribute to this line of research by further exploring how and why complementors may respond differently to value distribution mechanisms, considering their heterogeneity in terms of complement business models, as well as their possible response strategies to value distribution mechanisms.

To explain this, we draw on the concept of value slippage, which occurs when the value created by an actor slips partially to other actors (Lepak et al., 2007). Due to the interdependencies between actors in terms of value co-creation, some degree of value slippage is inherently part of platform ecosystems. On the long term, however, we theorize that value slippage may discourage actors from actively participating in the platform, either because they do not have sufficient resources, or they feel they are treated unfairly. As such, we argue that complementors' responses to value distribution are shaped by the degree of perceived value slippage. Thus, the balance between value creation and capture that is considered a key challenge for platform owners (e.g., Chen et al., 2022; Jacobides et al., 2018; Kretschmer et al., 2020), may be more usefully expressed as a challenge of managing value slippage.

Our theorization on the problem of value slippage in platform ecosystems offers three key novel insights. First, our study describes factors that influence the risk of value slippage for complementors. In line with previous studies (e.g., Jacobides et al., 2018; Rietveld & Schilling, 2021), we posit that the more value is captured by the platform owner, the lower the share of value that complementors can capture and *vice versa.* In other words, value slippage is influenced by the value distribution mechanisms of a platform. Contrary to treating all complementors equally, however, we contribute to this line of research by further elucidating the role of the business model of complements by focusing on the dependency on the platform and the value creation magnitude. In particular, we show how complements with certain business models as well as complements that perform better are subject to a higher risk of value slippage. In doing so, we extend recent research on value distribution in platform ecosystems

by further considering complementors' heterogeneity (e.g., Bhargava, 2022; Bhargava et al., 2022; John & Ross, 2021).

Second, we explain how and why different complementors may react differently to value distribution mechanisms by elucidating the relationship between value slippage and complementors' responses. In general, higher levels of value slippage can predispose complementors to challenge the value distribution mechanisms of the platform, which can be extremely costly for both the platform owner as well as the complementors. We go beyond the relationship between value slippage and complementors' responses by describing the moderating role of platform ecosystem substitutes. More specifically, we explain the role of the number of substitutes as well as the involved switching costs (Jacobides et al., 2018). While prior studies have raised awareness regarding the potential consequences of inappropriate value distribution in platform ecosystems in terms of the possible responses of complementors (Cusumano et al., 2019; Dhanaraj & Parkhe, 2006; Parker et al., 2017), it remains unclear to date how and why such responses differ and come into being.

Third, our study suggests that more successful complementors are likely to experience higher levels of value slippage and, in general, thus can be more inclined to challenge the value distribution mechanisms of the platform. Given the success of their complements, such complementors may simultaneously have sufficient resources to fight the platform owner (Cennamo et al., 2018). While value distribution, thus, seems to be especially crucial for larger and more successful complementors, platform owners increasingly adopt value distribution mechanisms that benefit smaller complementors. As we mentioned earlier, for instance, both Google and Apple have adopted revenue structures that favor smaller complementors. Our theory, however, suggest that such a strategy may eventually be harmful to the platform owner, as more successful complements may experience additional value slippage. As demonstrated by Bhargava et al. (2022), such revenue structures may in theory benefit all ecosystem actors, but are more likely to benefit the platform owner and smaller complementors, while more successful complements end up paying for the subsidies. Hence, increased levels of value slippage may encourage larger complementors to challenge the platform owner. We strongly encourage future research to further explore differential revenue schemes, and more specifically, the (long-term) consequences in terms of complementor behavior. Moreover, empirical research could explore what levels of value slippage may represent a turnover point in terms of complementor responses to value distribution.

While our theory serves as a foundational framework for the problem of value slippage in platform ecosystems, there might be factors beyond those included in our model that may

affect the risk of value slippage and complementor responses. For future research, we suggest exploring the effects of other value distribution mechanisms beyond revenue structures. Scholars can, for instance, differentiate between *explicit* value distribution mechanisms and *implicit* value distribution mechanisms. Explicit value distribution mechanisms directly influence the allocation of value, such as in the case of revenue structures, while implicit value distribution mechanisms provide complementors with *indirect* opportunities to capture value. Examples of implicit value distribution include complementor promotion and featuring (e.g., Rietveld, Seamans, & Meggiorin, 2021) and, therefore, is concerned with access to opportunities rather than output. For instance, platform owners tend to feature complements that do not perform best in their product niche (M. H. Lee, Han, Park, & Oh, 2022; Rietveld et al., 2019). In general, implicit value distribution mechanisms may affect value slippage by increasing the exposure to a specific subset of complements, thereby potentially steering users away from the focal complement to the featured one.

Future research could explore what specific strategies complementors may adopt to counteract value slippage. While we have distinguished between conforming and challenging responses, there may be other options for complementors. For instance, complementors may favor to be acquired by the platform owner (Staub, Haki, Aier, Winter, & Magan, 2021; Wen & Zhu, 2019). Moreover, contrary to more traditional buyer-supplier relationships, complementors have fewer opportunities to create isolating mechanisms for limiting value slippage due to their asymmetrical distribution of power with the platform owner (Cutolo & Kenney, 2021; Lepak et al., 2007). Empirical research could examine what such mechanisms may look like in the context of platform ecosystems.

Moreover, while we portray value slippage as a key challenge to platform governance, positive effects may be associated with certain degrees of value *spillover*. While value slippage indicates instances in which other actors capture part of the value created by a focal actor at the cost of that focal actor, spillover is concerned with instances in which other actors capture part of the value created by the focal actor at the advantage of that focal actor. Value spillover effects can, for instance, include expansion of market reach and increased visibility of complements. Future research could generate new insights by drawing on both value slippage and spillover literature. For instance, the literature on platform owner entry shows mixed results in terms of positive and negative effects on complementors and their responses (e.g., Chi et al., 2022). While spillover effects have received considerable attention in the platform ecosystems as well as the broader management literature (e.g., M. H. Lee et al., 2022), value slippage—that looks at the negative effects of value spilling to other actors—merits further attention. As our study

was driven by observations of adverse complementor responses to value distribution, we specifically focused on value slippage to bring forward sorely needed insights. Nevertheless, we see merit in combining these two streams of literature to further explore a possible spectrum of value slippage and spillover.

Besides that, although we do not make assumptions about fairness, complementors' responses to value distribution mechanisms may be catalyzed by such perceptions. For example, although we argue that a smaller number of substitute platforms weakens the relationship between value slippage and challenging responses, the 'monopolistic' position of a platform may invoke perceptions of unfairness. Future research could draw on fairness theories, and perhaps especially distributive fairness, to further explore the problem of value slippage (Gilliland, 1993). Finally, future research could expand the focus on other ecosystem actors, such as end users, to provide a well-rounded understanding of platform challenges from the perspective of all ecosystem actors.

Implications for Platform Governance

Our theory also has implications for the governance of platform ecosystems. Our study confirms that managing value slippage and ensuring that all ecosystem actors get an appropriate share of the value created is a key challenge for platform owners (Dattée, Alexy, & Autio, 2018). Although platform owners increasingly experiment with revenue structures that favor specific subsets of complementors, such initiatives usually revolve around a lower commission fee for smaller complementors. Nevertheless, as we argue, such revenue structures may be harmful to the ecosystem on the long term, as larger complementors often pay the price (Bhargava et al., 2022) and are more likely to challenge the platform owner.

Such challenging responses from complementors are increasingly reported in the mainstream media. Platform owners facing increasing pressures from complementors that challenge the value distribution mechanisms and, in some cases, are required to make significant changes, such as offering options to completely bypass the value distribution mechanisms of platforms[28]. In the long term, such forced actions may significantly reduce the value captured by the platform owner, who may not be able to profit sufficiently to keep improving and innovating the platform, ending up detrimental for the ecosystem as a whole. Hence, managing the degree of value slippage to avoid challenging responses from complementors becomes a vital governance capability for platform owners.

[28] https://9to5mac.com/2022/07/22/netflix-external-subscription-ios/

As our framework suggests, limiting the number of alternative options for complementors, for instance by prohibiting multihoming (i.e., allowing complementors to distribute their offerings via multiple channels) or by increasing complementors' switching costs, may reduce the likelihood of challenging responses to value slippage. Nevertheless, studies indicate that all ecosystem actors may be worse off when multihoming is prohibited (Belleflamme & Peitz, 2019). Consequently, we argue that on the long term, the optimal strategy for platform owners is to manage the degree of value slippage by reassessing their value distribution mechanisms rather than aiming to influence complementors' options.

6. Conclusion

Complementors increasingly challenge the value distribution mechanisms adopted by platform owners. We explore why and how complementors may respond differently to value distribution mechanisms by drawing on the concept of value slippage. We propose that value distribution mechanisms can influence the risk of value slippage, and that this relationship is moderator by the business model of a given complement. In general, higher degrees of value slippage can invoke non-conforming responses from complementors. This effect is moderated by the extent to which platform substitutes are available. Hence, we argue that a governance challenge for platform owners concerns the management of value slippage in the ecosystem. Our theory offers implications for platform owners to manage the level of value slippage to avoid potentially costly responses of complementors to value distribution, as well as implications for complementors as to how they may influence the level of value slippage. In doing so, we extend the literature on platform ecosystems by offering a novel perspective.

CHAPTER 5

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CONNECTING THE CHAPTERS: DISCUSSION AND CONCLUSION

1. IT Governance Challenges in the Digital Era

Organizations in all industries are continuously exposed to digital technologies and their effects through their employees, consumers, suppliers, and competitors. Such technologies rapidly change the demands of stakeholders due to their widespread consumerization (Harris et al., 2012) and provide opportunities to bring together a wide variety of actors (e.g., Hanisch et al., 2023). To harness the opportunities that such technologies bring forward, such as reaching a broader audience and making better use of the available wealth of data, organizations must reconsider their IT governance mechanisms to realize alignment IT and business alignment in the digital era and encourage desirable behavior of all stakeholders (Brown & Grant, 2005).

My doctoral dissertation focuses on three key IT governance challenges in the digital era and provides insights into how organizations can deal with them. Each one of the three essays of my dissertation (i.e., Chapters 2, 3, and 4) explores a distinct IT governance challenge. In this chapter, I first provide a summary of the findings of each essay and point out a number of overarching observations based on a synthesis of the findings. Afterward, I reflect on the research context and bring together the findings of each essay to delineate overarching theoretical and practical implications, as well as an agenda for future research on the topic.

In the first essay, I explore the implications of the widespread consumerization of digital technologies. Building on prior studies (e.g., Tumbas et al., 2018), I examine cultural changes that are brought forward by workers in their role as IT consumers. To look beyond the intentional and conscious strategic adoption of digital technologies enforced by managers, I have adopted the morphogenetic approach as an exploratory lens that distinguishes structure from culture and agency. The findings from the study at AirTrans show that a cultural transformation, during which workers start to experiment with digital technologies, precedes a structural transformation, during which managers implement and mobilize resources for such technologies. While such concealed experimentation with digital technologies can bring forwards flexible and innovative solutions, it also bears security risks that need to be carefully considered. Hence, traditional top-down IT governance, where IT is imposed on workers, is much less effective when workers have easy access to digital technologies. Based on these insights, I provide recommendations for organizations to set up IT governance mechanisms that allow for digital innovation on the level of workers while ensuring that such innovation is approached appropriately and scaled up in a desirable manner on the level of managers.

In doing so, organizations must attend to the quality of information, as I show in the second essay. Access to large amounts of unstructured data that are available in the digital era

presents risks in ensuring high quality information, which can in turn hamper the effective implementation of digital technologies. Pre-digital organizations that lack sophisticated IS and experience with data governance may be especially subjected to lower levels of IQ, hampering their ability to engage in digital transformation. Drawing on organizational information processing theory, I highlight the implications of quality—rather than quantity—of information, for the fit between information processing requirements and capacity. Together with AirTrans, an information quality strategy was designed and implemented, consisting of both technological and data governance solutions. Such an information quality strategy can assist organizations in navigating digital transformation and improving their operations.

Apart from access to increasing amounts of data, digital technologies allow for bringing together a wide variety of actors, as illustrated for instance by the rise in digital platforms developed by incumbent organizations as well as startups. In such settings, actors are likely to be connected by non-traditional buyer-supplier relationships. Besides governing data, therefore, organizations should also pay renewed attention to how they govern stakeholder relationships. In addressing this challenge, the third essay explores how organizations can govern the multitude of digital platform complementors to ensure that they remain incentivized to engage with the platform. In doing so, I focused on an underexplored, yet crucial, governance challenge for platform owners, namely the distribution of value in the ecosystem. More specifically, I attempted to better understand why complementors may respond differently to value distribution mechanisms. By drawing on the concept of value slippage (Lepak et al., 2007), the extant platform ecosystem literature (e.g., Chen et al., 2022; Kretschmer et al., 2020), as well as observations from practice, I brought forward a framework for exploring the challenge of value slippage in platform ecosystems.

In sum, my doctoral dissertation elucidates three key IT governance challenges that organizations face in the digital era and provides recommendations on how to deal with such challenges. As showcased by the findings of the three main essays, organizations may benefit from the use of digital technologies on the level of workers, ensuring that their implementation incorporates a strategic approach to information quality, and attends to the heterogeneity of relationships. While each of the essays provide novel insights, a number of additional observations stand out through the synthesis of the findings from the three essays.

The three essays stress the importance of adequately incentivizing actors by making available the necessary resources to materialize innovation. Such resources may range from more funds to more accurate information. Both essay one (Chapter 2) and essay three (Chapter 4) highlight the need for actors with power to allocate sufficient monetary resources to

materialize innovation. In the context of AirTrans, workers need funds to scale up their innovative ideas, while in the context of digital platform ecosystems, complementors need sufficient monetary resources to sustain engaged with the platform and be encouraged to develop innovative complements. Insufficient monetary resource allocation may inhibit the ability of an organization to innovate and remain relevant in the digital era. Similarly, in essay two (Chapter 3) I showcase that high-quality information can make stakeholders aware of the vision and direction of the organization and enable them to appreciate where and how they can contribute. Relatedly, in the context of platform ecosystems, providing complementors access to data and information can stimulate them in developing high-quality and attractive complements (Rietveld et al., 2019).

Moreover, IT governance in the digital era is largely becoming a "balancing act" in different domains between a variety of stakeholders. Essay one (Chapter 2) highlights a need to balance autonomy and control. While innovation is more likely to be achieved when giving workers autonomy and allowing them to experiment with digital technologies, control is necessary to ensure that no security risks exist. Hence, decision-makers need to ensure a combination of flexibility and control. Essay two (Chapter 3) highlights a need to balance information processing requirements and capacity and ensuring an alignment between the quantity and quality of data and information. Finally, essay three (Chapter 4) posits that platform owners need to manage value slippage in the ecosystem, as a means to balance collective value creation and individual value capture among all actors. All these balancing acts can ensure that stakeholders, such as workers and complementors, exhibit desirable behavior. For instance, workers may support transformational change initiatives, while complementors may conform to the governance mechanisms of the platform owner.

Overall, digital technologies bring forward opportunities as well as challenges for organizations and their operations, through direct adoption by the organization or their use by consumers, employees, and other stakeholders. Pre-digital organizations may need to tackle governance challenges associated with the adoption and implementation of digital technologies first (essay one and two), while digital native organizations may need to be much more concerned with governing the variety of interconnected actors (essay three). As such, encouraging *"desirable behavior in the use of IT"* (Weill, 2004, p.3) in the digital age goes beyond intra-organizational IT decision-making. The reconceptualization of IT governance in the digital era, therefore, must not solely look at IT decisions within the focal organization, but rather consider the variety of affordances of various stakeholder groups related to the use of digital technologies.

2. Reflection on Meta-Organizations

While the IT governance challenges addressed in my doctoral dissertation can be faced by all kinds of organizations, the research context of meta-organizations in which I explore them brings forward additional observations and insights. Having taken a critical realist stance in essay one (Chapter 2), drawing on the work of Archer (1995), I posit that the context might shape but does not determine the unfolding of phenomena. Hence, in this section, I reflect on the context of my research to outline contingencies and limits of the theorizing presented in the essays of this doctoral dissertation (Avgerou, 2019). Such additional observations related to the research context are considerably impactful, as meta-organizations are becoming an increasingly attractive organizational design in the digital era. In doing so, I mainly compare meta-organizations with more traditional organizational designs, including a hierarchical structure based on formal control and authority mechanisms. Meta-organizations are particularly characterized by the absence of such formal contracts and, as a result, their power and control structures are based on access to resources (e.g., Dahlander et al., 2016; G. K. Lee & Cole, 2003). The characteristics of meta-organizations shape how the three governance challenges may unfold.

In terms of IT consumerization, addressed in essay one (Chapter 2), the involvement of a variety of actors with different backgrounds, interests, and bargaining power are important contextual factors that can shape how individual experiences with digital technologies might cascade through the organization. Given the heterogeneous nature of the involved actors, experiences with digital technologies might differ significantly in meta-organizations, bringing forward an opportunity for recombination that may lead to high innovativeness. Nevertheless, as meta-organization actors are autonomous, they may have difficulties in understanding the central interests of the meta-organization *versus* their own interests, potentially holding back from sharing ideas or limited needs to push the organization forward, thereby leading to a slower unfolding of digital transformation (Findeisen & Sydow, 2016).

Relatedly, as shown in essay two (Chapter 3) the heterogeneous nature of meta-organization actors may more rapidly lead to the emergence of information silos. Based on my research at AirTrans, there are several explanations that can explain this. First, the employees of AirTrans were more inclined to discuss ideas and share information with employees from the same nation of origin with whom they identify. Second, the heterogenous backgrounds of actors lead to a variety of ways in which data and information are managed. Relatedly, control mechanisms are hard to effectively implement, as, for instance, a higher-ranked official from

nation A does not have the official autonomy to correct a lower-level employee from nation B, making it hard to break through such heterogeneous practices. Meta-organizations may also be subject to higher levels of employee turnover, due to their being contractually employed by their own organizations (i.e., the organization that is a member of the meta-organization). In the case of AirTrans, for instance, the employees who serve at the meta-organization stay on average for three years before returning to their own organizations.

Finally, incentivization in meta-organizations may be significantly more complex and challenging than in other economic relationships. Specifically, the incentives of actors to engage in a meta-organization vary from reaching synergies (Thorelli, 1986) to becoming better equipped for handling complexity (Valente & Oliver, 2018). This means that actors with less resources, for instance, are likely to benefit more from the meta-organization, while others need to be incentivized more extensively. As illustrated in essay three (Chapter 4), this may result in different behavior from meta-organization actors. While, in most cases, meta-organizations aim to make decisions based on consensus amongst actors (Ahrne & Brunsson, 2008; Bor, 2014), oftentimes this does not apply to platform ecosystems with a single powerful actor.

This points to another observation related to the context of meta-organizations. While approaching platform ecosystems as meta-organizations is useful—particularly for examining governance challenges related to digital technologies—the "traditional" meta-organization literature and platform ecosystems literature do not fully draw on the same conceptual toolkit. For instance, the platform ecosystem literature draws heavily on the idea of meta-organizations as a hybrid organizational design that combines organizational and market mechanisms (Kretschmer et al., 2020). Examples of meta-organizations from the traditional literature stream, however, such as military units and associations (e.g., Berkowitz & Bor, 2018), do not portray such characteristics. Consequently, going forward, there is merit for management and IS scholars to draw upon the lack of formal control mechanisms, as well as the system-level goals (Gulati et al., 2012) as the key characteristics of meta-organizations that can apply to both platform ecosystems as well as more traditional meta-organizations.

3. Theoretical Implications

The theoretical implications of the three essays are provided in their respective chapters and are summarized in **Table 7**. In this section, I provide the overarching theoretical implications of my doctoral dissertation, extending the literature on IT governance in the digital era in general (e.g., Aubert & Rivard, 2020; DeLone et al., 2018; Gregory et al., 2018; Kellogg, 2022; Vaia

et al., 2022), and more specifically in the context of meta-organizations (e.g., Berkowitz & Dumez, 2016; Brunsson, Berkowitz, & Bor, 2019; Chen et al., 2022; Kretschmer et al., 2020).

***Table 7** - Overview of Theoretical and Practical Implications per Essay*

Chapter	Key theoretical implications	Key practical implications
2	We bring forward a theory on the unfolding of digital transformation, elucidating the role of workers as IT consumers. In light of our findings, scholars should approach digital transformation as an ongoing and emergent process that unfolds over time and, in doing so, pay particular attention to cultural changes. In fact, based on our findings, cultural change is at the epicenter of digital transformation. Two generative mechanisms may explain the unfolding of digital transformation over time, namely a concealed experimentation and a resource mobilization mechanism.	Organizational decision-makers should allow for experimentation of lower-level employees, yet simultaneously be aware of risks associated with the use of personal digital technologies. Organizations, therefore, may benefit from organized events that encourage innovation and experimentation of employees. digital transformation may further be prematurely considered as failed or stagnated, while in reality, experimentation may be happening in pockets of the organization.
3	Organizational information processing is not only affected by the quantity of information but also by its quality. The increasing amounts of available information, make the considerations of information quality increasingly critical. Hence, we extend traditional organizational information processing theory by including information quality as a key concept.	We elucidate how organizations may assess their information quality *status quo* as a starting point for navigating digital transformation. Moreover, we recommend a focus on both technology and governance for practitioners to fully harness the possibilities that digital technologies can offer for organizations.
4	We develop a framework of value slippage in platform ecosystems to explain how and why complementors may respond differently to value distribution mechanisms. Future research should pay further attention to the heterogeneity of complementors and their behavior, which is vital for a well-functioning platform ecosystem. Moreover, the balance between value creation and capture in platform ecosystems may be more usefully expressed as managing value slippage.	Platform owners should pay significant attention to the distribution of value amongst ecosystem actors, while being aware of complementors' heterogeneity. Our framework suggests that platform owners should be careful when adopting governance mechanisms that favor smaller complementors, as larger complementors may be more likely to challenge the value distribution mechanisms of the platform.

Given the pervasiveness of digital technologies, *"it stands to reason that a traditional understanding of IT governance might not adequately reflect the realities of a digital world"* (DeLone et al., 2018, p.206). New theoretical insights are, thus, needed to make sense of IT governance in the digital era (Díaz Andrade et al., 2023). Drawing on three key characteristics of digital technologies, namely their widespread consumerization, increasing importance of data and information, and interconnectedness of a variety of autonomous actors, the three essays of my doctoral dissertation collectively contribute to reconceptualizing IT governance in the digital era.

In line with Vaia et al. (2022), my essays bring forward the importance of "disciplined autonomy", referring to a balance between autonomy and control. I go beyond existing theoretical insights (Gregory et al., 2018) and elucidate that workers, through the

consumerization of digital technologies, start concealed experimentation in pockets of the organization even without the consent of managers. Such experimentation represents a cultural transformation that precedes a structural transformation in which managers start to mobilize resources and redesign the way they govern such experimentation throughout the organization. In exploring how such structural transformation emerges and can be navigated, my doctoral dissertation also advances the current understanding of IT governance during digital transformation (DeLone et al., 2018).

Actors with power, such as managers and platform owners, need to ensure that besides autonomy, adequate resources are provided. By examining and theorizing how a lack of such resources may affect actors, my doctoral dissertation extends the recent research agenda on incentives as a key governance element (e.g., Chen et al., 2022), particularly by looking beyond powerful actors such as managers and platform owners and rather focusing on workers and complementors (e.g., Xue, Ray, & Zhao, 2017). For instance, ensuring that funds are provided so that experiments scale up is an important element in moving from cultural to structural transformation, while allocating created value between actors encourages contributing behavior. Moreover, importantly, I show that not only the quantity but rather the quality of information is important to encourage desirable behavior, as a lot of information does not need to entail that such information is accurate or actionable. Rather, having access to increased amounts of information makes ensuring its high quality a significant challenge (Clarke, 2016).

In light of my essays, traditional assumptions that have prevailed in the extant literature, such as IT governance being the responsibility of top managers, top-down decision-making, strict control, and the reliance on formal mechanisms only (e.g., Van Grembergen et al., 2004; Weill & Ross, 2004) no longer hold in the digital era. For instance, in settings such as platform ecosystems that are enabled by digital technologies, formal control is much harder to be achieved due to the autonomy of the involved actors. Similarly, decisions about what kind of digital technology to use and how to use it becomes a shared responsibility of workers and managers alike, rather than a top management one. Top-down decision-making might result in adverse behavior, such as resistance to change. Digital technologies provide actors with freedom in deciding how to work. For instance, workers have more employment opportunities as spatial boundaries dissolve, while complementors have the freedom in deciding what platform to use. In that sense, encouraging desirable behavior is more vital than ever. IT governance in the digital era is, thus, much less about determining and allocating decision rights (Weill, 2004) and much more about recognizing and facilitating the autonomy of actors that are empowered by digital technologies (Brenner et al., 2014; Lyytinen & Yoo, 2002).

Given that digital technologies are widely available, the IT governance challenges I present in my doctoral dissertation apply to a wide variety of organizations in different industries. Nevertheless, by exploring them in the context of meta-organizations, my doctoral dissertation brings forward additional theoretical contributions. First, I respond to calls in the literature to further explore the interactions of meta-organizational actors and their behavior (Berkowitz & Dumez, 2016). Despite the importance of contributing actors for the success of meta-organizations, only scarce insights are available in the literature (e.g., Boudreau & Jeppesen, 2015; Parker et al., 2017). The three main essays contribute to this literature by exploring the role of both employees and complementors. For instance, the third essay (Chapter 4) explores how the governance mechanisms of meta-organizations may result in different outcomes for different actors, depending on their characteristics and dependence on the meta-organization. The more dispersed the set of autonomous actors involved in the meta-organization, the more challenging it becomes to manage their diverse incentives and behavior.

I also elucidate how meta-organizations may realize organization-wide digital transformation. Prior research has mainly reported on the difficulties that meta-organizations face with regard to realizing change. Ahrne and Brunsson (2005), for instance, explain how organizational change in meta-organizations may be hampered by weak central authority, slow decision-making based on compromising, and high turnover. I argue that such explanations may no longer hold in the digital era. As digital technologies largely shift control to end users (Brenner et al., 2014; Lyytinen & Yoo, 2002), workers as IT consumers can generate a cultural transformation based on their experiences with such technologies. In such instances, the variety of backgrounds, knowledge, and experiences of employees may actually be beneficial for the speed with which the digital transformation unfolds. Moreover, the absence of a strong formal authority may result in a quicker organization-wide adaptation to novel ideas related to the use of digital technologies.

The essays, however, also point to several challenges that meta-organizations may face. Given the potential identification of employees with both the meta-organization and their own organization (Ahrne & Brunsson, 2012), employees with similar backgrounds may be inclined to flock. This can increase the likelihood of information silos that may reduce the innovative recombination of employees' diversity in backgrounds, as well as having implications for the level of information quality. Moreover, the relatively high turnover rates of meta-organizations have implications for information quality and can threaten experimentation and innovation. As such, my dissertation extends research on the potential costs and benefits of the design (Gulati et al., 2012), as well as transformation of meta-organizations (Ahrne & Brunsson, 2005).

4. Practical Implications

Along with the theoretical implications, each essay in isolation provides an overview of the practical implications, of which a short summary per essay is also provided in **Table 7**. In what follows, I will lay out practical implications for practice based on the collective findings from my essays. Organizations can use these insights to analyze their *status quo*, transform their IT governance, and ultimately address the challenges of the digital era.

Compared to more traditional views of IT governance, incentivizing organizational actors is becoming increasingly important in the digital era. Organizations face complexities in encouraging desirable IT behavior, as digital technologies provide flexibility and control to end users that are hard to monitor and control. The phenomenon of shadow IT, where workers use IT solutions not formally approved by the organization, illustrates this (Silic & Back, 2014; Silic, Barlow, & Back, 2017). Given that workers as IT consumers use digital technologies for a wide variety of purposes in their daily lives, they may be more likely to come up with innovative ideas to apply such technologies in the organization. When spotting opportunities to make work more efficient and effective, workers can bypass organizational procedures and policies and make use of their private technologies or use organizational technologies in different ways than intended for. Naturally, such behavior may bear significant security risks such as data leaks.

In addressing this, organizations need to rethink their IT governance mechanisms to ensure that workers feel discouraged to enact such practices. Based on the insights from the essays, I provide a number of recommendations for how organizations may do so. It is imperative that managers acknowledge and be attentive to digital innovation ideas of workers. Workers can generate a cultural transformation that, when allocating sufficient attention and resources, can lead to a structural transformation and improved organizational performance. In doing so, managers should provide clear and up-to-date information about undertaken initiatives and their desired positive effects. Both essay one (Chapter 2) and two (Chapter 3) indicate that when workers are taken seriously by managers, they are more inclined to stick with organizational procedures and policies.

While this may reduce the risk of adverse behavior, organizations need to also put in place governance mechanisms for controlling workers' experimentation with digital technologies. In this way, workers can still be engaged in digital innovation and share their ideas with managers, without facing significant security risks. Setting up cross-functional teams, creating BYOD policies, and organizing collective brainstorming and innovation events

allow for both flexibility and authority in experimentation. Concurrently, such governance mechanisms break through information silos that hamper effective execution of organizational processes. In such cases, information and knowledge remains largely localized, increasing heterogeneity in managing information and using IT. Information silos have a negative effect on the level of information quality, and can represent a barrier in organization-wide adoption of digital technologies and related policies. Hence, organizations need to leverage and bring together the experiences, ideas, and knowledge of workers from a variety of positions and roles.

Although the aforementioned suggestions may be especially relevant in intra-organizational settings, appropriate incentivization is equally important in inter-organizational contexts, such as platform ecosystems. In such contexts, the platform owner needs to devise governance mechanisms that encourage ecosystem actors, including complementors and users, to behave in a desirable manner. In this doctoral dissertation, I have focused mainly on the behavior of complementors, whose contributions are vital for the performance of the platform (e.g., Ghazawneh & Henfridsson, 2013; Jacobides et al., 2018). Similar to workers, if incentivized insufficiently, complementors may exhibit adverse behavior. Complementors can, for instance, create their own payment systems to bypass the platform owner or legally fight the platform owner in court. In such settings, it is imperative that complementors are properly compensated for their contributions to the platform ecosystem.

Overall, organizations need to step away from centralized, top-down governance mechanisms and pay particular attention to stakeholders, exploiting their variety of knowledge, backgrounds, and ideas. Stakeholders such as workers and complementors are key for digital innovation as well as organizational effectiveness, and simultaneously are empowered by the wide availability of digital technologies. Organizations face the need to bring balance in control and autonomy, the quantity and quality of data and information, and value creation and capture.

5. Limitations and Future Research

While my doctoral dissertation draws on rich empirical data and provides various theoretical and practical implications, a number of limitations need to be acknowledged that offer opportunities for further research. As each essay in isolation reflects on the limitations of the respective study, I reflect here on the limitations of the collective dissertation. Moreover, the three essays and their overarching insights open more avenues for future research. Based on the limitations and the findings, I therefore draw an agenda for future research, as summarized in **Table 8**.

Table 8 *- Agenda for Future Research*

Key Topic	Illustrative Research Questions
Consumerization of digital technologies	- How do the experiences of and interactions amongst consumers, workers, managers, and suppliers affect the unfolding of digital transformation in practice? - When and why (not) workers bring their experiences with digital technologies in their organization? - How does the consumerization of (generative) artificial intelligence affect organizations? - Which affordances of digital technologies bring forward changes in organizations, and how? - How do practices enacted in the organization evolve over time as new technologies emerge and get adopted in society? - How can the consumerization of digital technologies contribute to the creation of societal value? - Through what mechanisms can workers ensure that digital innovation ideas will mature within the organization?
Data governance	- What information quality dimensions have emerged in relation to digital technologies? - What information quality dimensions have become more/less important in relation to digital technologies? - How do different demographic characteristics of individuals, such as education and national culture, influence perceptions of information quality? - How do different organizational characteristics, such as hierarchical structure, industry, or size, influence perceptions of information quality? - How can different actors collectively contribute to data governance? - How can we ensure, contribute to, and create awareness about the risks of poor information quality at a societal level? - What role does information quality play in emerging technologies, such as (generative) artificial intelligence, particularly for decision-making?
Value distribution	- When does value spillover turn into value slippage and becomes problematic? - What is the role of platform users in value distribution? - How do complementor interactions affect value slippage and/or reactions to value slippage? - What role do other types of value distribution or incentivization mechanisms (such as featuring and promotion) play in value slippage? - What, if any, is an optimal balance between value capture and creation by the platform owner to encourage desirable behavior of all ecosystem actors? - How do complementors (and users) perceive “fairness” in value distribution? - To what extent should regulators, such as governments, mediate value distribution in platform ecosystems? - How do boundary resources affect value slippage?
Reconceptualization of IT governance	- How can organizations realize a fit between control and autonomy? - What, if any, is an optimal fit between control and autonomy of various stakeholders? - How do traditional assumptions of IT governance hold in the digital era? - What is the role of various structural governance mechanisms, such as steering committees, in the digital era? - What is the role of various procedural governance mechanisms, such as formal prioritization processes for IT investments, in the digital era? - What is the role of various relational governance mechanisms, such as the equality of different C-level executives (e.g., CIO, CDO, CTO, CEO, COO, CFO), in the digital era? - Which affordances associated with digital technologies induce and/or require governance changes? - How should organizations design governance mechanisms to deal with emerging technologies, such as (generative) artificial intelligence?

Meta-organizations	- What are the differences/similarities between (pre-digital) meta-organizations and digital platform ecosystems? - How does the relationship between platform owners and complementors stand to the relationship between meta-organizations and their members? - What lessons can pre-digital meta-organizations distill from digital native meta-organizations and vice versa? - What is an appropriate balance between competition and collaboration amongst members that can benefit the collective meta-organization? - How do meta-organization members identify themselves? How does such identity construction work in platform ecosystems? How can meta-organizations influence this? - In non-profit meta-organizations, how can value be distributed in such a way that encourages all members to contribute? - How do different information processing requirements and capabilities of meta-organization members affect the performance of the meta-organization?

Before discussing **Table 8**, I first reflect on the limitations associated with the methodological choices of the main essays. Essays one (Chapter 2) and two (Chapter 3) are based on qualitative research conducted at AirTrans. Although AirTrans provided me access to all organizational documents and allowed me to interview and observe employees in the period from 2018-2023, these two essays build solely on a single case. While this allowed me to examine governance challenges and associated digital transformation very thoroughly and build theory, I have not compared my findings with other organizations (e.g., Gustafsson, 2017). Consequently, I encourage future research endeavors to compare the findings of my work on these two essays with other organizational settings. For instance, novel insights may be obtained from exploring the generative mechanisms identified in essay one (Chapter 2) in organizations that do not have a meta-organizational design and/or do not belong to the military sector and, thus, might have different structural and cultural conditions.

Essay three presents conceptual research, meaning that the propositions provided in this essay are not based on empirical data but rather aimed at developing new theory with testable claims. Hence, future research endeavors can empirically test these propositions by, for instance, using data on complementor revenues, complement sales, platform owner revenues, and complementor responses to value distribution mechanisms. Such endeavors can draw on readily available data (e.g., Ceccagnoli et al., 2012) or attempt to get data from one specific platform (e.g., Rietveld et al., 2019). Alternatively, future research endeavors may use methods that rely on qualitative research techniques, such as case studies or action research to explore complementors' perceptions of value slippage and, relatedly, fairness. In doing so, they may rely on additional analysis techniques, such as system dynamics modeling (e.g., Akkermans, van Oppen, Vos, & Ou, 2021) to further explore and understand the dynamics and decisions associated with value distribution and slippage. Future research may also benefit from

examining value slippage in relation to value spillover effects, as the latter refer to positive effects while the former is concerned with negative effects for the focal actor. Hence, importantly, there may be a spectrum in which value spillover (positive) turns to value slippage (negative).

Moreover, while I focus on three key governance challenges in the digital era, there are other governance challenges that I have not explored in my doctoral dissertation. Phenomena such as the use of artificial intelligence for decision-making (Gante & Angelopoulos, 2022), technostress (Ayyagari, Grover, & Purvis, 2011), and work replacement (Belloc, Burdin, Cattani, Ellis, & Landini, 2022) are just a few examples of such challenges. In relation to the essays in my doctoral dissertation, however, I have identified a number of research avenues that merit further attention (**Table 8**). The research questions included in this table provide illustrative examples of research avenues based on the findings of my essays as well as insights from the literature. It is imperative, for instance, to explore the role of information quality in (generative) artificial intelligence, as the quality of information that is used for the training of such algorithmic solutions can greatly affect its outcomes. Consequently, new information quality dimensions may emerge or become increasingly important that need to be examined. In the near future, decisions may be increasingly based on such technologies (Angelopoulos et al., 2023).

As such technologies are spreading rapidly and broadly, I also encourage to shift the predominant focus on organizations to the societal level and, in particularly, explore how we can use such technology "to make a better world" (Walsham, 2012). While recent studies have started raising awareness on the need to look at governance from the societal level (e.g., Riemer, Ciriello, Peter, & Schlagwein, 2020), more research is needed on both the challenges and opportunities of emerging digital technologies as well as the broader role that institutions such as governments should play in this.

Besides focusing on societal aspects of governance in general, future research endeavors should further explore the role of consumers and users. In my doctoral dissertation, I focused on the manager-worker and platform owner-complementor relationships, thereby limitedly considering the role of consumers and users. As different actors are increasingly interconnected in the digital era, consumers and users become key for the design of governance mechanisms. Future research endeavors, thus, should further explore the role of such actors, especially in relationship to the other stakeholders. Panico and Cennamo (2022), for instance, draw attention to the role of user preferences on the degree to which tensions between value co-creation and capture exist in platform ecosystems. As users and consumers are vital for organizational and

platform performance—and, thus, competition—focusing on such actors could yield novel insights.

Finally, while I have conducted research in the context of meta-organizations and discuss the implications of this context in this chapter, my essays do not explicitly use a meta-organization lens, as the core focus of my doctoral dissertation was to explore governance challenges in the digital era. Nevertheless, the meta-organizational context brings forward a set of specific challenges and opportunities that are worthwhile to further explore. For instance, my essays bring forward complexities surrounding how meta-organization workers identify themselves in relation to the meta-organization and their own organization. Relatedly, member organizations, such as in the context of platform ecosystems, may have varying information processing requirements and capacity. Future research could explore how such heterogeneity influences platform performance. Moreover, while using the same terminology, slight differences exist in the conceptualization of meta-organizations when comparing platform ecosystem research (e.g., Chen et al., 2022; Kretschmer et al., 2020) and more mainstream organizational research (e.g., Ahrne & Brunsson, 2005; Berkowitz & Dumez, 2016). For instance, while the platform ecosystem literature portrays market versus organizational mechanisms as a key meta-organizational characteristic (e.g., Gawer, 2014; Kretschmer et al., 2020), this characteristic need not be present for other meta-organizations, such as trade unions. Hence, future research may benefit from further exploring the concept of meta-organizations to reduce ambiguity.

My doctoral dissertation joins and extends the scholarly discussions on IT governance in the digital era. Digital technologies are increasingly becoming the cornerstone of IT governance, empowering organizations to navigate dynamic landscapes and seizing possibilities for innovation. I showcase that the digital era requires "balanced" IT governance in terms of i) control and autonomy, ii) quantity and quality of data, and iii) value creation and capture. While my research addresses three key governance challenges brought forward by digital technologies and provides novel insights on how organizations can address them, much remains to be explored to thoroughly understand what, when, and how different governance mechanisms may contribute to desirable behavior in the digital era. My doctoral dissertation, along with the future research agenda in **Table 8**, can become the bedrock for further research.

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APPENDIX A - CHAPTER 2 OVERVIEW OF DEFINITIONS

Table 9 *- Overview of Definitions*

Concept	Definition and sources	Case observation
Digital Transformation	A process that triggers significant changes to organizational properties and practices through combinations of different digital technologies (Lanamäki et al., 2020; Vial, 2019).	Changes in the ways that innovation unfold, larger focus on specific air operations through the use of cloud and mobile technologies.
Morphogenetic Cycle	Cycle of transformation or reproduction, where the existing structures and culture condition (but do not determine) social interaction, which in turn leads to either transformation (morphogenesis) or reproduction (morphostasis) (Archer, 1995, p.91).	Identification of two different morphogenetic cycles: cultural morphogenesis and structural morphostasis as well as both cultural and structural morphogenesis.
Morphogenesis	Occurs when agential interactions result in transformation of the system (Njihia & Merali, 2013, p.884).	Structural changes in terms of the allocation of power and resources (Cycle II).
Morphostasis	Prevails when the interactions reproduce the existing system (Njihia & Merali, 2013, p.884).	Structural stability in terms of the allocation of power and resources (Cycle I).
Cultural System	All items that are capable of being grasped, deciphered, understood, or known by someone (Archer, 1996, p.104). Distribution of ideas, knowledge, values etc.	Informal discussions about digital technologies, and contradictions in how to operate in the digital era.
Structural System	Those parts of a social system where change primarily depends on material resources (Njihia & Merali, 2013, p.884). Distribution of power, wealth, access to opportunities etc.	Distribution of power and resources with regards to IT shifts from top management to lower in the organizational hierarchy. Creation of new positions and groups.
Agency	Concerned with the actions of agents (individuals and groups) with particular roles and positions, who act with the intention of achieving a specific result.	Workers bring their experiences with digital technologies in the organization to make their work more efficient.
Unfolding	Spreading of something that has been folded.	Digital changes only became visible to the entire organization after resource mobilization.
Emergence	A (concealed) process in which interactions in time and over time between two or more different elements give rise to a whole that cannot be reduced to those elements in isolation.	The broad digital transformation of AirTrans emerged through interactions amongst culture (new digital ideas), structure (resources), and agency.

APPENDIX B - CHAPTER 2 OVERVIEW OF DATA

Table 10 *- Overview of Archival Data*

Year	Strategic directives		Meeting minutes		Public (news) releases		Total	
	All	Relevant	All	Relevant	All	Relevant	All	Relevant
2010	1	1	8	6	5	0	14	7
2011	1	1	40	32	2	1	43	34
2012	1	1	39	21	32	3	72	25
2013	1	1	57	28	117	14	175	43
2014	1	1	56	21	101	6	158	28
2015	0	0	50	21	36	3	86	24
2016	0	0	41	12	35	1	76	13
2017	1	1	44	13	38	0	83	14
2018	0	0	67	25	28	3	95	28
2019	1	1	60	29	45	2	106	32
2020	0	0	50	35	58	3	108	38
2021	1	1	21	11	22	5	44	17
2022	1	1	98	32	63	8	162	41
Total	**9**	**9**	**636**	**291**	**582**	**49**	**1227**	**349**

Table 11 *- Overview of Interview Data*

#	Code	Function	Position in chain of command	Nationality	Number of interviews
1	BGG-1	Chief Operations Officer	High	A	3
2	GB-1	Deputy Chief Operations Officer	High	B	1
3	CI-1	Head of Policy Division (predecessor)	High	B	3
4	CF-1	Deputy Head of Policy Division	High	C	1
5	CB-1	Head of Operations Division (predecessor) Head of Policy Division (successor)	High	D	4
6	CS-1	Head of Operations Division (successor)	High	F	2
7	CD-1	Head of Support Division	High	E	3
8	LCD-1	Senior Information Manager/Head of CIS Branch	Medium	E	5
9	LCF-1	Head of Quality Management Branch	Medium	C	2
10	LCF-2	Head of Training Branch	Medium	C	2
11	LCI-1	Head of Data Analysis Branch	Medium	B	1
12	LCD-2	Head of Legal Affairs Branch	Medium	E	2
13	CDG-1	Head of Medical Support Branch	Medium	A	2
14	MD-1a	Head of Finance Branch (predecessor)	Medium	E	1
15	MD-1b OF-1	Head of Finance Branch (successor) Finance employee (joint interview)	Medium Low	E C	2 1
16	CG-3	Head of Operations Desk (predecessor)	High	A	2
17	MD-2	Head of Intelligence Branch	Medium	E	2
18	LCB-1	Head of Employment Branch	Medium	D	2
19	LCS-1	Head of Logistics Branch	Medium	F	1
20	LCG-1	Operations Desk Expert	Medium	A	1
21	LCDS-1	Medical Expert	Medium	F	1
22	LCD-3	Operations Desk Expert	Medium	E	2
23	CIVB-1	Executive Secretary	Low	D	2
24	CG-2a	Head of IT section (predecessor)	Low	A	2
25	CG-2b	Head of IT section (successor)	Low	A	2
26	ACF-1	Head of IT helpdesk	Low	C	1
27	CG-1	Quality Management Employee	Low	A	2
28	WOG-1	Senior Technician (IT employee)	Low	A	1
29	SD-1	Head of Supply Section	Low	E	1
30	LCF-3	Operations Desk Expert	Medium	C	1
31	CD-2	Operations Desk Employee	Low	E	1
32	LCD-4	Employment Expert	Medium	E	1
33	CG-4	Head of Operations Desk (successor)	High	A	1
34	CG-5	IT Security Officer	Low	A	1
Total					62

APPENDIX C - CHAPTER 3 DATA STRUCTURE

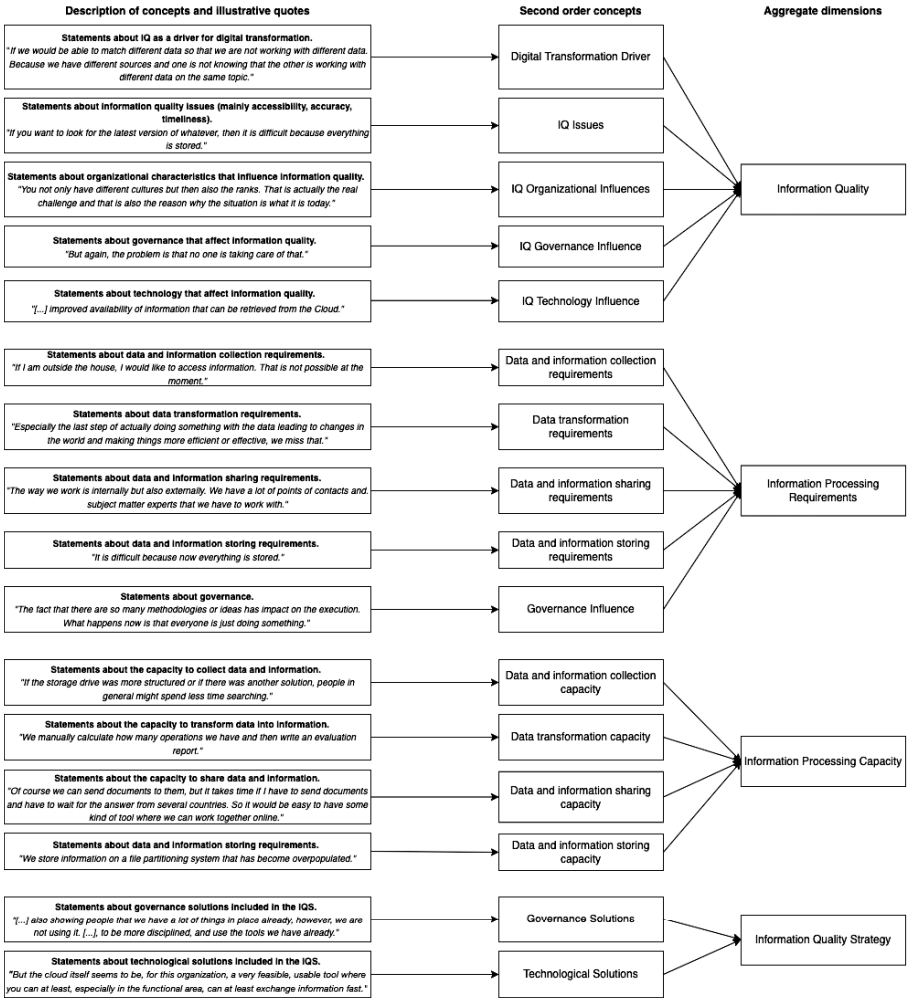

Figure 8 *- Data Structure*

APPENDIX D - CHAPTER 3 GOVERNANCE SOLUTIONS

Table 12 *- Information Quality Governance Solutions*

Solution	Status quo	Description	Possible information quality implications	Implications for information processing requirements
Set up information quality and digital transformation governance mechanisms	AirTrans is characterized by high levels of interdependence between different branches and divisions, as well as with external stakeholders such as the participating nations. Governance mechanisms (defined accountability and responsibility) were, however, not properly established and information silos were present.	Governance mechanisms can assist in deconstructing information silos (Abraham et al., 2019; Q. Zhang, Sun, & Zhang, 2022). Tactics for ensuring accountability of information include sharing explicit knowledge of the information chain (process flows), seeking input from information producers to get them involved, and including information quality goals into performance evaluations (Sebastian-Coleman, 2012). Division heads must become responsible for the storage, sharing, and structuring of information of their division. The division heads are, in turn, given the task to assign clear responsibilities and rules for employees within the division and should monitor conformance to these rules. The same principle applies for specifying who oversees digital transformation within the organization. If this is known throughout the organization, employees will know whom to reach out to for information about the digital transformation endeavor.	Improvement of *accessibility* - Improvement of the ease with which information can be retrieved as it becomes clear what stakeholder is responsible for what kind of information. Improvement of *appropriate amount* – By assigning responsibility and accountability, stakeholders will be more inclined to ensure sufficient (but not too much) information is available.	*Reduced information processing requirements* - The interdependence between the different branches of AirTrans and external stakeholders leads to higher levels of uncertainty, thereby affecting information processing requirements (Tushman & Nadler, 1978). By clarifying who is responsible for what kind of information, accessibility and appropriate amount of information will increase, thereby reducing some of the uncertainty inherent in the interdependency between branches and external stakeholders and reducing information processing requirements.

Creating instructions for cleaning existing information	Related to solution one, AirTrans had an abundance of information for which no-one felt responsible, resulting in too much information being available, causing uncertainty and questions about its timeliness and accuracy. Employees indicated that they had to put a lot of effort in processing information for each task, as it either could not be found, or it was unclear whether the appropriate information was appropriated.	After assigning responsibility, instructions had to be created for how to clean the existing information. Information that needs to be saved should be given a clear name according to a new naming convention. This way, AirTrans would have a clean and accurate inventory of information that would eventually be transferred to new IT solutions. "Garbage-in, garbage-out" (LCD-1) can be avoided in this way.	Improvement of *appropriate amount* – By reducing the amount of information (duplicates, outdated information) Improvement of *accuracy* – By removing outdated information. Improvement of *accessibility* – By reducing the amount of information available. Improvement of *timeliness* – By ensuring that outdated information is removed.	*Reduced information processing requirements* - We expect that the requirements for processing information decrease after implementing this solution, as the information processing process (collecting, transforming etc.) will speed by reducing the amount of irrelevant and/or inappropriate information.
Creating guidelines per division for storing information	Related to the previous solutions, there were no rules as to how data and information should be stored. Regardless the technological solution in place, there should be at least clear guidelines as to how to do so.	After cleaning the available information, every division (under supervision of the division head) should create clear guidelines on how to store information and share this in-house. While the previous measure is aimed to resolve the current issues, this measure should ensure that similar issues do not emerge in the future.	Improvement of *appropriate amount* – By ensuring that only relevant information is stored. Improvement of *accessibility* – By ensuring that information is stored properly, easily retrievable, and not too much information is stored	*Reduced information processing requirements* – By improving the storage of information, it will become easier for stakeholders to retrieve appropriate information, thereby reducing the requirements to process information.
Using Intranet functionalities	AirTrans had previously invested in the creation of an intranet portal. While this portal might not be state of the art, an observation of the intranet revealed that increased exploitation of this medium could solve some of the challenges faced by employees, as it	Digital channels, such as an Intranet, can transform previously invisible into visible information and encourages innovation within organizations (Joseph & Gaba, 2020; Leonardi, 2014). As such, division heads are encouraged to share information with employees through the intranet. To do so, new superuser	Improvement of *accessibility* – By providing a central place where internal stakeholders can retrieve information.	*Reduced information processing requirements* – By reducing the need to search for information in different places.

	provides an opportunity for visualizing information in a more structured and clear way. In the status quo, there was no description of responsibilities concerning the storage of information on the intranet (nor any other medium for that matter).	accounts must be created and assigned so that displaying information on the intranet is not only a task for the CIS-branch. For this, processes, guidelines, and rules must be developed to ensure that employees adopt the use of the intranet.		
Using functional mailbox functionalities	Employees primarily used their personal e-mail accounts, which led to a lack of transparency and, again, storage of information on different locations. This further caused an increase in information processing requirements, as employees did not always have access to the appropriate information and were, therefore, required to collect information themselves.	The use of functional e-mail accounts, that were already in place, must be promoted throughout the organization, setting the functional mailbox as the default account when drafting new messages.	Improvement of *accessibility* – By always allowing access to branch-related information.	*Reduced information processing requirements* – By reducing the need to ask employees for information that is not accessible for everyone.
Providing training for newcomers	Newcomers now receive limited training on dealing with information. Especially since turnover is high (three years at the command on average), many different processes and ways of working have come to exist. This has caused a lot of uncertainty amongst newcomers on how to collect, store, and communicate	As part of this solution, employees receive training about how to handle information (related to the previous solutions) as to reduce the lack of standardization arising from different nationalities, work experience etc.	Improvement of *accessibility, appropriate amount, and timeliness* – By ensuring that employees follow the standardized information policies. Improvement of *consistency* – By ensuring that there is as little variety between information formats as possible	*Reduced information processing requirements* – Since employees are trained in where to find and store information, they will require less time to get familiar with this themselves (especially considering the tenure period)

	information and they tend to use the procedures and processes they are familiar with from their prior deployments. This further reduces standardization and harmonization and leads to higher levels of uncertainty throughout the organization.			
Reviewing the processes involved	The continuous focus on governance and information quality should also be ensured when new technologies are implemented.	As showed in the past, the implementation of tool itself is not sufficient to guarantee success or to exploit information processing capacity improvements. It requires a change of processes, as well as the close involvement of different stakeholders. As such, a team should be ensembled to review all the processes that require new IS to define functional requirements, and consequently to model how processes will be changed after implementation.	Improvement of *accessibility, appropriate amount, accuracy, and timeliness* – By ensuring that the functionalities of the new technologies are utilized properly.	*Reduced information processing requirements* – Since the implementation of technologies requires and/or induces changes to organizational processes, a review of these processes helps to understand and design policies related to the technology and results in an exploitation of the technology.
Training employees and creating guidelines for new tools	The continuous focus on governance and information quality should also be ensured when new technologies are implemented.	In terms of digital transformation, training can help to show employees the potential benefits of digital technologies and reduce resistance (Svahn, Mathiassen, & Lindgren, 2017). These guidelines should complement the implementation of digital technologies. Training and guidelines are necessary to induce proper use of the provided tools.	Improvement of *accessibility, appropriate amount, accuracy, and timeliness* – By ensuring that the functionalities of the new technologies are utilized properly.	*Reduced information processing requirements* – Proper usage of the new technologies will ensure that information quality dimensions can improve and, hence, that information processing requirements can be reduced.
Providing digital transformation	There was a lack of understanding and transparency	Workshops and training foster collaboration in digital	Improvement of *accessibility, accuracy, and ease of*	*Reduced information processing requirements* – Since stakeholders will

training and workshops	with regards to the digital transformation initiatives of AirTrans, causing uncertainty and a lack of trust in the ability of AirTrans to improve. Information was primarily shared with top management.	transformation settings (Svahn et al., 2017). To reduce uncertainty and resistance regarding digital transformation, AirTrans need to involve different stakeholders (beyond the top management). In brainstorm workshops, stakeholders can indicate their challenges and potential solutions, similar as through the information quality strategy interviews.	*understanding* – Through discussing and extensively sharing information about the digital transformation endeavor in a way that is understandable and accessible for all stakeholders.	know where to find relevant information regarding the digital transformation endeavor and understand what is happening.

APPENDIX E - CHAPTER 3 TECHNOLOGICAL SOLUTIONS

Table 13 *- Information Quality Technological Solutions*

Solution	Status quo	Description	Possible information quality implications	Implications for information processing capacity
Implementing a cloud solution	While the organization had been experimenting with what they referred to as a cloud solution, this was deemed unsuccessful as the organization and its participating nations had issues adapting. Without such a solution, however, information about planning and executing medical evacuation missions was exchanged primarily via telephone communication. Getting access to complete information on-time was, therefore, perceived as challenging.	IS significantly enhance the information processing capacity of organizations (Tushman & Nadler, 1978). Cloud solutions provide on-demand access to information resources and support organizations in realizing flexible innovative processes (Kane et al., 2015; Vey, Fandel-Meyer, Zipp, & Schneider, 2017). This solution should be an on-premises cloud solution, requiring an internal data center. A privately hosted cloud solution (infrastructure-as-a-service, platform-as-a-service, or software-as-a-service) would not meet the security requirements. This solution would be especially relevant for the domain of medical evacuations and standardization of air transport procedures amongst the participating nations.	Improvement of *accessibility* – By offering a central place where both internal and external stakeholders can share information easily. Improvement of *completeness* – By allowing stakeholders to fill in predefined forms, compared to telephone calls, as well as allow for information exchange between parties that were first not directly connected. Improvement of *timeliness* – By removing an additional layer of human involvement (writing down information shared via telephone). Improvement of *consistency* – By reducing verbal communication dependent on the employee at call.	*Improved information processing capacity* – Since the cloud solution significantly enhances the ability to collect and share information with (external) stakeholders.
Implementing collaborative workspaces	AirTrans is currently lacking many IT possibilities that could increase the capacity to process information, such as collaboration suites. Stakeholders experience challenges with information duplicates because of the inability to work collectively on a piece of information.	This solution should allow for collaboration within AirTrans, as well as collaboration with external stakeholders. This would contribute to, for instance, the development of manuals and regulations that require data and	Improvement of *accuracy, completeness, and consistency* – By ensuring that stakeholders work in the same information environment.	*Improved information processing capacity* – Would increase the ability to share and store data and information, especially in terms of collaboration with external stakeholders.

		information from various sources.		
Implementing a document management system	There was no document management – in terms of governance and technology – in place, which caused confusion amongst employees.	A document management system makes information retrieval easier by facilitating the flow of information through an organization and to ensure the availability of information upon request (Alshibly, Chiong, & Bao, 2016).	Improvement of *accessibility* – By making information retrieval easier (e.g., through smart queries). Improvement of *appropriate amount, accuracy, and timeliness* – By automating functionalities such as archiving and detecting duplicates.	*Improved information processing capacity* – Ability to efficiently store and retrieve information would be enhanced.
Implementing mobile solutions offering access to all information	Access to critical information (or any information for that matter) from outside the AirTrans building is currently not possible. These solutions are approached separately from the cloud solution due to security restrictions.	This solution should allow access to the primary IT network of AirTrans from various geographical locations. Realizing such (mobile) access does not only offer flexibility to employees in case working at the headquarters of AirTrans is not possible, but also enhances connectivity, communication, and information exchange with people from mission areas, such as during a medical evacuation.	Improvement of *accessibility* – By offering access to all the related information of AirTrans from dispersed geographical locations.	*Improved information processing capacity* – Improves the ability to collect and store information from outside the headquarters of AirTrans.

APPENDIX F - CHAPTER 3 REFLECTION

Table 14 *- Canonical Action Research Reflection*

Principle 1: Researcher-Client Agreement	**AirTrans Case**
1a. Did both the researcher and the client agree that canonical action research was the appropriate approach for the organizational situation?	Prior to the start of the project, the research team and AirTrans had various meetings discussing the appropriate approach for the research project and agreed on the added value of following the canonical action research approach.
1b. Was the focus of the project specified clearly and explicitly?	The focus of the research project was established together with the top management of AirTrans (preliminary meetings and first interview round) and communicated to both internal and external stakeholders.
1c. Did the client make an explicit commitment to the project?	AirTrans supported the project and allowed for review of organizational documents, observations, and interviews. The Chief Operations Officer was appointed as the Executive Sponsor for the project, supported by the Senior Information Manager.
1d. Were the roles and responsibilities of the researcher and client organization members specified explicitly?	While the research team conducted an independent investigation, the expectations and responsibilities of both parties were known. Periodical discussions were initiated to prevent scope drift and AirTrans experienced direct pay off.
1e. Were project objectives and evaluation measures specified explicitly?	The objectives and evaluation measures were discussed with top management prior to the project, as well as during the project.
1f. Were the data collection and analysis methods specified explicitly?	The data collection and analysis methods were discussed with the top management of AirTrans, who gave access to documents and interviews. The interviewees gave consent for audio recording.
Principle 2: Cyclical Process Model	
2a. Did the project follow the cyclical process model or justify any deviation from it?	The project followed the phases of the canonical action research methodology, although the project was constrained by a limited time frame.
2b. Did the researcher conduct an independent diagnosis of the organizational situation?	The research (diagnostic phase) was independently conducted by the research team. AirTrans specifically requested this.
2c. Were the planned actions based explicitly on the results of the diagnosis?	The planned actions, in the form of the information quality strategy, addressed the challenges identified during the *status quo* assessment.
2d. Were the planned actions implemented and evaluated?	The information quality strategy was implemented and communicated throughout the client organization. A third round of interviews allowed for evaluation of the strategy.
2e. Did the researcher reflect on the outcomes of the intervention?	While not specifically mentioned in the paper, feedback on the strategy by AirTrans personnel was used to improve the strategy.
2f. Was this reflection followed by an explicit decision on whether to proceed through an additional process cycle?	There was not enough time to proceed with another cycle. However, AirTrans was encouraged to continue the project and later established a partnership with the research team for continuation

	of the research project in the future. AirTrans has confirmed doing so.
2g. Were both the exit of the researcher and the conclusion of the project due to either the project objectives being met or some other clearly articulated justification?	The objective of this research project, i.e., examining the nature of digital transformation and designing for successful digital transformation in the future was reached. AirTrans will continue the digital transformation process and the research team will be involved again in the future.
2h. How was the independent diagnosis of the organizational situation conducted?	We interviewed employees from various organizational levels (rather than only top management) to get an overview of the *status quo*. Employees were informed that their answers would be dealt with anonymously and could not harm them in any way. No employees of AirTrans were involved in the interviews.
2i. Which instrumental theories did the researcher use?	We build upon the articles by Lee et al. (2002) and Woodall et al. (2013) for the information quality assessment.
2j. How were these theories selected?	After the first round of interviews with the top management of AirTrans, we conducted an extensive literature review to identify the appropriate instrumental theories.
2k. How did these theories support the identification of the focal theory used to guide the changes?	We found a link between information quality, digital transformation, and organizational information processing during the diagnostic phase. Hence, we chose organizational information processing theory as the focal theory, aiming to enhance the fit between information processing requirements and capacity.
2l. Post-intervention, did the researcher reflect on the instrumental theories used and their suitability?	We reflected on the suitability of the hybrid framework and the semi-structured interviews.
Principle 3: The Principle of Theory	
3a. Were the project activities guided by a theory or set of theories?	An extensive literature review was part of the study, and the planned actions were guided by organizational information processing theory literature.
3b. Was the domain of investigation, and the specific problem setting, relevant and significant to the interests of the researcher's community of peers as well as the client?	AirTrans was very satisfied with the research project and the outcome. Hence, the issues we identified were relevant to the organization. The project identified a major cause of digital transformation failure, addressed a gap in the literature on information quality, created an enhanced version of organizational information processing theory in the context of digital transformation, and shows how organizations can successfully drive digital transformation.
3c. Was an instrumental theory used to derive the causes of the observed problem?	We used the widely accepted questionnaire of Lee et al. (2002) as input for our hybrid approach (Woodall et al., 2013) to assess the *status quo*.
3d. Did the planned intervention follow from the instrumental theory?	By assessing the *status quo*, we were able to tackle specific information quality issues and guide the digital transformation endeavor of AirTrans, using input from organizational information processing theory literature.
3e. Was the focal theory used to evaluate the outcomes of the intervention?	To evaluate the results, we build upon the *status quo* assessment interview protocol. Furthermore, we

	assessed the fit suggested in organizational information processing theory.
3f. Did a focal theory emerge from the situation or during the problem diagnosis?	Based on the interviews, we established organizational information processing theory as the appropriate focal theory.
3g. Was this focal theory acceptable to both client and researcher?	AirTrans agreed on the importance of knowledge and deemed organizational information processing theory as the most applicable theory.
3h. What role did instrumental and focal theories play with respect to the diagnosis and the action plan?	After the first interview round with the top management of AirTrans, we established the theories as input for both the diagnosis (*status quo* assessment) and the action plan (information quality strategy).
3i. Were these theories evaluated for their applicability to the organizational context, considering current organizational practices?	For organizational information processing theory, see 3g. For the information quality assessment, we explicitly chose to use the hybrid framework (Woodall et al., 2013), to ensure applicability
3j. Did both the researcher and the client undertake this evaluation?	The research team and AirTrans had periodical meetings to discuss the approach and progress.
3k. Were theoretical explanations for the current organizational problem situation evaluated and reflected upon?	The literature review was presented to AirTrans.
3l. Did the researcher reflect on the focal theory used and its ability to predict the change outcome?	We used organizational information processing theory as a cause-and-effect theory to enhance the fit between information processing requirements (reducing) and capacity (enhancing).
Principle 4: Change Through Action	
4a. Were both the researcher and client motivated to improve the situation?	There was a strong commitment of both the researchers and the client organization to improve the situation.
4b. Were the problem and its hypothesized cause(s) specified as a result of the diagnosis?	A description of the *status quo* situation was part of the information quality strategy.
4c. Were the planned actions designed to address the hypothesized cause(s)?	The solutions in the information quality strategy were focused on the identified information quality issues.
4d. Did the client approve the planned actions before they were implemented?	The top management of AirTrans agreed upon the planned actions and facilitated the implementation.
4e. Was the organization situation assessed comprehensively both before and after the intervention?	We conducted semi-structured interview to assess the situation both before and after the implementation of the planned actions.
4f. Were the timing and nature of the actions taken clearly and completely documented?	A schedule was developed prior to the project and was monitored together with AirTrans.
Principle 5: Learning Through Reflection	
5a. Did the researcher provide progress reports to the client?	Periodic meetings were held to discuss the progress of the project.
5b. Did both the researcher and the client reflect upon the outcomes of the project?	The research team and AirTrans together reflected upon the project and discussed recommendations for the future.
5c. Were the research activities and outcomes reported clearly and completely?	The research team shared a final research report with AirTrans, as well as the information quality strategy business case.

5d. Were the results considered in terms of implications for further action in this situation?	The long-term solutions included in the information quality strategy present further actions related to the digital transformation of AirTrans.
5e. Were the results considered in terms of implications for action to be taken in related research domains?	Recommendations for future research were provided by the research team.

SUMMARY

Digital technologies provide organizations with many opportunities to radically transform and improve existing ways of operating. Such technologies, for instance, enable organizations to reach a broader audience and get access to large amounts of data that can offer actionable insights for modifying their offerings or entering new markets. To harness such opportunities, however, organizations need to reconsider their decision-making processes in light of the characteristics of such technologies, as well as the challenges they bring forward. The decision-making processes, including roles and responsibilities, aimed at encouraging desirable behavior in the use of digital technologies are captured under the umbrella term information technology (IT) governance.

Despite the large body of literature on IT governance in the information systems discipline, most existing theoretical insights are obtained from studies on traditional, enterprise-centric IT. Contrary to traditional IT, however, digital technologies are widely available to consumers and shift control to the end user, while concurrently bringing together more actors than ever before and generating huge amounts of unstructured data. Hence, new insights are necessary that capture the changes and challenges brought forward by such technologies and reconceptualize IT governance in the digital era. For organizations, such insights are vital for the effective implementation and use of digital technologies, as illustrated by the large number of organizations that fail to realize their digital transformation endeavors.

With this doctoral dissertation, I join the academic conversation on the topic and explore three IT governance challenges in the digital era. I do so in the context of meta-organizations, which are organizations that consist of autonomous organizations and/or individuals that are not bound by employment relationships but work towards a common goal. By bringing together a variety of actors with different resources, capabilities, and assets, meta-organizations are particularly beneficial in addressing complex societal and economic challenges. Examples of meta-organizations include multinational military organizations and trade unions. The design of meta-organization resembles the increasingly common collaborative relationships between organizations that can be exploited through the use of digital technologies, such as for instance in the case of rapidly emerging digital platforms ecosystems. While meta-organizations are, thus, becoming increasingly common and relevant, academic literature on such an organizational design is scarce. Hence, besides exploring IT governance challenges for organizations in general, I pay additional attention to the characteristics of meta-organizations.

In **Chapter 2**, I examine governance challenges surrounding the widespread

consumerization of digital technologies. Such consumerization refers to a process through which organizational IT activities are influenced by changing practices and expectations of individuals brought forward by the broad adoption of digital technologies. In this essay, I focus on the role that such consumerization plays in the digital transformation of organizations. Contrary to predominant findings in the literature, the findings in this essay show that digital transformation is a much less conscious, strategic, and intentionally planned process than previously assumed. I show that workers start concealed experiments with digital technologies without the consent of managers, which generates a cultural transformation. Being subjected to such a cultural transformation, managers start to mobilize resources to scale up worthwhile experiments, resulting in a structural transformation. While such concealed experimentation with digital technologies can bring forward flexible and innovative solutions and improve the chances of a successful organization-wide implementation, it also bears IT security risks that need to be carefully considered. Hence, in the digital era, traditional top-down governance, where IT is imposed on workers, is much less effective and rather requires a delicate balance between control, and autonomy of both workers as well as managers.

Chapter 3 revolves around governance challenges associated with the increasing amounts of data and information available to organizations in the digital era. While extracting data from a variety of diverse data sources can assist organizations in decision-making, the largely unstructured nature of such data gives rise to significant information quality risks. Pre-digital organizations (that have been successful without the use of digital technologies) can be particularly susceptive to such challenges due to their limited experience with digital technologies and data governance. In this study, I adopt a theory-infused interventionist research approach to assist a multinational military organization in navigating its digital transformation endeavor by developing an information quality strategy. Such a strategy can support organizations in setting a clear scope for digital transformation, decreasing resistance to change, increasing satisfaction, and improving organizational efficiency. Importantly, in this essay I show that organizations should pay significant attention to data governance in the digital era, focusing not only on technology and information quantity but quality as well.

In **Chapter 4**, I shift my focus to governance challenges surrounding relationships between different actors in the digital era. In doing so, I focus explicitly on digital platform ecosystems and the distribution of value across platform owners and complementors. Complementors can develop and distribute a variety of offerings through such platforms, while platform owners need to orchestrate the ecosystem in such a way that complementors remain incentivized to engage with the platform. When insufficiently incentivized, complementors

may respond adversely, for instance, by taking legal action against the platform owner. While value distribution is vital to the longevity of platform ecosystems as a means to incentivize complementors and avoid such adverse responses, scant insights are available as to how and why complementors respond differently to value distribution. In this essay, I bring forward a theory that offers new insights into the heterogeneity of complementor responses to value distribution, paying attention to business models of complements and platform ecosystem substitutes. In doing so, I draw on the concept of value slippage, which occurs when an actor captures a part of the value created by a focal actor at the cost of that focal actor. In general, in this essay I argue that managing value slippage is a key governance challenge that platform owners should address to avoid costly negative responses from complementors.

In **Chapter 5**, I synthesize the findings from the different essays to provide overarching implications and reflect on the research context. The three essays stress the importance of adequately incentivizing actors by making available the necessary resources. Such resources may range from money to more accurate information. Moreover, IT governance in the digital era is largely becoming a "balancing act" in different domains, including i) autonomy versus control, ii) information quantity versus quality, and iii) collective value creation versus individual value capture. IT governance in the digital era goes beyond intra-organizational IT decision-making and rather needs to consider inter-organizational IT decision-making in terms of the variety of affordances of various stakeholder groups related to the use of digital technologies. In terms of meta-organizations, the essays illustrate that the different backgrounds of meta-organizational actors can serve as a catalyst for digital innovation, while concurrently presenting difficulties regarding managing information, effectively implementing control mechanisms, incentivizing actors, as well as understanding the central interests of the meta-organization *versus* their own interests. In sum, my doctoral dissertation joins and extends the scholarly discussions on IT governance in the digital era in general, and in the context of meta-organizations specifically.

SUMMARY (DUTCH)

Digitale technologieën hebben de potentie om bestaande werkwijzen te transformeren en te verbeteren. Ze stellen organisaties bijvoorbeeld in staat om een breder publiek te bereiken en waardevolle inzichten uit diverse databronnen te verkrijgen. Om deze mogelijkheden te benutten, moeten organisaties hun besluitvormingsprocessen heroverwegen en aanpassen aan de uitdagingen van digitale technologieën. Dergelijke besluitvormingsprocessen, inclusief rollen en verantwoordelijkheden, gericht op het stimuleren van gewenst informatietechnologie (IT) gebruik wordt ook wel IT governance genoemd.

De meeste theoretische inzichten over IT governance zijn verkregen uit onderzoek dat gericht was op meer traditionele, organisatiegerichte IT oplossingen. De opkomst van consumentgerichte digitale technologieën heeft echter de controle over het gebruik verschoven van organisaties naar eindgebruikers. Dit heeft geleid tot veranderingen in gedrag en motivaties van verschillende actoren. Bovendien genereren digitale technologieën enorme hoeveelheden ongestructureerde data, wat zowel kansen als risico's met zich meebrengt. Het intensieve gebruik van digitale technologieën, de overvloed aan ongestructureerde data en de samenwerking tussen diverse actoren zijn drie belangrijke veranderingen die door digitale technologieën zijn teweeggebracht. Om te begrijpen hoe organisaties met zulke veranderingen om kunnen gaan, is het noodzakelijk dat we IT governance in het digitale tijdperk verder onderzoeken en conceptualiseren. Dit belang blijkt onder andere uit het grote aantal organisaties dat er niet in slaagt hun inspanningen op het gebied van digitale transformatie te realiseren.

Dit proefschrift richt zich op IT governance in het digitale tijdperk, onderzocht in de context van meta-organisaties. Meta-organisaties zijn organisaties die bestaan uit autonome organisaties en/of individuen die niet gebonden zijn door formele arbeidsrelaties, maar desalniettemin samenwerken om een gemeenschappelijk doel te bereiken. De actoren die deelnemen in meta-organisaties brengen vaak een verscheidenheid aan middelen, capaciteiten en activa mee. Hierdoor zijn meta-organisaties vaak flexibel en veerkrachtig en uiterst effectief in het aanpakken van complexe maatschappelijke en economische uitdagingen. Digitale platform ecosystemen, maar ook multinationale samenwerkingsverbanden, zijn voorbeelden van dergelijke meta-organisaties. Ondanks het groeiende belang zijn er momenteel nog weinig theoretische inzichten in meta-organisaties en hun kenmerken.

In **Hoofdstuk 2** onderzoek ik de uitdagingen van IT governance in relatie tot ons dagelijks gebruik van digitale technologieën en de verschuiving van controle van organisaties naar eindgebruikers. Dit wordt "consumerization" genoemd, waarbij de veranderende

gewoonten en verwachtingen van individuen, gevormd door de brede adoptie van digitale technologieën in het dagelijks leven, invloed hebben op de IT-activiteiten van organisaties. Mijn onderzoek richt zich op de rol van consumerization in de digitale transformatie van organisaties. De bevindingen laten zien dat digitale transformatie minder bewust, strategisch en gepland is dan eerder werd gedacht. Werknemers starten verborgen experimenten met digitale technologieën zonder toestemming van managers, wat kan leiden tot een culturele transformatie. Als gevolg hiervan worden managers gestimuleerd om middelen beschikbaar te stellen om bepaalde experimenten op te schalen, wat kan leiden tot een structurele transformatie. Hoewel zulke verborgen experimenten kunnen bijdragen aan digitale innovatie, brengen ze ook beveiligingsrisico's met zich mee die zorgvuldig moeten worden overwogen. Daarom is IT governance in het digitale tijdperk afhankelijk van een delicaat evenwicht tussen controle en autonomie voor zowel werknemers als managers.

Hoofdstuk 3 behandelt governance-uitdagingen met betrekking tot de groeiende hoeveelheid ongestructureerde data en informatie. Hoewel organisaties theoretisch gezien betere beslissingen kunnen nemen met meer data, brengen het toenemende volume, de snelheid en de variëteit van data(bronnen) aanzienlijke risico's en uitdagingen met zich mee voor de kwaliteitsborging van data en informatie. Vooral pre-digitale organisaties, die succesvol waren zonder het gebruik van digitale technologieën, kunnen bijzonder kwetsbaar zijn voor dergelijke uitdagingen vanwege hun beperkte ervaring met digitale technologieën en data governance. In dit onderzoek maak ik gebruik van een interventionistische onderzoeksmethode die gericht is op informatiekwaliteit, om een multinationale militaire organisatie te helpen bij hun digitale transformatie. Door het implementeren van een strategie voor informatiekwaliteit kunnen organisaties een duidelijk kader vaststellen voor digitale transformatie, weerstand tegen verandering verminderen, de tevredenheid van medewerkers verhogen en de efficiëntie van de organisatie verbeteren. Dit onderzoek benadrukt het belang van kwaliteit boven kwantiteit als het gaat om data en informatie voor organisaties in het digitale tijdperk.

In **Hoofdstuk 4** verleg ik mijn aandacht naar de relaties tussen verschillende actoren. Specifiek richt ik me op digitale platform ecosystemen en de verdeling van waarde tussen platformeigenaren en complementoren. Platformeigenaren zijn de ontwikkelaars van een digitaal platform, terwijl complementoren via die platformen verschillende diensten aanbieden. Om een goed functionerend platform ecosysteem te behouden, is het belangrijk dat platformeigenaren complementoren stimuleren om nieuwe diensten te ontwikkelen en bestaande diensten te verbeteren. De verdeling van de gecreëerde waarde binnen het ecosysteem is hierbij van cruciaal belang. Als er onvoldoende stimulans is, kunnen

complementoren negatief reageren, bijvoorbeeld door juridische stappen te ondernemen tegen de platformeigenaar. Er is echter weinig inzicht in hoe en waarom complementoren verschillend reageren op waardeverdeling binnen een ecosysteem. In dit essay ontwikkel ik een theorie die nieuwe inzichten biedt in de diversiteit van de reacties van complementoren op waardeverdeling, met aandacht voor de bedrijfsmodellen van aangeboden diensten en platform ecosysteem alternatieven. Daarbij bouw ik op het concept van waardeverschuiving, dat optreedt wanneer een deel van de waarde gecreëerd door één actor, ten koste van die actor, ingenomen wordt door een andere actor. Ik betoog dat waardeverschuivingen binnen het ecosysteem een belangrijke IT governance-uitdaging vormen voor platformeigenaren, die ze moeten aanpakken om negatieve reacties van complementoren te voorkomen.

In **Hoofdstuk 5** vat ik de bevindingen van de verschillende essays samen, presenteer ik overkoepelende bevindingen en reflecteer ik op de onderzoekscontext. De drie essays benadrukken het belang van het effectief stimuleren van actoren door de benodigde middelen beschikbaar te stellen, variërend van financiële middelen tot accurate informatie. Daarnaast blijkt dat IT governance in het digitale tijdperk voornamelijk een 'evenwichtsoefening' is op verschillende gebieden, zoals autonomie versus controle, informatiekwantiteit versus informatiekwaliteit en gezamenlijk waarde creëren versus individueel waarde toe-eigenen. Tegenwoordig gaat IT governance verder dan alleen besluitvorming binnen organisaties en omvat het ook besluitvorming buiten traditionele organisatorische grenzen. Op het gebied van meta-organisaties tonen de essays aan dat de diverse achtergronden van actoren een katalysator kunnen zijn voor digitale innovatie. Tegelijkertijd kan dit uitdagingen opleveren op het gebied van informatiebeheer, effectieve implementatie van controlemechanismen, stimulering van actoren en het managen van centrale belangen van de meta-organisatie ten opzichte van individuele belangen. Mijn proefschrift draagt bij aan wetenschappelijk onderzoek gericht op IT governance in het digitale tijdperk, zowel in algemene zin als specifiek binnen de context van meta-organisaties.

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Digital technologies have fundamentally changed the interactions of actors within and around organizational settings, offering opportunities to radically improve how organizations operate while concurrently presenting various risks and challenges. To deal with this, organizations need to reassess their information technology (IT) governance mechanisms, referring to decision-making processes, including roles and responsibilities, aimed at fostering desirable behavior in the use of digital technologies. This doctoral dissertation consists of three essays that advance the existing body of knowledge on IT governance in the digital era by drawing insights from meta-organizations. Such organizations consist of autonomous entities that work towards a common goal yet are not bound by employment relationships. Meta-organizations are becoming increasingly common in practice due to the widespread adoption of digital technologies.

Essay one explores IT governance challenges surrounding the widespread consumerization of digital technologies and, in particular, the role that workers play in the unfolding of digital transformation. Essay two revolves around governance challenges associated with the increasing volume, variety, and velocity of data available to organizations in the digital era, stressing the importance of information quality. Essay three directs its focus to governance complexities surrounding the distribution of value among actors engaged in meta-organizations. In sum, this doctoral dissertation contributes to the reconceptualization of IT governance in the digital era and extends the literature on meta-organizations.

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