Strategic Implications of Digital Transformation: Navigating the Evolution of Traditional Organisations Through Sustainable and Agile Practices

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Mirheta Omerović Smajlović
Darmstad, 02.11.2024

Abstract

This doctoral dissertation investigates digital transformation (DT) within traditional organisational contexts, analyzing both managerial and technological dimensions. The research emphasizes how traditional organisations, faced with the imperative to adapt despite rapid digital disruptions, manage and implement DT strategies effectively to remain competitive in a digital landscape. The thesis first researches the organisational aspects of DT, focusing on the dynamics between management and technology. It scrutinizes the alignment process necessary for integrating advanced digital technologies with existing business strategies and resources. Special attention is given to managerial challenges such as adapting leadership, communication, and organisational culture to support a digitally-enabled workforce. This section of the research highlights the critical role of management in facilitating DT through strategic adaptations that enhance organisational flexibility and responsiveness. Secondly, the dissertation delves into the technological facets of DT, centring on how traditional organisations incorporate digital technologies like the Internet of Things (IoT) and Artificial Intelligence (AI) to transform their operational and BMs. It discusses the profound impact of these technologies on organisational structures and processes, illustrating how they lead to the blurring of traditional industry boundaries and create new competitive realities. This part of the study also explores how IoT and AI contribute to innovative BMs and value creation, emphasizing the need for organisations to evolve from conventional methods to integrated, technology-driven approaches. A significant aspect of the thesis is its focus on the catalytic role of the COVID-19 pandemic in accelerating DT. It assesses how the crisis has shifted organisational management and leadership, urging a revaluation of digital strategies and an increased commitment to digital initiatives. The pandemic has underscored the necessity for organisations to be agile and proactive in their digital approaches, ensuring long-term sustainability in a rapidly changing environment. The research further identifies and addresses the gaps in existing DT literature, particularly the need for clear, actionable strategies that traditional organisations can employ to navigate their digital journeys. By integrating theoretical insights with practical applications, the dissertation offers a comprehensive framework for understanding and executing DT in traditional settings. In conclusion, this doctoral dissertation provides a nuanced understanding of the complex interplay between management and technology in the context of DT. It offers valuable insights for traditional organisations aiming to leverage digital technologies for enhanced competitiveness and efficiency, contributing to the broader discourse on digital innovation and organisational change.

Abstract (Deutsche Übersetzung)

Diese Doktorarbeit untersucht eingehend die DT innerhalb traditioneller Organisationskontexte und analysiert sowohl die Management- als auch die technologischen Dimensionen. Die Forschung betont, wie traditionelle Organisationen, konfrontiert mit der Notwendigkeit, sich angesichts schneller digitaler Umwälzungen anzupassen, DT-Strategien effektiv implementieren, um in einer digitalen Landschaft wettbewerbsfähig zu bleiben. Die Arbeit untersucht zunächst die organisatorischen Aspekte der DT, wobei der Schwerpunkt auf der Dynamik zwischen Management und Technologie liegt. Es wird der für die Integration fortgeschrittener digitaler Technologien mit bestehenden Geschäftsstrategien und -ressourcen notwendige Abstimmungsprozess untersucht. Besondere Aufmerksamkeit gilt den Managementherausforderungen wie der Anpassung von Führung, Kommunikation und Organisationskultur, um eine digital ermöglichte Belegschaft zu unterstützen. Dieser Abschnitt der Forschung hebt die kritische Rolle des Managements bei der Erleichterung der DT durch strategische Anpassungen hervor, die die organisatorische Flexibilität und Reaktionsfähigkeit verbessern. Zweitens vertieft die Dissertation die technologischen Facetten der DT und konzentriert sich darauf, wie traditionelle Organisationen digitale Technologien wie das IoT und KI integrieren, um ihre Betriebs- und Geschäftsmodelle zu transformieren. Es wird der tiefgreifende Einfluss dieser Technologien auf Organisationsstrukturen und -prozesse diskutiert, der zeigt, wie sie zu einer Verwischung traditioneller Branchengrenzen führen und neue Wettbewerbsrealitäten schaffen. Dieser Teil der Studie erkundet auch, wie IoT und KI zu innovativen Geschäftsmodellen und Wertschöpfung beitragen, und betont die Notwendigkeit für Organisationen, von konventionellen Methoden zu integrierten, technologiegetriebenen Ansätzen zu wechseln. Ein wesentlicher Aspekt der Arbeit ist der Fokus auf die katalytische Rolle der COVID-19-Pandemie bei der Beschleunigung der DT. Es wird bewertet, wie die Krise das Organisationsmanagement und die Führung verschoben hat, was eine Neubewertung digitaler Strategien und ein erhöhtes Engagement für digitale Initiativen erfordert. Die Pandemie hat die Notwendigkeit für Organisationen unterstrichen, agil und proaktiv in ihren digitalen Ansätzen zu sein, um eine langfristige Nachhaltigkeit in einem sich schnell ändernden Umfeld sicherzustellen. Die Forschung identifiziert und adressiert auch die Lücken in der bestehenden DT-Literatur, insbesondere den Bedarf an klaren, umsetzbaren Strategien, die traditionelle Organisationen zur Navigation ihrer digitalen Reisen verwenden können. Durch die Integration theoretischer Einsichten mit praktischen Anwendungen bietet die Dissertation einen umfassenden Rahmen für das Verständnis und die Ausführung der DT in traditionellen Einstellungen. Zusammenfassend bietet diese Doktorarbeit wertvolle Einblicke für traditionelle Organisationen, die digitale Technologien zur Steigerung ihrer Wettbewerbsfähigkeit nutzen möchten und trägt zum breiteren Diskurs über DT und organisatorischen Wandel bei.

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List of Abbreviations

AI	Artificial Intelligence
BM	Business Model
BMC	Business Model Canvas
BU	Business Unit
CoP	Community of Practice
DP	Design Principle
DR	Design Requirement
DT	Digital Transformation
DSR	Design Science Research
GDPR	General Data Protection Regulation
IM	Information Management
IoT	Internet of Things
IoE	Internet of Everything Index
ISO	International Organisation for Standardization
IS	Information System
IT	Information Technology
ROI	Return on Investemnt
SLR	Systematic Literature Review
SME	Small and medium-sized enterprises
TFR	Technological Frames of Reference
Y	Years
YoE	Years of Experience

1 Introduction

The importance of digital transformation (DT) today cannot be overstated. As the McKinsey (2023) report highlights, ‘DT is critical for organisations to not only compete but survive’. It represents a fundamental reimagining of how organisations function and is intended to create value through the strategic deployment of technology at scale. Matt et al. (2015) note that across various sectors, firms are increasingly embarking on initiatives to harness digital technologies, transforming their core business operations, products, and even organisational structures. This is especially demanding in traditional organisations since DT challenges established business paradigms (Bharadwaj et al. 2013; Drnevich and Croson 2013).

For traditional companies, leveraging DT is about more than implementing new technologies. It is about cultivating an environment and culture in which these technologies can thrive and generate business value. As the McKinsey report articulates, ‘No company can outsource its way to digital excellence’ (McKinsey 2023). Although DT can lead to enhanced efficiency, innovative value creation, and new business models (BMs) (Downes and Nunes 2013), these transformations are complex, often requiring the reshaping of long-standing practices and a rethinking of business and operational strategies (Matt et al. 2015).

1.1 Motivation and Relevance of the Work

The importance of DT is increasingly recognised in scholarly research and practical applications (Hanelt et al. 2021), and organisations across sectors are keen to enhance their internal workflows and customer service by digitalising their offerings. DT has long been relevant in information systems (IS) research, but conceptual clarity has been muddied by differing interpretations (Vial 2019). It is often used interchangeably with the terms ‘digitisation’ and ‘digitalisation’, although these carry distinct meanings depending on the context. Vial (2019, p. 9) defines DT as ‘a process aiming to augment an entity by inducing substantial changes to its attributes through the synergy of information, computing, communication, and connectivity technologies’. DT thus transcends simple digitisation, for example, documents being made available online or public services being offered in digital form (Mergel et al. 2019).

DT is an extensive process that fundamentally changes an organisation’s internal architecture and the value proposition of its offerings. It requires alignment with external stakeholders like public administrations, partners, and customers. For instance, local regulations may facilitate or hinder organisations’ DT efforts (Henfridsson and Bygstad 2013). The comprehensive nature of DT, affecting products, services, and the broader organisational ecosystem, became particularly evident during the COVID-19 pandemic.

The pandemic acted as its catalyst by forcing a rapid shift in how services are delivered and interactions are maintained, thus intensifying organisational focus on DT strategies (Dwivedi et al. 2020). Hence, the subject of DT and its various elements has become crucially important.

This thesis examines the different facets of DT in traditional organisations, focusing on the technological and managerial aspects of the phenomenon. The focus is on offering insights into how technology and management practices interact and influence each other in the process of organisational change.

First, the thesis addresses the organisational aspects of DT in traditional settings to establish a foundational understanding of how DT can be managed in a conventional business paradigm (Matt et al. 2015). This is a multifaceted phenomenon that involves the integration of advanced technologies and significant shifts in BMs and organisational strategies. Considering these many aspects highlights the imperative for traditional organisations to evolve amidst digital disruptions.

From a theoretical perspective, we need to clarify the phenomenon because the lack of a common definition within IS research (Vial 2019) signifies a fragmented understanding of DT within the academic community. This conceptual ambiguity hampers the ability to develop a coherent theoretical and practical framework, which is essential for guiding traditional organisations through the profound change DT implies (Vial 2019).

Riasanow et al. (2019) enrich this discourse by categorising approaches to DT into twelve schools of thought, reflecting the breadth of perspectives that can potentially enrich IS research and underscoring the need for an integrated approach to DT and its impacts on organisations and their broader ecosystems. From a practical point of view, understanding DT is crucial because it allows organisations to improve customer experiences, reduce costs, and remain competitive in an evolving digital landscape (McKinsey 2023). Further research is needed to offer traditional organisations meaningful guidance on such issues as how digital technologies interact with various organisational dimensions, including strategy, structure, and culture, as well as how these technologies relate to broader societal and economic forces.

In discussing the organisational elements of DT in traditional settings, this thesis first considers the key factors identified in the literature as influencing DT, including how these have evolved due to the COVID-19 crisis and the resultant acceleration of DT, focusing on shifts in the management and leadership of traditional organisations. It contributes to the literature on the managerial aspect of DT, examining how executives' commitment to digital initiatives and the adaptation of strategies in response to the pandemic have become critical drivers of long-lasting DT in these organisations. The thesis then examines the complexity of developing digital services, highlighting the critical need for alignment between business and information technology (IT) experts.

Discrepancies between a company's current resources and its evolving digital business strategy are systematically reconciled through an alignment process (Yeow et al. 2017). Further, it addresses the managerial challenges of adapting to new work paradigms and emphasises the need for strategic changes in leadership, communication, and organisational culture. There is a call to study micro-foundations that help us understand and explain how DT unfolds in practice (Vial 2019). For traditional organisations, it is imperative to rethink managerial strategies and structures to support a digitally-enabled workforce, an important aspect of DT.

Second, the thesis studies the technological facets of DT in a traditional organisation with a focus on the adoption and integration of digital technologies that reshape organisational structures, processes, and strategies (Hanelt et al. 2021). With the advent of digital technologies, organisational functions have been integrated, blurring traditional industry demarcations and prompting novel competitive forces (Seo 2017; Yoo et al. 2012; Yoo et al. 2010). For example, traditional firms in the transportation or automotive sectors are now positioned in direct competition with inherently digital entities like Apple, Google, and various digital start-ups.

Firms across nearly all industries are engaging with new digital technologies to identify how these might transform key business operations, products, processes, organisational structures, and management concepts (Matt et al. 2015). Research on how organisational structures are impacted by emerging technologies (Hanelt et al. 2021) and how these can be effectively integrated is vital to understanding the transformation of traditional organisations. This thesis considers the technological underpinnings of DT, drawing extensively on the literature on the pivotal role of advanced technologies in reshaping organisational processes, enhancing decision-making, and driving innovation. Recent research underscores the significance of integrating advanced technologies—for example, the IoT (Saarikko et al. 2017), AI (Kaplan and Haenlein 2019), and machine learning (McAfee and Brynjolfsson 2017)—in the study of DT within established organisations.

These technologies can fundamentally alter value creation, representing complex developments that demand novel intellectual assets and frequently exceed the scope of a single organisation's expertise. The IoT offers an empirical setting that is appropriate for examining DT, representing a novel technological paradigm that can disrupt organisations and markets (Krotov 2017; Porter and Heppelmann 2015). Sebastian et al. (2017) find that DT is especially shaped by social, mobile, analytics, cloud, and IoT technologies due to their digital properties, most importantly their re-programmability, homogenisation of data, and self-referential nature (Yoo 2010). In established organisations, technologies such as IoT and AI are pivotal for DT as they drive significant enhancements in business value and operational efficiency.

IoT technology is reshaping BMs and industry dynamics, compelling traditional organizations to adopt more integrated, technology-driven solutions to ensure their competitiveness in a rapidly changing digital landscape (Iansiti and Lakhani 2014; Bradley et al. 2013). The IoT's capacity to transform industries lies in its ability to interconnect devices, facilitating new forms of data exchange and automation that can drive efficiencies and innovation. However, despite the economic promise of the IoT (Greengard 2015; Manyika et al. 2015), there are few well-defined BMs that capture the complex, interconnected nature of these technologies (Leminen et al. 2012; Westerlund et al. 2014). This gap underscores the need for comprehensive and clear BMs that can help traditional organizations adapt and thrive in the digital era.

Developing these models requires a deep dive into how IoT can redefine value creation and industry boundaries (Engelbrecht et al. 2016; Fleisch et al. 2015; Porter and Heppelmann 2014; Weinberger et al. 2016). IoT's potential to create new value lies not only in the efficiencies it offers but also in its ability to foster entirely new products and services that were previously unimaginable. For traditional organizations, understanding and leveraging these opportunities is crucial for remaining competitive.

Similarly, there is an increasing reliance on AI to enhance business value given the surge in data and computational capacity. Researching the development of AI is thus important when considering DT in traditional organizations (Collins et al. 2021; Ng and Chui 2018). AI is essential for harnessing vast data and computational power to improve decision-making and innovation. This capability allows businesses to predict market trends, optimize operations, and create personalized customer experiences, thereby driving significant competitive advantages. However, for the sake of sustainable development, there is a need to address the extensive resource demands of AI (Collins et al. 2021; Ng and Chui 2018). Substantial resources are required for AI development, including the preparation and collection of data and the training and maintenance of AI models. This resource intensity poses a critical challenge, intersecting with the need for organizational sustainability (Baier et al. 2019; Davenport and Ronanki 2018).

Sustainable AI development, which includes the reusability of AI models and data, offers a way to limit extensive resource consumption and environmental impacts. This approach aligns with the increased imperative to adopt sustainable and resource-efficient practices (Chatterjee et al. 2022; Wamba-Taguimdje et al. 2020). By focusing on sustainable AI practices, organizations can ensure that their technological advancements do not come at the cost of environmental degradation or unsustainable resource use.

Research on sustainable AI development can provide actionable insights for traditional organizations to navigate their DT journeys. Balancing technological advancement with environmental and social responsibility will be key to achieving long-term success.

This balance ensures that organizations not only remain competitive but also contribute positively to broader societal goals. Addressing these complex challenges requires a strategic approach that integrates sustainability into the core of digital transformation efforts, fostering innovation while safeguarding the environment.responsibility.

1.2 Structure of the Thesis

This section offers a motivation for the research and underscores its relevance, establishing a foundational context for the studies conducted. As graphically indicated in *Figure 1*, it is followed by a detailed exploration of the theoretical background pertinent to DT within the IS field. The body of the thesis is divided into two sections, each focusing on distinct facets of the study. As detailed in a previous chapter, this thesis is mainly concerned with 1) the organisational elements of DT and 2) the technological facets of DT within a traditional organisational context.

The studies on the organisational elements of DT establish a foundational understanding of DT, drawing on the perspectives provided in the initial study concerning the definition of DT and its key influencing factors, as well as managirial and organizational challeges related to the DT process.

The first study, *'Exploring the Foundations: Identifying Key Factors of Digital Transformation Through Literature'*, defines DT within the context of traditional organisations following a systematic literature review (SLR) on the factors influencing DT. The study identifies six categories of factors impacting DT: digital leadership, culture of innovation, capabilities, strategy, technical infrastructure, and product-and-service fit.

The second study, *'From Theory to Practice: Examining the Evolution of Digital Transformations' Key Influencing Factors'*, offers a detailed examination of how the COVID-19 pandemic accelerated DT, emphasising the transition to remote work and digital processes. It analyses DT factors identified in existing studies, highlighting how these have been impacted by the pandemic and offering novel factors that became relevant as a result of the pandemic, offering insights into the dynamic nature of DT. Overall, the study provides valuable perspectives on how traditional organisations can navigate DT during and beyond crisis, contributing to a more nuanced understanding of the key factors influencing DT in organisational settings.

The third study, *'Deep Dive into Digital Transformation: Business and IT Collaboration in Traditional Organisational Contexts'*, contributes to the study of DT by exploring the intricacies of developing digital services in the automotive industry. It emphasises the need to align business and IT perspectives, highlighting how differences in these understandings and the expectations they produce can impede successful digital service development. This analysis of a case study in a German car manufacturer sheds light on the need for collaboration and a shared strategic vision to overcome managerial and organisational challenges, offering insights into the factors influencing DT in established firms.

The final study within the organizational elements of DT, *'Digital Transformation and Organisational Dynamics: Navigating Performance and Change in the Era of Remote Work'*, comprises a detailed analysis of how remote work practices, accelerated by DT, impact organisational structures and performance. Utilising the Burke–Litwin model, the study identifies key transformational factors influenced by digitalisation and remote work, such as leadership, strategy, and organisational culture. This research supports the definition of DT in traditional organisations by highlighting the critical role of technology in supporting remote work and the associated changes in organisational dynamics. The study argues that organisations should adapt their strategies, leadership styles, and cultures to thrive in the evolving digital landscape, marking a significant step in understanding the organisational elements vital for DT success in traditional contexts.

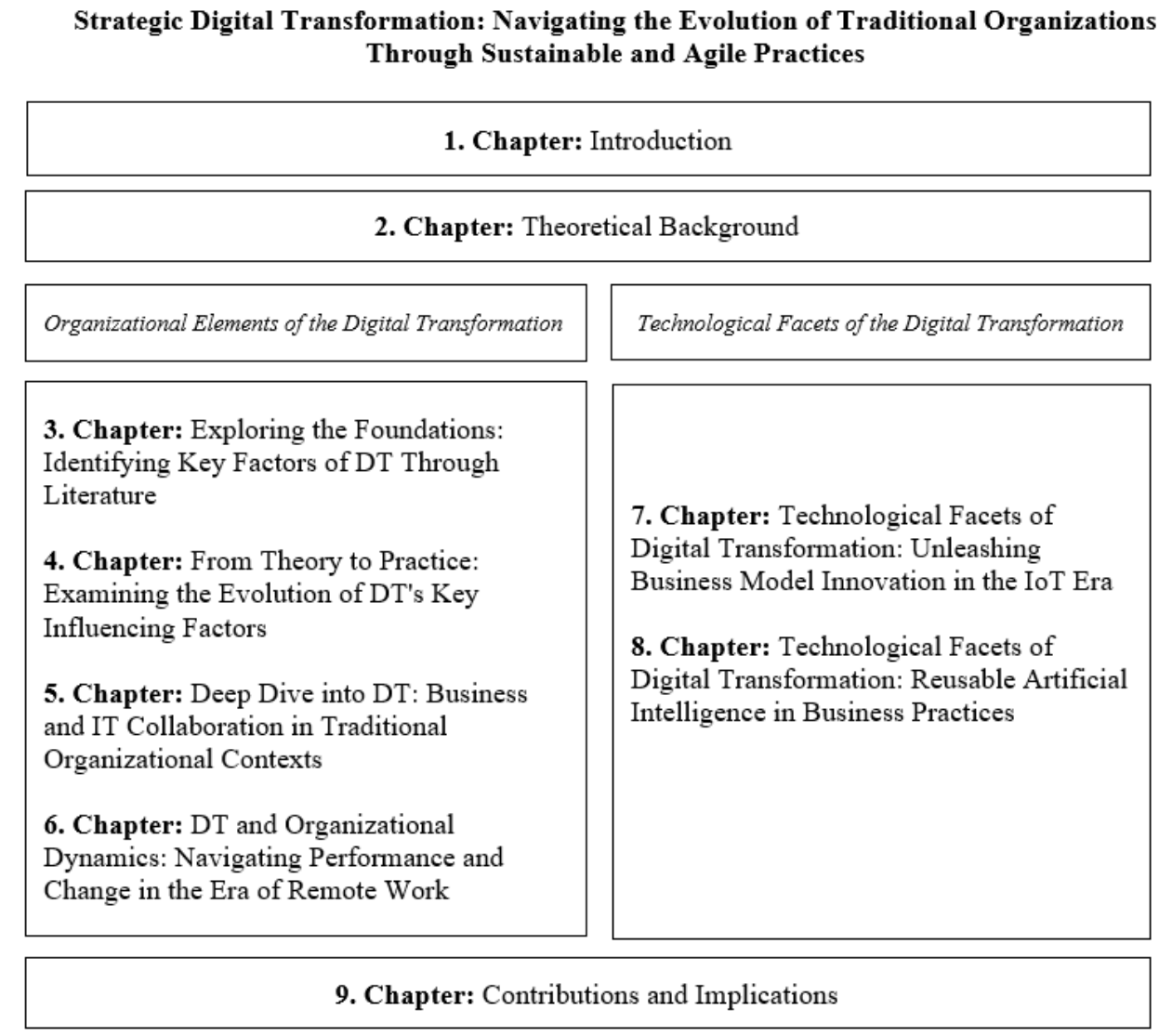


Figure 1: Overview of the Thesis Structure

All of these studies collectively enhance our understanding of DT's organisational elements within traditional settings by examining the role of digitalisation and remote work practices. They illustrate how DT necessitates shifts in leadership, strategy, and culture, particularly under the catalytic pressures of crises like the COVID-19 pandemic. They underline the importance of aligning business and IT, adapting to new work paradigms, and leveraging technology to sustain and advance organisational performance in the digital era.

Finally, two studies within the technological faces of DT explore how the technologies, such as IoT and AI, evolve throughout the process of DT in established firms.

First, *'Technological Facets of Digital Transformation: Unleashing Business Model Innovation in the IoT Era'* delves into the profound impact of the IoT on the BMs and organisational structures of traditional organisations. It underscores the need for a paradigm shift in value creation and in how BMs are understood in light of the IoT's capability to redefine industry boundaries and foster new, profitable BMs. Through a systematic review of the literature, the study sheds light on current IoT-driven BM research, identifies gaps and proposes future research directions, contributing significantly to understanding the technological aspects of DT in traditional organisational contexts.

In the second technology-related study, *'Technological Facets of Digital Transformation: Reusable Artificial Intelligence in Business Practices'*, the integration of AI is explored in traditional organisational structures, emphasising sustainable development in AI practices. AI models and data must conserve resources and mitigate negative environmental impacts by ensuring reusability. By proposing design principles for reusable AI, the study contributes to our understanding of how AI technologies can be designed and implemented in a sustainable manner and in alignment with the broader goals of DT of traditional organisations. Such research provides actionable insights for organisations seeking to adopt AI sustainably and promotes a nuanced understanding of the technological facets of DT in traditional organisational settings.

The studies in this thesis are important for advocating a novel approach to value creation and BM design, emphasizing the alignment between technological advancements and sustainable business practices. As industries rapidly digitize through the IoT and AI, traditional BMs must be revisited to capture the complexities of these technologies. While IoT and AI promise significant economic benefits, their resource-intensive nature necessitates sustainable practices to avoid environmental and social challenges. By integrating sustainability into BM design, organizations can achieve long-term success and contribute to broader societal goals. The studies in this thesis provide a strategic framework for navigating DT, ensuring that technological progress supports both competitive advantage and responsible growth.

2 Theoretical Background

This section consists of three subsections. The first briefly describes the contemporaneity and scholarly relevance of DT within academic discourse, underscoring the subject's significance and the prevailing interest in its rigorous investigation. The second comprises an overview of the DT definition and its key characteristics. The third subsection elaborates on the topic of DT within traditional organisational contexts.

2.1 Digital Transformation

DT is increasingly recognised as vital in business and social contexts, becoming a mainstay in academic and practitioner dialogues, as evidenced by a significant increase in related discourse and publication over recent years (Hanelt et al. 2021). The phenomenon is about more than technological change. It has profound impacts on BMs, organisational structures, and market dynamics. Scholarly interest in DT is predominantly in the management (Hanelt et al. 2021) and IS (Vial 2019) fields. There is a growing body of research attempting to demystify various facets of DT, including its drivers, outcomes, and mediating factors (Hanelt et al. 2021). The outcomes of DT are linked to enhancements across various performance metrics, such as innovativeness (Svahn et al. 2017), financial outcomes (Karimi and Walter 2015), company growth (Tumbas et al. 2015), reputation (Kane 2016; Yang et al. 2012), and developing a competitive edge (Neumeier et al. 2017).

Research indicates that DT also boosts operational efficiency through business process enhancement (Gust et al. 2017), cost reductions (Pagani 2013), and automation (Andriole 2017). The literature points to DT's positive (e.g., Agarwal et al. 2010; Bravhar and Juric 2017; Pramanik et al. 2016) and negative (e.g., Newell and Marabelli 2015; Piccinini et al. 2015) outcomes.

Notably, the COVID-19 pandemic accelerated the urgent need for DT, pushing organisations to fast-track their transformational processes (McKinsey 2023). The pandemic served as a catalyst, pushing organisations to rapidly adopt digital technologies and practices. This acceleration is primarily the result of an urgent need to advance remote work capabilities and digital operational processes in response to social distancing measures and lockdowns. The lessons learned and the transformations undertaken during the pandemic could have long-lasting effects on how organisations approach DT, potentially setting new standards and expectations for digital agility and resilience.

2.2 Definition of the Digital Transformation and Key Characteristics

There is no clear, agreed-upon definition of DT and its encompassing elements (Warner and Wäger 2019; Wessel et al. 2020). Although defining DT has a long history in IS research, there are multiple understandings of DT hindering conceptual clarity (Vial 2019). Some studies compare DT to digitalisation (see Hanelt et al. 2021), but digitisation, digitalisation and DT must be distinguished.

Digitisation alters traditional products by introducing digital features or creating digital alternatives (Prem 2015; Tilson et al. 2010). Digitalisation allows more extensive leveraging of digitised products or systems to develop new organisational procedures, BMs, or commercial offerings (Brynjolfsson and McAfee 2014; Chahal 2016; Dremel et al. 2017; Matt et al. 2015).

While digitisation delineates technologies by their nature and functionalities, digitalisation increases the significance of such technology for a particular process or organisation, addressing the 'why' behind its adoption (Sarrikko et al. 2020). There are several definitions of DT in the general literature on the topic, and they mostly depend on the context of the particular study (see, for example, Hess et al. 2016; Liu et al. 2011; Matt et al. 2015; Parviainen et al. 2017; Hinings et al. 2018). This thesis adopts the definition developed by Vial (2019) of DT as 'a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies'.

DT is thus a sociocultural adaptation process through which firms adjust to new organisational structures and develop the skills necessary to stay competitive and pertinent in a digitally evolving environment (Sarrikko et al. 2020). Digital technologies have proliferated, and organisations must transform and integrate these into their core functions and processes (Bharadwaj et al. 2013). The literature describes digital technologies as inherently disruptive (Karimi and Walter 2015) and extending across society and various industries (Vial 2019). Within the IS literature, however, it is important to distinguish between IT-enabled organisational transformation and DT; Wessel et al. (2020) identify two key distinctions between these. First, DT initiatives utilise digital technology to (re)shape an organisation's value proposition, whereas IT-enabled organisational transformation efforts employ digital technology to support the existing value proposition. Second, DT entails the creation of a new organisational identity, whereas IT-enabled organisational transformation augments the organisation's existing identity.

Digital disruptions demand a strategic organisational response, a core theme in DT scholarship (Vial 2019; Kane et al. 2015; Hess et al. 2016). DT strategy should fundamentally alter how organisations function and interact with their environments. Its strategic significance is well recognised, affecting managers across industries and challenging them to adapt to new digital realities (Singh et al. 2020). Matt et al. (2015) describe DT strategies as having four dimensions: 'use of technologies, changes in value creation, structural changes and financial aspects.' The three dimensions (above) represent the main changes in the DT process enabled by appropriate financial resources. DT is also a significant process of change, affecting an organisation's internal structure and its value proposition. It redefines how organisations operate internally and deliver value to their customers, going beyond simple digital enhancement (Mergel et al. 2019).

Alignment with external stakeholders, including public administration entities (Mergel et al. 2019), partners, and customers (Islam et al. 2017; Svahn et al. 2017), is essential. For example, local legislative frameworks can either facilitate (e.g., through financial incentives) or hinder (e.g., via restrictive regulations) the DT of organisations. Substantial structural adjustments are needed, and obstacles impeding organisations' transformational endeavours must be surmounted. While these transformations can yield benefits for organisations, individuals, and society, they may also entail adverse effects (Vial 2019).

Seufert and Meier (2016) recommend that companies embarking on DT should initiate this journey by understanding and aligning with consumer needs and preferences, thereby orienting changes towards fulfilling these requirements.

In summary, research on DT has primarily defined this as the integration and utilisation of digital technology across all aspects of an organisation, fundamentally changing how businesses operate and deliver value. The main aspects of DT identified in the literature include its transformative impact on BMs, value creation processes, organisational structures, and the strategic imperative to adopt a digital-first approach. Despite these insights, the academic community continues to seek a more unified and precise definition of DT, as well as a deeper understanding of its distinctive characteristics, given its pervasive influence across sectors and organisational contexts.

2.3 Digital Transformation in Traditional Organisations

Innovative initiatives, such as LEGO's development of a customer engagement platform, illustrate how traditional businesses are adopting new technologies to foster customer interaction and drive innovation (El Sawy et al. 2016). Incumbents are also reassessing their competitive tactics in the digital arena, investing in emerging technologies and building new competencies to position themselves as leaders in the digital age (Sebastian et al. 2017). The success of DT, however, extends beyond mere technological adoption—it signals a shift in organisational culture, with employees increasingly drawn to firms that prioritise digital advancement (Kane et al. 2015). Therefore, DT has evolved from being optional to a critical necessity, especially as organisations strive to meet the dynamic needs of a global audience (Kraus et al. 2021). This shift demands a detailed and careful remodelling of business processes, incorporating innovative and data-driven simulations that require significant investments of time and resources (Andriole 2017). Despite the apparent urgency of transformation, many established organisations are hesitant to research new partnerships or seek external expertise, preferring to stay within their comfort zones (Sarrikko et al. 2020).

The hurdles associated with substantial organisational change are well recognised, with many extensive transformations failing to achieve their planned objectives (Barrett and Stephens 2017; Burke 2011). Organisational inertia further complicates this scenario, reducing the chances of successfully adopting and executing DT strategies (Wright et al. 2004).

Many organisations, particularly those in the early stages of digital maturity, struggle to fully grasp how digital technologies can impact and enhance their business operations (Kane et al. 2015). Hess et al. (2016) argue that the real test is not accessing technology but formulating and implementing sustainable digital business strategies. Vial (2019) adds that with tangible assets diminishing in significance relative to services and consumer feedback and complex network values expanding, companies are plunged into greater uncertainty. This is compounded by the fact that many organisations adopt new technologies as the result of external pressure rather than a proactive strategy (Sarrikko et al. 2020).

Research shows that the right mindset, rather than technological access, is key to successful DT, with a supportive culture being indicative of companies that are maturing digitally (Kane et al. 2015). In their study on seeding new analytics capabilities within a traditional organisational context, Gust et al. (2017) highlight three immediate challenges to successful DT: identifying new business value sources, fostering follow-up initiatives by enhancing the technological skills of employees, and ensuring access to pertinent data sources. Their study results in four key lessons: 1) focus on building onto existing business processes; 2) enhance data awareness to overcome data 'blindness'; 3) use agile development practices; and 4) transit to open platforms.

The path to digital reorientation is intricate, demanding a comprehensive overhaul of traditional BMs and practices, which might mean discarding long-standing processes and attitudes (Sarrikko et al. 2020). Sebastian et al. (2017) offer strategic insights for a successful digital transition, highlighting the need for a coherent digital strategy, a strong operational foundation, and a digital services platform that encourages innovation and collaboration. The significant restructuring at General Motors, which involved major layoffs, is a stark reminder of the profound impact of DT, which forces businesses to fundamentally re-evaluate their core strategies and market offerings (Sarrikko et al. 2020). DT transcends simple technology uptake, redefining organisational frameworks and value propositions (Krotov 2017).

In conclusion, the literature stresses that traditional organisations must adapt to thrive in the digital landscape. There are many potential challenges, but failing to adapt poses even greater risks. Embracing DT entails reimagining business strategies, cultivating a culture that values digital innovation and technology, and understanding the new, interconnected digital business ecosystem—all pivotal for navigating the complexities of modern organisational transformation.

3 Exploring the Foundations: Key Factors Influencing Digital Transformation[1]

To advance our understanding of DT and explore various dimensions such as challenges, collaboration, and impacting technologies, it is imperative to first identify the key factors influencing DT. Understanding these factors lays the groundwork for a more nuanced investigation into how organisations can effectively navigate DT. By pinpointing critical influencers, researchers can better assess the barriers and enablers of DT, thus offering more targeted insights and strategies for traditional organisations undergoing the change. In the forthcoming sections of this thesis, outcomes of an extensive literature review aimed at uncovering key factors of DT are presented.

3.1 Motivation and Relevance

Researching DT has a profound impact on modern organisations, and successfully navigating this complex landscape requires a comprehensive understanding of the process and the factors that impact its success. DT has evolved from a technological enhancement to become a critical necessity for organisations aiming to meet the dynamic demands of a global population.

Organisations need to shift their strategies to remain competitive and relevant in the digital era (Kraus et al. 2021). Moreover, the onset of the COVID-19 pandemic in early 2020 initiated an unforeseen global crisis and significant shifts in how organisations operate, accelerating their DT processes. Businesses had to navigate the challenges of lockdowns and economic disruptions; for example, companies like Airbnb carried out massive employee layoffs (Hu and Lee 2020) and were simultaneously compelled to adopt digital working practices and shift to digital channels (Almeida et al. 2020).

The transition to digital maturity involves more than the adoption of technology; it requires a significant cultural and organisational shift. Studies show that organisations' attitudes and readiness, rather than their access to technology, play a decisive role in successful DT, highlighting the importance of fostering a culture that is supportive of digital initiatives (Kane et al. 2015). The need to understand the key factors influencing DT is underscored by the challenges organisations face, such as resistance to change, the need for new BMs, and the need to integrate digital technologies into established processes.

Organisations that fail to adapt risk falling behind, as digital technologies can disrupt even the most stable industry giants (Nylén and Holmström 2015). The pandemic magnified the urgency of understanding DT and its influencing factors, highlighting the role of digital technologies in organisational agility and resilience (Vial 2019; Günther et al. 2017; Hong and Lee 2017).

[1] This chapter is based on the study "*The Impact of the COVID-19 Lockdown on Digital Transformation in German Organisations*" published in *Proceedings of the European Conference on Information Systems*.

3.2 Theoretical Background

DT is a pivotal subject gaining traction in scholarly discourse and practical application across diverse sectors (Hanelt et al. 2020). Organisations are keen to enhance their operations and offerings by digitalizing their products and services, yet they encounter challenges in fully actualizing their DT initiatives (Hess et al. 2016). A significant obstacle in academic research is the lack of consensus on DT's definition, which complicates the term's conceptual clarity (Vial 2019). Although "digitization," "digitalization," and "digital transformation" are terms frequently used interchangeably, their interpretations vary, influencing different aspects and outcomes of transformation processes. Vial (2019, p. 9) defines DT as a *comprehensive process that aims to augment an entity through substantial changes induced by the synergy of information, computing, communication, and connectivity technologies*. This definition draws upon an extensive review of 282 studies in IS research (Vial 2019).

According to Matt et al. (2015, p. 340), effective DT strategies encompass four key dimensions: technological utilization, value creation evolution, structural alterations, and financial considerations, indicating that DT transcends mere digital product and service transitions (Mergel et al. 2019; Smajlovic et al. 2021). DT processes deeply influence organisational structures and product strategies, necessitating alignment with both internal dynamics and external stakeholders such as public administrations and market partners (Mergel et al. 2019; Islam et al. 2017; Svahn et al. 2017). This alignment may be influenced by various factors, including legislative frameworks which can either support or obstruct DT endeavors.

Extending the framework proposed by Matt et al. (2015), Gurbaxani and Dunkle (2019, p. 212) introduce a six-dimensional perspective on DT, adding strategic vision, innovation culture, know-how, digital capabilities, strategic alignment, and technological assets to the mix. These comprehensive views highlight DT's multifaceted nature, emphasizing its broad impact on organisational and environmental aspects.

While the COVID-19 pandemic has underscored the urgency of accelerating DT, particularly as organisations pivot to remote operations and digital sales channels (Richter and Mohr 2020), financial constraints pose significant hurdles (Berg 2020; Karabasz 2020). Despite the imperative to adapt, securing the necessary financial and talent resources remains a pressing challenge. In light of these dynamics, this first study aims to investigate the evolving landscape of DT, exploring what are the key influencing factors of DT. Such exploration intends to offer valuable insights into the strategic imperatives and potential trajectories of DT across various industries.

3.3 Methodology

This study follows a qualitative research methodology in the form of an SLR that identifies the factors influencing DT in organisations, as suggested by Webster and Watson (2002). It is based on existing conceptual and empirical studies that consider DT and digitalisation (Paré et al. 2015).

The study follows a rigorous protocol consisting of a replicable, scientific and transparent process introduced in Tranfield et al. (2003), a highly cited standard reference for the SLR method in IS research. This chapter entails a detailed description of the method and analysis process in support of reproducibility (vom Brocke et al. 2009). The focus is on DT, but multiple terms are included due to their synonymous usage. The exploratory search shows that DT is often understood as the digitalisation of internal processes, although these are differentiated in scholarly work.

Therefore, search terms are the following: (‘influence’ OR ‘impact’) AND (‘DT’ OR ‘on digitalisation’ OR ‘on digital products’ OR ‘on digital services’). The literature search employs the following databases: ACM Digital Library, AIS eLibrary, EBSCOhost Business Source Premier, ScienceDirect, SpringerLink and Web of Science with title, abstract, keyword and full-text searches and no publication-date limits. Only peer-reviewed content (e.g., conference papers and journal articles) is included, and duplicates are removed to ensure the validity of the reviewed literature. The initial list consists of 1,779 publications in all highly ranked sources in the period ending in early 2020. After reading through the titles and abstracts, the publications are filtered based on topic relevance. Out of this process, 160 studies are selected for a focal analysis, which includes reading the full text of the items identified; based on topic and journal relevance, 24 publications are selected. Five additional studies are identified in a backward and forward search. The final sample includes 29 publications (*Figure 2*).

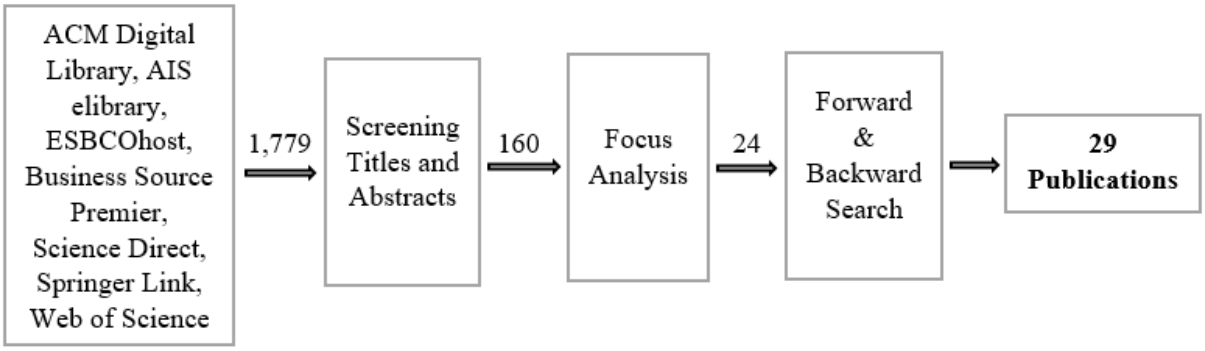


Figure 2: Systematic Literature Review Process

To establish a comprehensive framework for the results, findings are organized into six categories of influencing factors. Grounded theory techniques (Charmaz 2006) were employed to identify all DT-influencing factors mentioned in the selected publications. Through axial coding, relationships between the identified influencing factors were determined, facilitating the creation of categories that encompass all identified factors, resulting in a high-level framework that provides an overview of DT influencing factors. This framework forms the foundation for the interview guide used in the following study.

3.4 Key Influencing Factors on Digital Transformation

From 29 relevant publications identified through the literature search, a total of 59 influencing factors were extracted and categorized into six groups, as shown in Table 1. In this table, all key factors influencing DT are listed. The factors mentioned in the literature are categorized on the left, with the corresponding sources on the right. These categories are based on drivers and dimensions of DT identified in the reviewed literature and include those discussed by Matt et al. (2015) and Gurbaxani and Dunkle (2019). The categories of DT factors and the count of influencing factors (in parenthesis) are as follows: digital leadership (10), a culture of innovation (15), capabilities (12), strategy (8), technical infrastructure (8), and product and services fit (6).

The initial findings from the SLR reveal a consensus regarding most factors influencing the DT of organisations. They show that the DT emerges as a process influenced by organisational elements like leadership, culture, and strategy. It represents a gradual shift in mindset rather than an abrupt, prescriptive change process. Despite the constraints of the COVID-19 lockdown, effective digital leadership is expected to persist in driving organisational transformation, albeit through modified approaches during a crisis. However, successful DT is contingent upon adequate technical infrastructure and a clear, customer-centric objective.

	Influencing Factors on DT	Source(s)
Digital Leadership	Understanding of executives	Dremel et al. 2017; Gurbaxani and Dunkle 2019
	Establishment of new, dedicated roles	Dremel et al. 2017; Tumbas et al. 2018
	Commitment from executives	Ancarani et al. 2019; Dremel et al. 2017; Herri et al. 2019; Karimi and Walter 2015; El Sawy et al. 2016
	Definition of a digital strategy	Gurbaxani and Dunkle 2019
	Communication of the digital strategy	El Sawy et al. 2016
	Significant return on investment	Herri et al. 2019
	Setting up a clear, strategic goal	Gurbaxani and Dunkle 2019; Herri et al. 2019; Islam et al. 2017; Sebastian et al. 2017
	Promotion of a culture of innovation	Alos-Simo et al. 2017

	Leaders who support digitalization	Goerzig and Bauernhansl 2018; Gurbaxani and Dunkle 2019
	Establishment of a culture of agility	Babatunde and Oshodi 2019
Culture of Innovation	Culture of digital transformation	Chudaeval et al. 2020; Gürkan and Çiftci 2020; Herterich et al. 2016
	Fail-and-learn culture	Dremel et al. 2017; El Sawy et al. 2016; Gurbaxani and Dunkle 2019
	Promotion of risk-taking mindsets	El Sawy et al. 2016; Goerzig and Bauernhansl 2018; Gurbaxani and Dunkle 2019
	Empathetic work conditions	El Sawy et al. 2016
	Empowerment of employees	Ancarani et al. 2019
	Encouragement for employees	Gurbaxani and Dunkle 2019
	Promotion of innovations	Dremel et al. 2017; Herri et al. 2019
	Reward for innovators	Gurbaxani and Dunkle 2019
	Promotion of pioneering spirit	Herterich et al. 2016
	Curiosity towards technologies	Goerzig and Bauernhansl 2018; Matt et al. 2015
	Rethinking existing offerings	Eidhoff et al. 2016
	Transparent management of data	Dremel et al. 2017; El Sawy et al. 2016
	Overcoming cultural resistance	Gurbaxani and Dunkle 2019
	Development of digital competencies	Ganz et al. 2019; Goerzig and Bauernhansl 2018; Gurbaxani and Dunkle 2019; Islam et al. 2017
Capabilities	Big data competencies	Dremel et al. 2017
	Development of digital soft skills	Gurbaxani and Dunkle 2019; Leite et al. 2019
	Development of information management capabilities	Levallet and Chan 2018
	Competencies to use technologies	Gurbaxani and Dunkle 2019; Matt et al. 2015
	Employee upskilling and training	Ancarani et al. 2019; El Sawy et al. 2016; Herri et al. 2019; Porter and Heppelman 2015; Wildgrube et al. 2019
	Internal knowledge transfer	Goerzig and Bauernhansl 2018
	Fostering diverse skill sets	Herterich et al. 2016
	External competencies	Dremel et al. 2017
	Collaboration with partners	El Sawy et al. 2016; Herterich et al. 2016
	Capabilities to develop new BMs	El Sawy et al. 2016

	Capabilities to promote DT	Butschan et al. 2019
	Middle management empowerment	Herterich et al. 2016
Strategy	Consideration of employee capacities	Ladeira et al. 2019; Karimi and Walter 2015
	Partnerships and ecosystems	Goerzig and Bauernhansl 2018; Islam et al. 2017; Olsen et al. 2020; Sebastian et al. 2017; Svahn et al. 2017
	Funding with uncertain ROI	Eidhoff et al. 2016; Gurbaxani and Dunkle 2019; Herri et al. 2019; Ladeira et al. 2019; Matt et al. 2015; Karimi and Walter 2015
	Cannibalization of revenue streams	Gurbaxani and Dunkle 2019
	New forms of software	Gurbaxani and Dunkle 2019
	Revising organisational structure	Hess and Barthel 2017; Levallet and Chan 2018; Matt et al. 2015; Porter and Heppelman 2015; Svahn et al. 2017
	Enablement of interdisciplinary work	Dremel et al. 2017; El Sawy et al. 2016; Gurbaxani and Dunkle 2019; Herterich et al. 2016; Sebastian et al. 2017; Yeow et al. 2018
	Amount of existing data	Dremel et al. 2017
Technical Infrastructure	Providing a competent IT department	Dremel et al. 2017
	Providing good software support	El Sawy et al., 2016; Goerzig and Bauernhansl 2018; Gurbaxani and Dunkle 2019; Ladeira et al. 2019
	Providing good hardware support	Islam et al. 2017; Ladeira et al. 2019
	Ensuring good infrastructure quality	Goerzig and Bauernhansl 2018; Henfridsson and Bygst 2013; Herri et al. 2019
	Ensuring good infrastructure capacity	Herri et al. 2019; Herterich et al. 2016
	Good infrastructure flexibility	Levallet and Chan 2018
	Implementation of new technologies	Gurbaxani and Dunkle 2019
	Product development cycles	Dremel et al. 2017; Svahn et al. 2017
Product and Services Fit	Targeting customer pain points	Dremel et al. 2017; Islam et al. 2017
	Serving market demands	Islam et al. 2017
	Compatibility with existing offerings	El Sawy et al. 2016; Matt et al. 2015
	Value added through DT	Herterich et al. 2016; Matt et al. 2015
	Ensuring a good user experience	El Sawy et al. 2016

Table 1: Overview of Influencing Factors on the Digital Transformation

3.5 Discussion

Identifying the key factors impacting DT is essential for establishing ways for traditional organisations to successfully navigate their transformation efforts. This chapter provids the discussion on the key influencing factors, their categorisation and their implications using a grounded approach backed by the literature.

Digital Leadership. Central to DT is digital leadership, which requires executives to have a nuanced understanding of the digital landscape (Dremel et al. 2017; Gurbaxani and Dunkle 2019). The establishment of new roles dedicated to digital initiatives underscores the organisational commitment to transformation (Dremel et al. 2017; Tumbas et al. 2018). Leaders must exhibit a strong commitment to digital agendas and champion a culture that supports digitalisation and sets clear strategic goals (Ancarani et al. 2019; El Sawy et al. 2016). The communication of a digital strategy is fundamental to ensuring that all organisational members are aligned and motivated to meet shared digital objectives (Gurbaxani and Dunkle 2019; El Sawy et al. 2016).

Culture of Innovation. Fostering a culture that embraces DT is also critical for its success (Chudaeval et al. 2020; Gürkan and Çiftci 2020). Organisations must cultivate an environment where failure is viewed as a learning opportunity (Dremel et al. 2017; El Sawy et al. 2016) and where innovation is not only encouraged but rewarded (Herri et al. 2019; Gurbaxani and Dunkle 2019). Empowering employees to experiment and research new ideas is essential for sustaining an innovative culture that can adapt to and capitalise on digital opportunities (Ancarani et al. 2019; Gurbaxani and Dunkle 2019).

Capabilities. The development of relevant capabilities, particularly around big data, digital soft skills, and information management, is required to leverage digital technologies effectively (Dremel et al. 2017; Gurbaxani and Dunkle 2019). Organisations must invest in upskilling and training their workforce to ensure that employees can navigate and contribute to the digital ecosystem (Porter and Heppelmann 2015; El Sawy et al. 2016).

Strategy. Strategic DT considerations include the alignment of employee capacities and organisational goals, as well as the nurturing of partnerships and ecosystems to enhance digital capabilities (Goerzig and Bauernhansl 2018; Islam et al. 2017).

While the return on investments in digital initiatives might be uncertain, strategic funding decisions are essential for nurturing innovation and rethinking organisational structures to support digitalisation (Karimi and Walter 2015; Gurbaxani and Dunkle 2019).

Technical Infrastructure. A robust technical infrastructure is the backbone of any successful DT initiative. This must include competent IT support, advanced software and hardware, and must be flexible and scalable to accommodate the organisation's evolving digital needs (Dremel et al. 2017; El Sawy et al. 2016; Goerzig and Bauernhansl 2018).

Product and Services Fit. Finally, ensuring that DT initiatives are closely aligned with customer needs and market demands is fundamental. Organisations should also ensure that new digital offerings are compatible with existing products and services and add discernible value to the customer experience (Dremel et al. 2017; Matt et al. 2015).

3.6 Theoretical and Practical Contribution, Future Research Outlook and Limitations

This study advances the understanding of DT. By synthesising insights from a range of sources, it offers a comprehensive framework of the key factors influencing DT. These factors are categorised according to six distinct dimensions: digital leadership, culture of innovation, capabilities, strategy, technical infrastructure, and product and service fit. This categorisation provides a structured lens through which to analyse DT initiatives. We adopt and extend definitions from influential studies (e.g., Gurbaxani and Dunkle 2019; Matt et al. 2015) to enrich the conceptualisation of DT by acknowledging its multifaceted and dynamic nature.

Moreover, drawing on the literature, the study underscores the integral role of organisational factors such as leadership commitment, cultural adaptiveness, and strategic alignment in driving DT (Dremel et al. 2017; El Sawy et al. 2016). It illustrates how these factors relate to shaping the trajectory and success of DT efforts. By summarising specific digital capabilities, the study offers insights into how organisations develop these competencies to enhance their digital maturity and transformation success (Porter and Heppelmann 2015; El Sawy et al. 2016).

The findings also provide actionable insights for managers and decision-makers in traditional organisations embarking on or steering DT initiatives. The critical influencing factors serve as a strategic guide for prioritising resources, designing interventions, and aligning organisational efforts towards effective DT. Organisations can use the framework to assess their current DT status, identify gaps, and plan targeted improvements across the identified dimensions, facilitating a more structured and informed approach to managing DT.

Finally, the emphasis in the framework on leadership and culture has practical implications for nurturing an environment conducive to digital innovation. In particular, it highlights the importance of executive support, a culture of innovation, and employee empowerment in DT success.

Although the study provides a comprehensive overview of influencing factors, the dynamic and evolving nature of digital technologies means that new factors may emerge. Future research could explore additional or emerging factors that influence DT.

The study primarily synthesizes findings from the existing literature, which may not fully capture organizational contexts or industry-specific challenges. Future studies could investigate how these factors play out in different sectors or cultural settings, offering a more nuanced understanding of the DT landscape.

The proposed framework and factors would benefit from empirical validation through case studies, surveys, or longitudinal research. Such empirical approaches could test the relationships and impacts suggested here, providing robust evidence for the theoretical constructs outlined. Moreover, given the transformative impact of the COVID-19 pandemic on digitalization, future research should consider how the various influencing factors have evolved and what new dynamics have emerged in the post-pandemic landscape.

Furthermore, given the rapid advancements in technologies such as AI, IoT, and blockchain, future research could explore how these technologies specifically influence DT and what new capabilities organizations might need to develop to leverage these technologies effectively. The evolving technological landscape suggests that organizations must continually adapt and refine their strategies to stay competitive. Exploring the intersection of these technologies with DT could provide valuable insights into the future directions of DT and the capabilities required to navigate this complex terrain.

Overall, while this study offers a foundational understanding of the factors influencing DT, it also highlights the necessity for ongoing research to keep pace with the fast-moving digital landscape. Future investigations should aim to provide deeper, context-specific insights and validate theoretical models with empirical data, ensuring that organizational strategies for DT remain relevant and effective in an ever-changing environment. Furthermore, exploring the long-term implications of digital transformation on business models and value creation strategies can offer valuable perspectives for both scholars and practitioners.

Additionally, investigating the role of leadership in fostering a culture of innovation, examining the impact of digital competencies on organizational agility, and identifying best practices for managing remote work are critical areas for further study. Moreover, delving into the integration of sustainability considerations into DT strategies and exploring how advancements in technology can harmonize with sustainable business practices would enrich the academic discourse and provide practical guidance for organizations navigating the complexities of the digital era.

4 From Theory to Practice: Examining the Evolution of Digital Transformations´ Key Influencing Factors[2]

This study investigates the impact of the pandemic on DT to empirically test and potentially refine the list of key influencing factors identified in the previous section. This chapter integrates theoretical insights with practical observations from expert interviews to provide a nuanced understanding of how the COVID-19 pandemic influenced DT dynamics. It assesses the evolution or stability of the identified factors, such as leadership commitment, innovation culture, and technical infrastructure, in the context of the pandemic. Additionally, it considers whether any new factors emerged as significant in shaping DT during this period, thereby providing a detailed examination of the pandemic's role in influencing organisation's DT.

4.1 Introduction

In Germany, as in other parts of the world, the sudden lockdown due to the COVID-19 pandemic went from causing individual difficulties to having a massive impact on organisations and the global economy (Ågerfalk et al. 2020; Kamal 2020). Many businesses were forced to close, reduce operations, or even lay off people. For example, Airbnb cut about a quarter of its direct employees (Hu and Lee 2020). Other organisations were able to promptly adapt to new ways of remote work and adapt their BMs to new realities (Carroll and Conboy 2020; Leidner 2020). There were massive changes in internal processes, employee demands, organisational structures, and market demands as a result of the lockdowns (Soto-Acosta 2020). For instance, there was a marked increase in customers' willingness to use digital channels, services, and products (Almeida et al. 2020; Richter and Mohr 2020).

Recent research shows that consumers are more open to new products and services when their usual habits are disrupted (Ho et al. 2020). The changes are seen in consumer behaviour (i.e., affinity for digital channels) and in working habits in response to short-term requirements. These changes have the potential to trigger long-lasting transformations in the digital landscape; it will become the 'new normal' to work from home or buy everything online (Kamal 2020). A social media analysis indicated that remote work would likely remain after the pandemic is over (Wrycza and Maślankowski 2020). And, we see nowadays that this is in many cases true.

[2] This chapter is based on the study "*How to Drive Digital Transformation in a Pandemic and Beyond: Learnings from COVID-19 Crisis*" published in *Proceedings of the Pacific Asia Conference on Information Systems*.

Therefore, it is increasingly relevant to build a better understanding of DT processes and challenges. Vial (2019, p. 50) reviews the DT literature in the IS field and calls for a more comprehensive understanding of DT at various levels of analysis.

He notes the need to 'better understand the strategic implications of DT and the dynamic interactions that take place between firms and their environment as digital technologies continue to impact these interactions'. This necessity gained even higher significance as a result of the COVID-19 pandemic. The social distancing requirements and multiple restrictions motivated the establishment of novel BMs and accelerated the use of technology. Scholars argue that increased DT of companies will ensure that they are more 'crisis-proof' for the future (Dwivedi et al. 2020). However, these circumstances also raise many questions for the future: How should our working habits and lifestyle look after COVID-19 (Boland et al. 2020)? Will this new normal simply become our normal? Are the adaptations of BMs and changes during this period also suitable for the future without COVID-19? Several scholars call for investigations (e.g., Ågerfalk et al. 2020; Rai 2020; van der Aalst et al. 2020) into these issues.

There is a strong impetus to examine the pandemic's impact on DT drivers within organisations and the consequent effects on both research and practice (e.g., Ågerfalk et al. 2020; Leidner 2020). Therefore, we conducted interviews with knowledge workers from German organisations to obtain insights on the changes induced by the lockdown. We include entities of various sizes and sectors to ensure a comprehensive understanding of different organisational contexts. The objectives of this investigation are multifaceted. First, it is intended to augment the existing body of knowledge by introducing new factors that significantly influence the transformation of processes, products, and services. Second, it is intended to pinpoint critical drivers of DT during the crisis and offers guidance for organisations to enhance their preparedness for a potentially altered future. Third, it is intended to identify areas for further inquiry to solidify the guidance provided.

The structure of the remainder of this study is as follows. Following an introduction to the theoretical foundations of DT and its determinants, we offer our detailed methodology, including the approach to data gathering and the analytical procedures employed. Finally, the empirical outcomes are presented. We then discuss these findings and conclude by outlining the implications for future research and practical application.

4.2 Theoretical Foundation

Pre-pandemic DT is understood as a comprehensive change process that integrates digital technology into all areas of a business, fundamentally changing how organisations operate and deliver value to customers (Matt et al. 2015; Vial 2019). It is distinguished by its emphasis on holistic change that impacts various organisational dimensions, including strategy, culture, and infrastructure. Pre-pandemic studies describe DT as a multifaceted process influenced by various organisational, technological, and environmental factors (Hanelt et al. 2020; Vial 2019).

The pandemic necessitated a re-evaluation of these factors, and researchers and practitioners were urged to scrutinise the evolving DT dynamics. The onset of the pandemic amplified the urgency and the scope of DT, pushing organisations to rapidly adapt their processes, products, and services to a digital-first environment (Richter and Mohr 2020; Almeida et al. 2020).

The pre-pandemic literature identifies numerous factors influencing DT; a thorough analysis of these is offered in the study in the preceding section. Each of the identified factors has a crucial role in shaping the trajectory and effectiveness of DT initiatives. For instance, digital leadership is pivotal in setting a vision for DT (Dremel et al. 2017; El Sawy et al. 2016). The pandemic further catalysed DT, accelerating digital adoption and forcing a re-evaluation of existing DT strategies and models. Organisations have had to confront immediate demands for digitalisation, often reshaping their infrastructure, strategies, and operations in real time to maintain continuity (Leidner 2020; Ågerfalk et al. 2020). These circumstances highlighted the resilience of organisations and exposed new vulnerabilities and challenges, demanding a fresh look at the factors influencing DT in the post-pandemic era.

DT is far-reaching and needs to include the organisation, its products and services and the external environment. COVID-19 mainly affected environmental factors, which, in turn, caused organisations to change. Shutting down physical interactions accelerated the DT trend (Dwivedi et al. 2020; Leidner 2020). The pandemic-related challenges increased organisations' awareness of DT (Richter and Mohr 2020), as distanced interactions are rarely feasible without digitalisation. Nevertheless, multiple sources claim that despite the need for DT, organisations have limited financial resources (e.g., Berg 2020; Karabasz 2020). Finding digital talent was already a challenge (Dahlander and Wallin 2018) and is becoming increasingly difficult due to increased demand.

The background for this research is created by reviewing studies on DT challenges related to or caused by the pandemic. However, most of the studies identified are not properly scientific; these include editorials, critiques, and individual opinions.

For instance, recently published opinion pieces argue that organisations must transform their digital capability to deal with future crises (Fletcher and Griffiths 2020; Leidner 2020). Soto-Acosta (2020) argues that the pandemic is accelerating DT by forcing businesses to join digital business platforms, automate tasks, or facilitate remote working with virtual tools. Kamal (2020), by contrast, points to the pandemic's effects that have been disruptive (i.e., digitalisation and transformation of business processes and operational practices) and destructive (economic crisis). Leidner (2020) claims, however, that COVID-19 opened space for new BMs and opportunities from the combination of digital and traditional businesses (e.g., blended learning that combines onsite and e-learning).

Marabelli et al. (2021) also discuss the impact of IT on organisational practices during and after the pandemic. They describe 'digital scars' that might remain due to the irresponsible usage of technologies during the pandemic. In particular, those scars are 'ethically problematic sociotechnical innovations that outlast their emergency rollouts, when broader effects of these technologies could not be carefully examined'. Lastly, Dwivedi et al. (2020) assess the key challenges of COVID-19, outlining experts' opinions on different topics (e.g., online learning, digital strategy, AI). Although these studies are highly valuable for future research, many are only reflections, individual opinions, and remarks.

The commentary by Dey et al. (2020) sheds light on a need for empirical evidence and conceptual enrichment in the wake of the COVID-19 pandemic. Several scholars discuss research areas and methodologies suitable to investigate concepts in relation to the emerging crisis, such as virtual collaboration, new technologies, and remote work (e.g., Dwivedi et al. 2020; Fink 2020; Ting et al. 2020). Only a few empirical studies consider the link to DT.

Waizenegger et al. (2020) study the negative effects on team collaboration of mandatory work from home. They find that virtual collaboration decreases spontaneous knowledge sharing and, as such, threatens the problem-solving and innovation capabilities of teams. Recent research indicates that while there are virtual alternatives, these cannot replace onsite meetings entirely (Whillans 2021). Kodama (2020) finds a substantial increase in the use of cloud-based collaboration tools (e.g., Teams, Slack, and Zoom), while Hacker et al. (2020) show how social technologies (e.g., Zoom) allowed a new virtual togetherness during the lockdown by facilitating access to everyday activities and contacts that were 'locked away'. Finally, Abbu et al. (2021) analyse the unprecedented DT experienced by the grocery business and accelerated by the pandemic. These articles show how organisations struggled to manage the enforced digital shift to maintain business continuity.

Papagiannidis et al. (2020) and Papadopoulos et al. (2020) discuss how organisations can be more prepared for future crises and minimise risks to business continuity. Seetharaman (2020) concludes that an organisation's chance of survival is associated with its agility and its ability to seize opportunities.

This study is intended to help organisations on this path by exploring how such struggles could transform into opportunities. The aim is to explore how the key factors influencing DT in organisations have changed and what we can learn from such changes. The SLR in the study above helps to construct a more comprehensive list of DT drivers. The existing research is assessed to gather all relevant literature related to DT and its key influencing factors. These are listed and sorted into six categories, as shown in *Table 1*.

Each DT success factor must be re-examined in the wake of the pandemic. For instance, digital leadership now extends beyond vision setting to ensuring agility and rapid decision-making in crisis situations (Ancarani et al. 2019; Herri et al. 2019), while a culture of innovation must accommodate remote collaboration and digital ideation (Chudaeval et al. 2020; Gürkan and Çiftci 2020).

4.3 Methodology

This study mainly follows the principles of planning, designing, preparing, collecting, analysing, and sharing data described in Yin (2009). It is based on qualitative interviews that offer rich descriptions of DT as the basis for further statistical analysis, contributing to the literature and providing lessons for practitioners (Wiesche et al. 2017). The research model, depicted in *Figure 3*, outlines the study's approach.

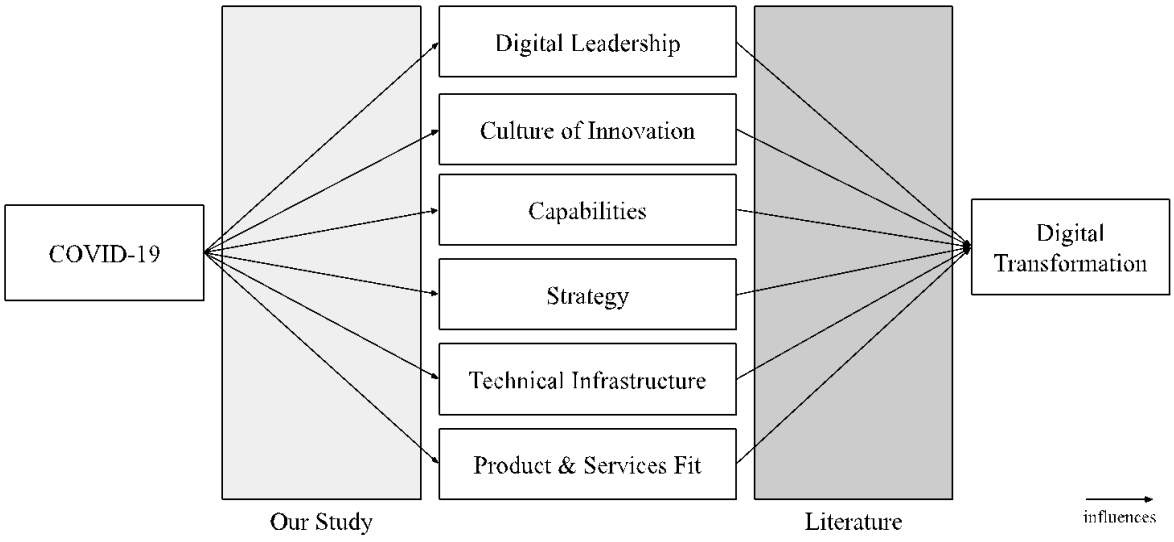


Figure 3: Research Model

4.3.1 Data Collection and Interview Setting

Representatives from various industry sectors were selected to participate in interviews to ensure a diverse and comprehensive understanding of organisational responses to DT. A representative is defined as an individual capable of providing detailed insights into the DT process within their respective organisation. These individuals, or 'knowledge workers,' use knowledge as their primary asset and tool in their professional role; those included in this group range from engineers and managers to programmers, consultants, and business developers (Davenport 2005). Following the methodology outlined by Yin (2017), the selection of interviewees was based on a heterogeneous purposive sampling approach, considering individuals in managing roles, those with a comprehensive understanding of DT within their organisation, or those with over three years of experience in their current role.

ID	Industry	Function
I-1	Automotive	Development of a digital software for controlling and finance
I-2	Food	Digitalization of processes within the supply chains
I-3	Consulting	Connecting digital collaboration and activities
I-4	Engineering	Development of digital services and applications
I-5	Consulting	Change management in consulting services
I-6	Manufacturing	Digitalization of financial processes
I-7	Consulting	Provision of software development services
I-8	Technology	Digitalization of the retail sector
I-9	Finance	Developing software for regulatory processes
I-10	Production	Development of digital services for sanitary facilities
I-11	Finance	Creating new solutions using technology possibilities
I-12	Software	Improving customer experience through digitalization
I-13	IT Consultancy	Consulting services related to the DT processes
I-14	Media	Management of communication tools and channels
I-15	Transportation	Management of customer networks and needs

Table 2: Overview of the DT Interviewees

Contact with potential participants was established through personal networks via LinkedIn or other preferred communication channels. A total of 15 interviews were conducted. Participant details, including industry and function, are summarised in Table 2. The willingness of all contacted individuals to participate reflects their interest in DT and their readiness to share their perspectives. Invitations to participate included a brief overview of the study, avoiding additional preparatory materials so that participants' unfiltered perceptions of DT in their organisations can be captured in the interview.

A semi-structured interview guide was employed, comprising fourteen open-ended questions. If participants pre-emptively addressed a query, this was acknowledged, and they were asked if they wished to expand on their earlier responses. The interview guide is based on the findings from the SLR presented in Table 1 and from the study above that formed the preliminary groundwork for this investigation. While the DT drivers identified in prior research inform the interview guide, they were not intended to confine the study's scope

The aim is to employ the factors identified in the literature as influencing DT as a reference point for participants, encouraging them to reflect and provide personal insights without constraining their responses. By framing open-ended questions, the expectation was to identify additional drivers not previously acknowledged in the literature. The interviews were conducted from October 2020 to March 2021 and took place virtually to ensure the safety of all involved. Each interview was a one-on-one session lasting approximately 30 to 45 minutes, utilising built-in recording technologies of the communication platforms used, including Microsoft Teams. Participant consent for recording, storage, and processing is obtained at the beginning and reaffirmed 'on tape' as an alternative to a written declaration; basic demographic information, such as industry, role, and age, is requested, with minimal personal data collected out of respect for participant privacy.

4.3.2 Coding and Data Analysis

Data analysis was conducted using structured content analysis following Lacity and Janson (1994) and Mayring (2002) and adhere to the seven principles of interpretive field research by Klein and Myers (1999). The analysis focuses on understanding participants' perspectives on the COVID-19-related factors influencing DT, iterating through individual responses to synthesize insights. Open coding is applied to the entirety of the data, followed by selective coding iterations that align codes with categories identified in the SLR (referenced in Table 1).

	DL	COI	DC	S	TI	PSF	Total
# Total	71	55	73	40	40	70	**349**
# Duplicates	31	22	47	17	19	48	**184**
% Duplicates	44%	40%	64%	43%	48%	69%	**53%**

Legend: DL – Digital Leadership | COI – Culture of Innovation | DC – Digital Capabilities | S – Strategy | TI – Technical Infrastructure | PSF – Product and Services Fit

Table 3: Overview of Duplicate Ratios in Codings

Additional categories are inductively formulated during the selective coding phase if existing ones do not align; the intention is to enhance the current model, especially regarding the impacts of COVID-19. Coding units consist of sentences and paragraphs that elucidate COVID-19-induced changes. For validity and reliability, new categories are only acknowledged if mentioned by over half the participants (at least eight). Independent coding by two researchers enhances the study's rigour and reliability; QCAMap is employed for this process (Fenzl and Mayring 2017). Out of a total of 349 statements coded, the congruency between coders ranges from 40 to 60%, with the overall duplication rate at 53%. Table 3 presents a breakdown of these duplicates by their primary driver. The average congruency is attributed to the coders' varied backgrounds, which influence their interpretation of participants' statements, as highlighted by prior research (Armstrong et al. 1997). Thus, the incorporation of both sets of coding results and the deliberation on all divergent coding (e.g., different categories, coded/non-coded) are employed to achieve consensus.

4.4 Results

Table 4 displays the key drivers of DT identified during the COVID-19 lockdown, each illustrated with a quote. The subsequent discussion centres on newly identified drivers and those with characteristics that transformed due to the pandemic.

4.4.1 Digital Leadership

During the lockdown, the commitment and understanding of executives played a very important role in the DT of organisations, as one interviewee stresses: '[Digitalisation] is slightly accelerating but more in the way that leadership team is now even more aware of its importance.' (I-5).

The lockdown helped leaders become aware of the need for full dedication and commitment to the digitalisation of internal processes as well as products and services. As Interviewee I-3 stresses, ‘COVID for us was, besides all the pain and challenges, new frame conditions. We have seen that leadership in [a] digital environment is even more important, and we need to dedicate to bring that to life.’

While the lockdown may have prompted executives to better understand and commit, it created the challenge of remote and socially distant leadership: ‘[Leaders] see that they need new practices and [a] new mindset of routines to be productive without losing oneself. We are targeting a lot now the connection of oneself and to others through [a] screen.’ (I-5) Finally, the lockdown posed a new set of issues for leaders: ‘Now, [leaders] sometimes go even into more psychological issues related to the home office: What can I do if I do not have a separate working space, how I can distinguish between working and private.’ (I-1).

4.4.2 Culture of Innovation

The DT element that causes the most stress for management and employees is how to pursue innovation with a virtual setup. Although many interviewees praise the idea of virtual collaboration, most note that workshops and innovation processes were held back: ‘It is definitely harder. Some people [like] me are working really with pictures. I need my hands to dive in the non-existing world that which is really in your head. This kind of staff is hard to reach virtually.’ (I-9) Many interviewees state that they were unaware of or lacked effective virtual tools, methods and processes to, for instance, work on new business ideas. As an example, Interviewee I-4 states, ‘I think [the] third development we have seen is that productivity stayed high but innovation decreased so the companies see that they can be almost as productive from home as people work remotely together, but creative potential, innovation workshops - this is not as easy to transfer to a virtual space.’ Interviewee I-11 also notes that ‘During the crisis, people do work efficiently in a digital way, but this part when the innovation comes up, for example, where people have to discuss together, draw something or work in a team or maybe take a work trip this is going down.’

4.4.3 Digital Capabilities

The willingness of employees to digitally collaborate increased because they were forced to see the positive sides of such an effort: ‘For the very first time people are switching to a virtual space and see also the benefits that they do not have to travel a lot, that they are flexible with their time’ (I-3).

Many interviewees noticed multiple advantages of using virtual tools during the lockdown: ‘I think that we learned from this crisis that discussions on Skype or Teams or whatever digital tool may be even more effective and efficient than these discussion in one room where everyone wants to show off’ (I-1). Interviewees point out that, as a result, their digital capabilities generally improved. Most experts mention that although there is a need for basic training, due to the crisis, organisations have actually cut the budget for these. Finally, experts mostly agree that virtual training still has potential for improvement: ‘The biggest topic in the area of training is which tools should be used and how can virtual training be attractive. Everyone knows about online courses, but how can we excite the attendees?’ (I-12)

4.4.4 Strategy

Most interviewees point out that there is a lack of funding for new digitalisation projects, and despite the urgency, a smaller number of innovative initiatives despite the urgency thereof. As our interviewee put it: ‘Digitalisation has become more important, but due to the current situation, it has also become harder for companies to invest’ (I-7). Furthermore, at the beginning of the lockdown, existing projects and initiatives, as well as organisational structures, were somehow ‘questioned’. Revising organisational structure was another important factor for DT in organisations: ‘This acceptance really grew through COVID; we accept more and more that things do not have to be done here in Germany, and they can happen in Amsterdam or Vittoria or in the US somewhere’ (I-5)

4.4.5 Technical Infrastructure

The enhancement of IT department capabilities and remote support emerged as a pivotal driver of DT. For instance, one participant notes that ‘An increase in the speed and efficiency of IT response to queries is amazing, and this is probably because of the improvement in resource allocation in IT support’ (I-12). Interviewees underscore the critical role of IT support in DT success, citing enhancements such as ‘innovative hardware distribution systems’ (I-8). Additionally, during the initial stages of the lockdown, as one of the experts points out, ‘robust remote support is essential’ (I-11); remote support was very important, facilitating a seamless transition to remote work environments and compensating for the reduced onsite IT support.

Main Category	DT Drivers	Example Quote
Leadership	Effective Remote Leadership	'The challenge for leaders to work in an environment where they are not in the same physical room with their team, I think for some people that was quite new.' (I-3)
	Understanding of Executives	'Now, [leaders] try out new things and are open to the suggestions from the younger generation. I do think that a lot has changed.' (I-12)
	Commitment from Executives	'But all of this was quite slow in the past, adapting these new tools, but because of the pandemic these projects get the prioritized.' (I-9)
Culture of Innovation	Digital Collaboration	'People did not work from home; people did not even have phones or headphones. I would say that COVID tremendously accelerated and [put] this 20-30 years' jump into today.' (I-5)
	Virtual Innovation	'During the crisis people do work efficiently in a digital way but this part when the innovation comes up for example where people have to discuss together, draw something or work in a team or maybe take a work trip - this is going down.' (I-11)
Digital Capabilities	Development of Digital Competencies	'There's lots of things I've learned in terms of digital tools that I never even knew existed.' (I-15)
	Fostering of Internal Knowledge Transfer	'We have Skype sessions where you can dial in and then people explain how they used this and that working model. Internal learning but I am not aware of big digital trainings.' (I-7)
	Virtual Development of Capabilities	'Also, how can virtual training be attractive? Everyone knows about online courses, but how can we excite the attendees?' (I-12)
Strategy	Funding of Initiatives with Uncertain Return on Investment	'On the one hand, one is more open to invest to try out new things. There is more willingness to invest. Digitalization has become more important, but due to the current situation, it has also become harder for companies to invest.' (I-13)
	Revising Organisational Structure	'COVID is the reason you can question everything that you made so far.' (I-1)
Technical Infrastructure	Remote IT Support	'Since IT support is not possible onsite or at least reduced due to lesser demand. Thus, there were capacity reductions on this site and the digital support was strengthened.' (I-12)
	Competent IT Department	'They had hotline if you have problems, you can call them and they helped.' (I-2)

Product and Services Fit	Targeting new Customer Pain Points	'What we expect in the future once the crisis is gone, once a pandemic has come at that stage, what driving patterns? All of our customers will be quite different from what we had originally meant to be before Corona started.' (I-15)
	Serving Market Demands	'We have done several things and recognized that our customers have changed their behaviors due to the corona crisis and that we need to adapt our products and our thinking to the customers.' (I-14)

Table 4: DT Drivers during COVID-19 Lockdown

4.4.6 Product and Services Fit

Participants indicate that during the first lockdown, customer demands were changing: 'Requirements have definitely changed and also in a way that they are way more specific. Previously, [customers] postponed digital projects, but now they have received a radical push with the importance of digitalisation, and their requirements are much more specific and detailed' (I-12). They highlight the importance of agility and the need to react promptly: 'We have recognised that our customers have changed their behaviours due to the Corona crisis and that we need to adapt our products and our thinking to the customers' (I-14).

4.5 Implications for Research and Practice

This section elaborates on the findings and their implications for academia and industry, specifically focusing on actionable insights for navigating DT in pandemic contexts and potentially enduring changes. Key observations are summarised, particularly highlighting newly identified DT drivers that may become permanent post-pandemic, as outlined in Table 4. While there is extensive discussion in the literature on the established DT drivers, this discussion centres on novel drivers, identified through interviews, that may persist post-pandemic (Boland et al. 2020) and examines the pandemic's effects on pre-existing drivers.

Executive understanding and commitment remain paramount for successful DT, as these factors encourage and support the workforce and leadership (Ancarani et al. 2019; Dremel et al. 2017; Gurbaxani and Dunkle 2019; Herri and Handika 2019; Karimi and Walter 2015). The analysis validates these two elements as crucial DT drivers during the pandemic, and shows how the lockdowns had a positive impact on executive commitment and DT understanding within organisations. The shift to remote leadership emerged as a significant theme, illustrating executives' learning curve with respect to remote workforce productivity and trust (Bartik et al. 2020; Bartsch et al. 2020; Waizenegger et al. 2020; Kane et al. 2021).

At the onset of the lockdown period, the culture of innovation culture was not initially prioritised. Despite the recognised need for creative solutions (Kudyba 2020), challenges in fostering virtual innovation have become apparent.

The impact of collaboration systems on knowledge sharing underscores innovation's reliance on interaction (Kodama 2020), with lockdown potentially hindering innovative culture due to a reduction in spontaneous collaboration (Waizenegger et al. 2020). This analysis underscores the importance of digital competencies during the pandemic. Lockdowns catalysed the improvement of digital skills, primarily through internal knowledge exchange, transforming informal learning into more structured formats (Tynjälä 2008; Kyndt and Baert 2013). The findings suggest that there is an emerging focus on the development of virtual capabilities within IS research, emphasising engaging and interactive online learning methods (Soto-Acosta 2020). The strategy remains particularly important in organisational DT.

The lockdown also impacted funding for innovative initiatives, highlighting the need for structural reassessment and strategic reorientation to leverage potential post-crisis opportunities (Dwivedi et al. 2020; Kamal 2020). Technical infrastructure, particularly remote IT support, emerged as a crucial enabler for DT during lockdowns. The distinctiveness of remote support (as compared to conventional IT assistance) demands further investigation into its role in organisational DT. Lastly, the pandemic's impact on the alignment of products and services with market demands signifies a shift in organisational focus towards agility and responsiveness to rapidly evolving customer needs; companies need to reassess their operational and strategic approaches to maintain relevance and competitiveness in a changing market landscape.

4.6 Conclusion

The COVID-19 pandemic and the resultant lockdown posed significant challenges for public health systems and economies worldwide (McKibbin and Roshen 2020). Unpreparedness was evident across the board, and most nations implemented extensive lockdowns. Organisations were compelled to swiftly transition to digital operations, adopting online practices and digital product offerings (Almeida et al. 2020). The impact of this crisis on DT in organisations raises questions about future preparedness and contains lessons for post-crisis resilience.

Remote leadership became crucial in driving DT when employees transitioned to remote work. The culture of innovation and encouragement for new initiatives suffered, prompting a call for further research into innovation within virtual settings and the digital evolution of business concepts in resource-constrained environments. The pandemic period made clear that organisations must continuously adapt their offerings in response to evolving market demands and customer preferences. The evolving 'new normal' will undoubtedly reshape DT, warranting deeper examination to capitalise on these transformations. The limitations of this study include its interpretive approach, reflecting the researchers' perceptions. While this study considered diverse industries, not all were included, and the focus is on German organisations. Finally, the study's insights are drawn solely from the responses of knowledge workers.

5 Deep Dive into Digital Transformation: Business and IT Collaboration in Traditional Organisational Context[3]

This study explores the challenges in aligning business and IT experts while developing digital services in the automotive industry. It highlights how differences in their perspectives on business values, technological functionalities, and development strategies can impede collaboration. This research ties into the previous studies by examining a specific DT challenge and emphasising the critical role of effective business–IT collaboration in successful DT in traditional organisational settings.

5.1 Introduction

This study investigates the intricacies of business and IT collaboration within the automotive sector. In the context of rapid technological evolution, IS development catalyses new business value creation (Fichman et al. 2014) and requires a comprehensive reassessment of organisational and managerial frameworks (Chanias and Hess 2016; Firnkorn and Müller 2012; Hanelt et al. 2015). For established firms in particular, digital technology integration necessitates a departure from conventional innovation trajectories without undermining existing product innovation strategies (Henfridsson et al. 2014; Henfridsson and Yoo 2014; Svahn et al. 2017; Tiwana et al. 2010).

The automotive industry stands at a crucial juncture. Emergent technologies point to unprecedented avenues for digitalisation, enabling vehicular communication and the creation of digital service platforms (Brookes et al. 2014; Broy et al. 2007; Golestan et al. 2015; Pillmann et al. 2017; Venkatesh et al. 2012). The sector's shift towards in-house digital service provision is a response to the dynamic competitive landscape and demands substantial managerial and organisational transformation (Henfridsson et al. 2014; Henfridsson and Yoo 2014; Kyriazis and Varvarigou 2013; Porter and Heppelmann 2014; Tiwana et al. 2010).

The synergy between business and IT expertise emerges as a pivotal element in such transformation, and a nuanced understanding of this collaboration is needed to harness the full potential of digitalisation (Gregory et al. 2015). Despite extensive discussion of strategic business–IT alignment in IS research (Reynolds and Yetton 2015; Vermerris et al. 2014), there is a discernible gap in the literature regarding alignment at the operational or project level (Campbell 2005; Cragg et al. 2002), particularly within the automotive sector's evolving digital environment.

[3] This chapter is based on the study "*How Challenging is the Development of Digital Services in an Automotive Environment? An Empirical Study of the Incongruences between Business and IT Experts*" published in *Proceedings of the International Conference on Wirtschaftsinformatik*.

This research identifies incongruities in business and IT perspectives regarding digital service development. We employ the technological frames of reference theory (TFR; Orlikowski and Gash 1994) to examine the perceptions and sense-making processes of project stakeholders (Davidson 2006; Goes 2013). We offer a nuanced understanding of the challenges and alignment opportunities in fostering effective business–IT collaboration, which is crucial for realising the strategic advantages of DT in the automotive industry.

5.2 Theoretical Foundation

The sections that follow outline the theoretical contributions in the literature that address the alignment of business and IT. The discourse is extensive and focuses on the strategic and operational coordination essential for harnessing IT to achieve business goals and support innovation. Additionally, the application of TFR theory provides a theoretical foundation for scrutinising perceptions and interactions regarding IT in organisational settings. Proposed by Orlikowski and Gash (1994), TFR theory serves as a prism through which to view and analyse the interpretations of organisational stakeholders—specifically, those from the business and IT sectors—of their technological context. This perspective aids in comparing their respective viewpoints, revealing how perceptions shape technology-related decisions and implementation. By merging insights from these theoretical frameworks, the literature advances our understanding of the intricate relationship between business strategies and IT functionalities, highlighting how important alignment is in attaining DT and operational efficacy.

5.2.1 Business and IT Alignment

This section explores recent theoretical advancements in the literature concerning the alignment of business and IT, particularly in light of the transformative impact of digitalisation. Studies increasingly focus on digital services and DT, addressing such areas as personal information disclosure (Anderson and Agarwal 2011), technology and innovation (Dougherty and Dunne 2012), intellectual property governance (Greenstein et al. 2013), ecosystems (Riasanow et al. 2017), incumbent firm challenges (Svahn et al. 2017), and supply chain intricacies (Xue et al. 2013). These studies illuminate the comprehensive nature of digital services as utilities facilitated by digital transactions (Athanasopoulou et al. 2016; Williams et al. 2008); the integration of diverse resources and IT artefacts culminates in novel value creation (Lusch and Nambisan 2015; Nambisan et al. 2017).

The literature contains an extensive examination of the synergy and alignment between business and IT functions. Analytical reviews (Chan and Reich 2007) and empirical studies (Gerow et al. 2014) have laid the groundwork for understanding the various types of alignment, including strategic, infrastructural, and process-oriented alignment.

Haffke and Benlian (2013) highlight the significance of interpersonal dynamics in business–IT partnerships, and Preston and Karahanna (2009) focus on the alignment of organisational IS strategies with broader business objectives. Sledgianowski and Luftman (2005) further advocate for sustained strategic alignment between business and IT and propose tools and frameworks to do so.

In the context of ongoing DT, the role of IT transcends operational efficiency, becoming a driver of innovation and new service development (Horlach et al. 2016). The evolution of digitalisation necessitates structural and strategic realignments within traditionally product-centric industries, such as automotive manufacturing (Juehling et al. 2010; Mahut et al. 2015), and requiring the reconciliation of business and IT objectives (Delaney and Levy 2017; Gregory et al. 2015). As IT is more deeply integrated into BMs (Campbell 2005; Lindgren et al. 2008; Omerović et al. 2020), the development of digital services requires a new paradigm of collaboration between business and IT entities (Matthies et al. 2016; Pagoropoulos et al. 2017). There is thus a need for a nuanced understanding of the relationship between these in the context of DT. This research illuminates the evolving dynamics of business and IT collaboration, providing insights into their alignment in the era of digital service proliferation and DT.

5.2.2 Technological Frames of Reference Theory

The TFR theory offers an insightful analytical perspective to assess project participants' perceptions and interpretations of technology-related project requirements. The TFR theory, as conceptualized within the field of IS by Orlikowski and Gash (1994), explains that various stakeholders within a project may possess distinct 'technological frames,' which encapsulate their views on the utility, importance, and implications of technological applications. The foundational work by Orlikowski and Gash (1994) delineates three frame domains that shape individual and group understandings of, and interactions with, technology: the 'nature of technology,' which encompasses beliefs about technology's capabilities and functions; 'technology in use,' which describes perceptions regarding the actual application and outcomes of technology; and 'technology strategy,' which refers to the envisioned role and value of technology in particular organisational contexts.

Orlikowski and Gash (1994) employ interviews with technologists and users regarding 'notes technology' to argue that divergence in the views of these groups can lead to challenges and conflicts in the use of technology; the authors highlight the importance of TFR theory in diagnosing and addressing such disparities. Subsequent research affirms the relevance of the TFR theory in various contexts, demonstrating that disparities in technological frames can precipitate organisational inefficiencies and impede effective technology integration and usage (Allen and Kim 2005; Luftman and Brier 1999).

There has been extensive empirical validation of the theory, underscoring its applicability across diverse scenarios and disciplines (Hsu 2009; Lin and Silva 2005; Mathieu et al. 2000; Williams et al. 2008). By contrast, a minority of studies identify instances in which the anticipated effects of frame incongruence did not materialise as expected, offering a more complex picture of the theory's applicability (Davidson 2000; Kilduff et al. 2000). The implications of frame incongruence are taken up in scholarly discussions on strategies to foster alignment and coherence among different organisational groups.

Various mechanisms are proposed to mitigate misalignment and its associated challenges, including leveraging power dynamics (Davidson 2002), engaging in political strategies (Kandathil et al. 2011), enhancing interaction and communication (Sarker et al. 2005), promoting knowledge exchange (Robey and Sahay 1996), deepening the understanding of technology (Horlach et al. 2016), and implementing tool support alongside clear procedural guidelines (Harnisch et al. 2013). These strategies are intended to reconcile technological frames to enhance organisational efficiency, improve technology adoption, and ensure alignment between business and IT sectors; the latter is crucial for achieving strategic and operational objectives in an increasingly digitalised corporate landscape.

5.3 Methodology

The investigation into the underlying causes of challenges in the development of digital services, as perceived by business and IT experts, utilized an interpretive case study methodology (Yin 1989). This approach is particularly useful when delving into the cognitive processes that underpin technology-related judgements (Nardon and Aton 2012) and offers a thorough exploration of the subject matter (Flynn and Du 2012; Huang et al. 2014; Kaiser and Buxmann 2012). Interpretive case studies are based on the principle that knowledge emerges from experience and interaction, shaping individuals' cognitive structures and influencing their engagement with technological and organisational environments (Fiol 1994; Griffith 1999).

TFR theory, as proposed by Orlikowski and Gash (1994), is employed as a framework to understand the challenges encountered in the collaboration between business and IT domains. The TFR theory allows a nuanced examination of how distinct perceptions and expectations regarding technology, shaped by individual and collective experiences, can influence collaborative efforts and outcomes. It serves as a lens to identify and understand the differences in the technological frames of business and IT experts in the development of digital services. The sections below elaborate on the specific methodologies and analytical strategies adopted. The focus is on how the TFR framework guides data collection and analysis to enable a comprehensive understanding of the cognitive and interpretive dimensions underlying collaboration between business and IT experts.

This methodological exposition clarifies how the theoretical and empirical aspects of the research coalesce to address the pivotal research question, shedding light on the cognitive underpinnings and interpretive dynamics that characterise the interaction between business acumen and IT expertise in the context of digital service development.

5.3.1 Research Setting

The case study considers the dynamics of collaboration between business and IT professionals engaged in developing a digital service at a renowned German automotive company, hereafter referred to as CAR AG, to preserve confidentiality. The choice of company for this detailed inquiry is informed by several pivotal factors, including the company's proactive engagement with digitalisation, the complex challenges faced during its inaugural venture into digital service development, and the accessibility of comprehensive information about its operations. CAR AG stands as a global powerhouse in the commercial vehicle sector, employing nearly 300,000 individuals worldwide, suggesting its vast organisational structure and extensive reach in the industry. Its current core objective is to transition from a traditional manufacturing business to an avant-garde provider of comprehensive digital services and solutions, encapsulating an ambitious transformation agenda.

The focus of the case study is a specific digital service project initiated in 2015 with hardware and software components designed to integrate seamlessly within vehicles. This digital service is envisioned as an open platform for hosting CAR AG's proprietary software and services as well as those from external parties, thereby embodying a versatile and inclusive digital ecosystem. By 2018, this project had garnered significant attention and participation across various departments within CAR AG, emphasising its importance and cross-functional nature. The expertise of personnel involved in the service can be broadly as concerning business and IT, with each bringing a unique perspective and knowledge to the development process. However, interactions among these experts were sporadically organised, and deeper investigation into their collaborative processes was needed.

This scenario offers a unique opportunity to explore the interplay of business and IT perspectives in the context of digital service development within an automotive giant. In-depth interviews with those directly involved in the project bring to light the intricacies of their collaboration and make it possible to discern their respective interpretations and views on digital service development, as well as identify any challenges encountered. Such an investigative approach is intended to yield critical insights into factors influencing the efficacy of cross-disciplinary collaboration in the realm of digital innovation at CAR AG, thereby contributing valuable knowledge to the existing literature in this area.

5.3.2 Data Collection and Analysis

This research uses an interpretive case study methodology, rigorously following the procedural guidelines outlined by Yin (2009). It encompasses several stages: planning, design, preparation, data collection, analysis, and dissemination. The focus of the analysis is the business and IT professionals engaged in collaborative efforts to develop a digital service at CAR AG.

The roles of the experts in the digital service are delineated, with business professionals concentrating on aspects like customer requirements and pricing strategies and IT specialists dedicated to the technical facets of software and hardware development (Table 5). Experts, as defined by Bogner et al. (2009), possess distinct and advanced knowledge in their respective fields; the business and IT personnel involved in this study as key informants clearly qualify. Data were collected through interviews conducted in person over May and June 2019, employing a semi-structured format to guide the dialogue while allowing flexibility and depth in the responses (Gibbert et al. 2008). Yin's (2017) recommendations inform the selection of interviewees and ensure a diverse and knowledgeable participant base; participants fulfil the criteria of being well-informed, actively engaged in relevant business or IT units, and with a minimum of three years of experience in their roles.

ID	**Y**	**Function | *Expertise***	**ID**	**Y**	**Function | *Expertise***
BU1	4	Business Developer *Use Case Development*	IT1	3	Software Developer *Diagnosis and Flashing*
BU2	5	Strategy Expert *Migration of Data*	IT2	3	Software Architecture Expert *Device Management*
BU3	3	Sales Manager Customer Acquisition	IT3	4	Software Developer Prototyping
BU4	3	Business Developer *Use Case Development*	IT4	5	Software Developer *Prototyping*
BU5	3	Sales Expert Use Case Development	IT5	5	Software Architecture Expert *Testing*
BU6	6	Service Product Owner *Substitution Use Case*	IT6	3	IT Project Manager *Defining IT Requirements*
BU7	4	Sales Expert *Customer Requirements*	IT7	6	Platform Development *Expert Technological Fit*
BU8	3	Business Developer *Use Case Development*	IT8	4	IT Security Manager *Security Testing*
BU9	5	Strategy Expert *Strategy Development*	IT9	4	IT Project Manager *Technological Feasibility*

Table 5: Interviewed Experts

In total, eighteen interviews were meticulously executed, with insights offered on the business and IT sectors through questions crafted to elicit comprehensive perspectives on individual roles, experiences, and perceptions of the digital service's business value, technological functionality, and perceived developmental success. This approach aligns with the interpretive principles articulated by Klein and Myers (1999), promoting a thorough understanding of expert viewpoints within the broader organisational and project context. The analytical phase employs a content analysis strategy (Lacity and Janson 1994), allowing an expansive yet nuanced exploration of the data (Walsham 1995; 2006).

Initial open coding, as per Miles et al. (1994), identifies key themes and patterns. These are further refined through alignment with the TFR theory (Orlikowski and Gash, 1994), emphasising the examination of frame incongruences—differences in perceptions and interpretations that may impede collaborative synergy. These themes are distilled through detailed coding and attributed to either business or IT perspectives. This allows a comparative analysis of the convergence and divergence in viewpoints. The synthesis of these aspects into broader frame domains is facilitated through pattern coding; this allows a structured yet insightful depiction of the collaborative dynamics under study. The coding process, executed by dual coders using the 'f4' software, ensures rigour and consistency, with a consensus reached on themes reflected across multiple interviews to establish a robust foundation for the findings.

5.4 Empirical Results

This study adheres to the methodological guidance of Orlikowski and Gash (1994) and explores the technological frames within their natural organisational context, recognising that these frames are inherently influenced by temporal and situational factors. This in situ analysis ensures a genuine understanding of how business and IT experts perceive and interpret various aspects of digital service development, leading to the identification of three distinct frame domains that highlight the incongruence between the experts' perspectives.

The 'Business Values of a Digital Service' domain captures the views of business and IT experts regarding the potential and value that the digital service brings to the organisation. Divergences in this domain often indicate fundamental differences in how each group perceives the economic and strategic worth of digital service initiatives. The focus in the 'Technological Functionalities of a Digital Service' domain is on the functionalities of the digital service as understood by business and IT professionals. While IT experts might emphasise the technical sophistication and innovation of the service, business professionals may be more concerned with how these functionalities align with market needs and business strategies. Finally, the domain referred to as 'Strategy for the Development Process of a Digital Service' pertains to the perceived strategies for the effective and successful development of digital services.

It reflects the experts' viewpoints on planning, execution, and management of the development process, revealing their priorities and expectations for achieving project success. The distribution of perspectives within these frame domains is represented visually using a coding scheme with symbols in tables (e.g., white box, white box with a black dot, black box within a white one, and solid black box) to signify the frequency at which specific aspects are mentioned by the experts. Such visual codification aids in discerning the points of consensus and divergence among the experts.

The presence of distinct values or characteristics within these frame domains, as indicated by the coding scheme, suggests that business and IT experts have different 'technological frames,' which impacts their collaboration and the approach of each group to digital service development. This disparity in frames can lead to challenges when attempting to align the goals, strategies, and actions of the two groups. A mechanism is required to bridge these differences to enhance collaborative efficacy in digital service development (Orlikowski and Gash 1994). The ensuing sections delve more deeply into each frame domain, elaborating on the specific perspectives and interpretations that emerged from the data and offering a nuanced understanding of the interplay between business and IT viewpoints in the context of digital service innovation.

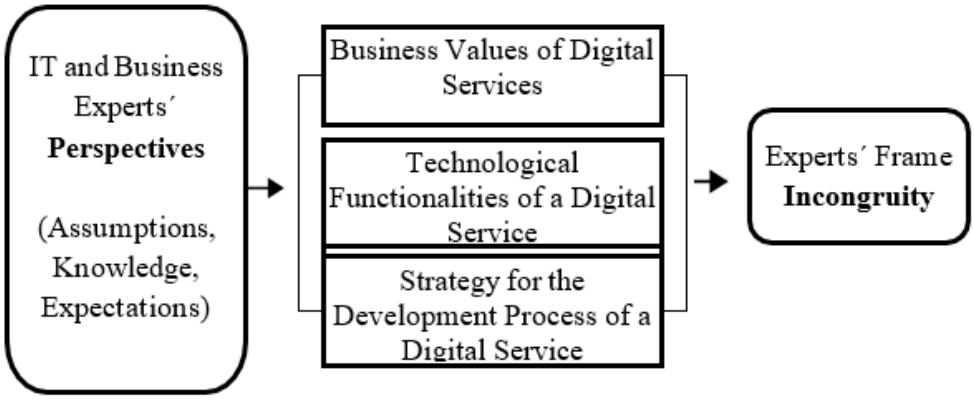


Figure 4: Frame Domains related to the Development of a Digital Service

5.4.1 Business Values of a Digital Service

This domain concerns the assumptions, expectations, and knowledge of the business and IT experts about the potential of the digital service to win over customers and provide positive returns for CAR AG. Table 6 sets out the identified business values of the digital service. Business and IT experts agree that a great benefit of the service is the possibility of providing customers with a platform to develop their own solutions.

The comment of a business expert exemplifies this finding: ‘Digital service helps us provide new innovative products or services that are beyond [the] classic automotive environment’ (BU3). An IT expert also emphasises this aspect: ‘[The] digital service has the potential to offer customised and individualised specific software adaptations’ (IT4).

There are consistent differences regarding the remaining aspects. IT experts see considerable business value in establishing recurring long-term payments for the digital service itself and the possibility of saving on costs through the use of only one hardware for multiple digital services: ‘We make some money by selling the hardware and then by establishing recurring payments for the service’ (IT8).

Business Experts	Business Value of a Digital Service	IT Experts
▣	Ensuring recurring payments	■
⊡	Developing customized digital solutions	■
⊡	Cost efficiencies	■
■	The upselling power for the vehicles	⊡

Table 6: Business Value of a Digital Service

By contrast, business experts focus on the short-term benefits and upselling potential of the service for vehicles. They do not see the digital service as a stand-alone business but as an additional benefit for vehicle customers that will increase vehicle sales: ‘If we can fix this (digital) solution and the customer is satisfied, we will sell more vehicles’ (BU4). These differing perspectives on the business value of the digital service reveal several issues between the groups. IT experts complain about the vague requirements expressed by the business side of the organisation due to different expectations related to the real value of the final service: ‘Mostly, there is a gap in how the business describes the business solution. It is never as detailed as IT needs it, and this gap is huge’ (IT9). Business experts point to the problem of trust: ‘If I say that the customer is not willing to give out so much money, I would expect IT colleagues to understand this.’ (BU4).

5.4.2 Technological Functionality of a Digital Service

The technological functionality of the service refer to the perceived technological potential of a digital service’s software and hardware components. As Table 7 shows, IT experts seem enthusiastic about the general-purpose nature of the digital service that allows easier development and fast prototyping: ‘Digital service has one feature that enables me to easily make function prototypes without reinventing the new hardware platform’ (IT6).

Business experts, by contrast, praise how digital service technology affects the customer context. As the following indicates, they appreciate the power of the digital service to combine data and automate the processes for the customers: '[The] combination of the driver information, vehicle and sensors are creating the main added value for the customer' (BU2). Business experts also agree that the real promise of the digital service is its ability to connect different customers on one platform, creating an ecosystem for services and customers.

According to both groups, these differences in perspective give rise to several issues. Business experts criticise the classical structure: 'Classical set-up within CAR AG is that you have business and IT as separate organisations and therefore it is always difficult to come to the same level of understanding about requirements and how they could be implemented' (BU6). The IT experts mostly agree on this point: 'A lot of times it is difficult to see the client behind all of it; it is abstract because that is more of a job for business experts and for us, it is more technically oriented' (IT3).

Business Experts	Technological Functionality of a Digital Service	IT Experts
▣	Decoupling car and software development	■
⊡	General-purpose platform nature	■
⊡	Fast prototyping	■
■	Flexibility to combine data	⊡
▣	Digital service as the ecosystem enabler	⊡

Table 7: Technological Functionality of a Digital Service

5.4.3 Strategy for the Development Process of a Digital Service

This frame domain encompasses the generalised assumptions, knowledge, and expectations of business and IT experts concerning how a digital service should be developed in the organisational and project management context. Table 8 shows that the business and IT experts have different perspectives on what might make the development of a digital service a successful process. Business experts believe that the following factors are essential: finding the paying customer who would like to invest in the digital service and create their services, clearly defined deadlines and timelines, and a good strategy to overcome legal and political issues. The examples provided by a business expert confirm this: 'What matters is customer acceptance and how many devices you can bring to the field and how many paying customers you connect [with]' (BU5).

In contrast, IT experts assume that proper software development documentation and IT security are the main issues that must be tackled to make the process successful: 'The security is the most critical part of the digital service because it is […] to open up the intellectual property of the car' (IT5).

Business Experts	Strategy for the Development Process of a Digital Service	IT Experts
■	Ensuring technological stability of digital service	■
■	Finding paying customers	⊡
⊡	Design a proper software documentation	■
■	Formulating clear and aligned timelines	⊡
▣	Tactics to overcome legal and political issues	⊡
■	Overcoming conflicting political environments	⊡
□	Ensuring the IT security of the digital service	■

Table 8: Strategy for the Development Process of a Digital Service

Business and IT experts agree that the technological stability of a digital service is a crucial prerequisite for the successful execution of the process. The differences in perspective of business and IT experts on strategy relate to the lack of communication in the process: 'There is a big language barrier […] and therefore, there is a lack of communication' (IT8).

5.5 Discussion of the Results

Considering the divergent perspectives of business and IT experts on digital service development and applying TFR theory allows insight into their distinct viewpoints across three critical domains: business values, technological functionalities, and development strategies.

Regarding the 'Business Values of a Digital Service', IT professionals perceive digital services as innovative BMs capable of fostering new revenue streams through recurring payments. This stands in contrast to the perspective of business professionals, which is oriented towards leveraging digital services to augment the core value of existing products by, for example, enhancing vehicle sales through added digital features. This variation reflects the different operational philosophies and signals potential challenges in achieving a unified approach to digital service development, as noted by Reich and Benbasat (2000) and Yoo et al. (2010). Balancing these divergent perspectives requires an integrated approach that harmonises immediate product-centric benefits with the strategic, long-term value proposition of digital services.

Turning to the 'Technological Functionalities of a Digital Service,' IT experts emphasise the intrinsic value of these functionalities in enabling innovation and efficiency. In particular, they emphasise the role of digital services in facilitating rapid prototyping and development, a view supported by their focus on technical aspects. By contrast, business experts prioritise the practical, customer-centric benefits of digital service functionalities, echoing the strategic focus identified by Huang and Hu (2007) and Orlikowski and Gash (1994).

This dichotomy suggests an underlying division that reflects traditional organisational structures, where business units focus on market and customer needs while IT departments concentrate on technical and engineering solutions. Bridging this gap is crucial for aligning the development process with organisational goals, as underscored in Gilchrist et al. (2018).

Concerning the 'Strategy for the Development Process of a Digital Service,' IT professionals emphasise the importance of robust documentation and security measures; this is indicative of a risk-aware and detail-oriented approach. In contrast, business professionals are more attuned to market acceptance and the strategic positioning of the digital service, aligning with the broader organisational objectives.

This divergence points to the need for integrated strategic planning that aligns technical specifications with market demand and business strategies, as reinforced by Birchmeier (2004) and Huang and Hu (2007). Such alignment is crucial for navigating the complexities of digital service development in automotive environments, where market dynamics and technological innovation are both essential. In conclusion, fostering a synergistic collaboration between business and IT experts is imperative for the successful development of digital services in the automotive sector. Adopting a holistic and integrative approach to digital service development, informed by the insights of Sklyar et al. (2019), can facilitate a more coherent and aligned process that leverages the technical expertise of IT professionals and the strategic acumen of business personnel.

5.6 Conclusion, Limitations and Future Research

The objective of this study was to explore the incongruences between business and IT experts during the development of digital services in the automotive manufacturing context. The collaboration dynamics in this innovation domain were thoroughly analysed to explore the challenges that arise when divergent perspectives intersect, particularly in the creation of digital services in this context. Adopting the TFR theory as an analytical foundation, this study identified three principal frame domains that catalyse incongruence: perceptions of business values, interpretations of technological functionalities, and strategies for digital service development.

These domains are at the core of misalignment and demonstrate how differing views on the BM underpinning a digital service can create friction between business and IT personnel.

For instance, IT professionals may view the digital service as an autonomous business entity capable of generating sustained revenue. By contrast, their business counterparts might see the service as designed to enhance core product offerings, such as vehicle sales. This divergence in viewpoints can lead to a variety of operational challenges, including diminished trust and understanding. There is thus a need for a proactive approach by project managers to require harmonised business and IT inputs. Managers are encouraged to delve deeply into the framing logic employed by both sets of experts, ensuring a cohesive and aligned understanding of the project's goals, values, and overarching vision.

The findings suggest that the traditional structural divide between business and IT units in automotive organisations may exacerbate these challenges, underscoring the need for a re-evaluation of how teams interact and collaborate. The identification of frame incongruences is helpful for organisations that need to reconfigure their business and IT teams for enhanced synergy and effectiveness. From a scholarly perspective, this research contributes novel insights by applying the TFR theory outside its conventional bounds.

This study's focus on technological frames related to external customer-facing digital service development expands the theory's applicability, demonstrating its relevance in analysing business-centric perspectives in digital service development. This application underscores the theory's utility in dissecting and understanding the interaction between business and IT domains in the context of DT aimed at external market engagement. It also highlights the evolving role of IT in business strategy and model formulation. The study emphasises the need for integrated collaborative approaches in the development of digital services. This aligns with the work of Dijkman et al. (2015) and Islam et al. (2017), who discuss the incorporation of IT strategies into broader business frameworks. As DT becomes a pivotal aspect of strategic orientation, the alignment of business and IT functions emerges as critical for success. There is a need for further exploration within IS research to uncover effective organisational and managerial strategies for navigating the complexities of digital service development in established firms.

Following the pathways outlined by Matthies et al. (2016) and Lin and Silva (2005), this study advocates for a deeper understanding of how digital technologies interact with various organisational dimensions, including strategy, structure, and culture, as well as the interplay between these technologies and broader societal and economic forces. Overall, this research enriches the academic discourse on DT, providing substantial theoretical contributions that enhance our understanding of how traditional organisations can effectively implement and benefit from digital innovation in established firms (Matthies et al. 2016; Lin and Silva 2005).

6 Digital Transformation and Organisational Dynamics: Navigating Performance and Change in the Era of Remote Work[4]

The research presented here investigates the impact of DT on organisational dynamics in the context of remote work, a phenomenon that has gained prominence in the modern business environment. The study explores the operational and strategic shifts that the adoption of remote work has required. It employs the Burke–Litwin model of organisational performance and change as a theoretical backdrop. By integrating this well-established framework with insights gleaned from contemporary organisational practice, the research sheds light on the transformational dimensions of digitalisation and remote work, highlighting technology's pivotal role in driving these changes.

6.1 Introduction

Prolific digitalisation and advanced technological innovation have facilitated the widespread adoption of remote work and transformed traditional workplace paradigms. This trend has been supported by the potential advantages of remote work (Madakam et al. 2019), particularly during the COVID-19 pandemic when working from home using digital technologies was a necessity for many individuals (De et al. 2020; Richter et al. 2018).

A variety of novel working methods are emerging as a result of advancements in technologies (Altman et al. 2021), and there is a need to redefine how employees work with fewer geographical, physical, and organisational constraints (Ameri and Kurtzberg 2022). Employees and organisations can benefit from a carefully crafted strategy for future workplace arrangements (Altman et al. 2021).

Research shows that remote work positively influences employee satisfaction and productivity and thus enhances individual (Zhang et al. 2020) and organisational performance (Chatterjee et al. 2022; Bloom et al. 2015). In practice, we observe very different strategies in the post-pandemic period. For instance, Google issued a company-wide email mandating that all employees return to the office for a minimum of three days per week (Kruppa 2023). Similar moves were made by car manufacturing giant Tesla (Rushe 2022) and several other large corporations, such as Amazon and Disney (Lebowitz et al. 2023). However, there are companies that still strongly promote remote work, such as Microsoft and SAP (Eads 2023). Nvidia and Airbnb have also maintained their work-from-home policies (Ma and Ding 2023).

[4] This chapter is based on the study "*Here, There, or Anywhere: Organisational Change and Performance in the Digital and Remote Work Era*".

As organisations look to a post-pandemic future, it becomes increasingly important to understand and create novel strategies for future workplace arrangements. Research is urgently needed to determine whether working from home will be a temporary convenience or become an integral part of an effective work environment (Ameri and Kurtzberg 2022). This study thus tackles the following research question: How does the acceleration of digitalization push towards remote work affect the organizational performance and change management? To answer this research question, in-depth interviews, with senior executives from a traditional organisation, have been conducted. Despite its conventional roots, this organisation actively endorses flexible and remote work. The interviewees, all of whom are executives overseeing teams operating under remote or hybrid models, offer helpful insights into the company's remote work policies.

These discussions also offer valuable information regarding leadership approaches, the organisational mission, strategic orientation, and related dimensions that enrich our understanding of the interplay between remote work and organisational dynamics. We structure our findings following the model in Burke and Litwin (1992), which is a framework for identifying factors that drive organisational change and how they relate. The model's emphasis on transformational changes affecting performance makes it particularly useful for analysing the impact of increased digitalisation and the shift to remote work.

6.2 Theoretical Background

6.2.1 Remote Work

The term 'remote work' is typically used to describe work conducted outside the traditional boundaries of an organisation's physical location and working hours (Olson 1983). IT has long been a catalyst for the alternative organisation of work, challenging traditional management paradigms and enabling organisational structures to evolve to meet the growing demand for greater work flexibility. The development of supportive tools over the last several decades has led to the expansion of remote work. This has transformed how work is conducted (Davison 2020; Popovici and Popovici 2020; Dwivedi et al. 2020) and resulted in a dramatic surge in society's dependence on technology (Herath and Herath 2020).

This transformation is further evidenced in the literature, which highlights the managerial benefits of remote work, including significant improvements in employee productivity (Bloom et al. 2015). Remote work offers considerable advantages. Employees working from home express higher levels of job satisfaction, which has, among other benefits, led to a significant decrease in employee turnover (Fonner and Roloff 2010; Bloom et al. 2015). Despite these advantages, by 2019, remote work had remained limited to 6 per cent (Coate 2021).

In 2020, remote work surged due to the COVID-19 pandemic (Yoon et al. 2023). This shift represents a significant change in workplace perceptions, prompting research into the ongoing feasibility of remote work (Dingel and Neiman 2020).

The transition to remote work is not without challenges. Researchers discuss the 'smart' and 'dark' sides of remote work, including the difficulties faced by organisations in fostering a supportive culture and tracking informal remote work practices (Peters et al. 2016). Additionally, its business impact, whether positive or negative, is difficult to measure, potentially deterring organisations from encouraging remote work (Golden and Raghuram 2010; Taskin and Bridoux 2010). Organisations have thus accelerated the adoption of digital workplace platforms to enhance communication and employee well-being (Mancl and Fraser 2020; Dudezert et al. 2023). Remote work has profoundly shifted how organisations operate, pushing the boundaries of traditional work environments and necessitating thoughtful transformation management (By 2005; Errichiello and Pianese 2019).

6.2.2 Burke-Litwin Model of Organisational Performance and Change

The increasing 'forced' adoption of new technologies requires effective change management practices if implementation is to be successful (McKeeby et al. 2021). A variety of analytic techniques have been developed to increase organisational effectiveness (Errida and Lotfi 2021), with researchers focusing primarily on models to manage organisational change. The Burke–Litwin causal model, introduced by Burke and Litwin in 1992, identifies the factors driving organisational change and performance and the interaction between these. The transformational dimension of the model focuses on strategic, long-term changes that have a significant impact on individual and organisational performance; the key elements in this dimension include the organisation's mission and strategy, leadership styles, and the overarching organisational culture. These elements are influenced by external environmental forces, prompting a shift in employee behaviour patterns and necessitating adjustments in how work is conducted and managed (Burke and Litwin 1992).

The model's transactional dimension addresses the operational and administrative aspects of change that affect the organisation's day-to-day functioning. Included here are the processes, structures, and management practices that directly impact how tasks are executed and how employees interact in the remote work context (Burke and Litwin 1992). Addressing these transformational elements is critical to ensuring a smooth transition to remote work, particularly where external factors make doing so urgent – for example, health crises like the COVID-19 pandemic.

While remote work offers benefits such as increased autonomy and the potential for a better work-life balance, it also presents challenges to organisational cohesion and employees feeling valued and supported (Bentley et al. 2016; Errichiello and Pianese 2019; Kossek et al. 2006; Smith et al. 2019). This study focuses on the transformative factors that Burke and Litwin (1992) identify as influencing organisational change and highlights the significant influence on the overall process of organisational change. The model serves as a cornerstone for the application of a deductive method in the collection and study of data.

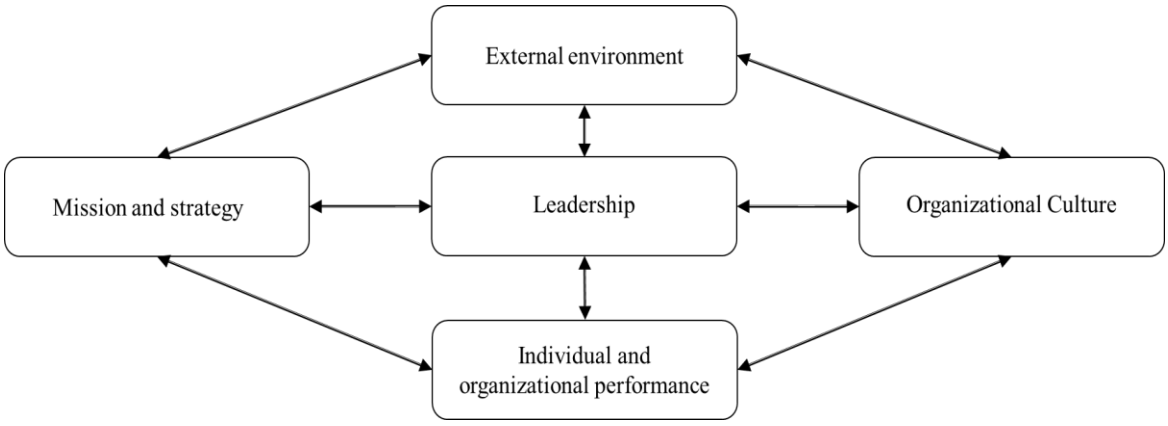


Figure 5: Model of Organisational Performance and Change:The Transformational Factors

This model also provides a practical framework for interpreting research findings (Caillouet et al. 2022), particularly in the context of different organisational structures and the need to integrate remote working practices. Since its conception, the model has undergone rigorous testing and validation (Stone 2015; French et al. 2022). Applications of Burke and Litwin's (1992) model have examined its effectiveness in assessing factors that impact organisational effectiveness (Martins and Coetzee 2009), addressing significant changes in the external environment (Spangenberg and Theron 2013), and assessing organisational capabilities to address community issues (Ali et a. 2019).

6.3 Research Setting and Methodology

6.3.1 Research Setting

This research focuses on a multinational automotive corporation renowned for its production of luxury vehicles, buses, coaches, and trucks. With a history that traces back to the late 19th century and the invention of the gasoline-powered automobile, this company has consistently been at the vanguard of automotive engineering. Specifically, the focus is on the company's remote work policy and the impacts of transitioning to remote and hybrid work environments on various organisational dimensions.

An agreement established in 2009 and expanded in 2016 grants all employees of the company the fundamental right to engage in up to 100 per cent remote work, provided such arrangements align with their tasks. The pandemic accelerated the adoption of home-office setups, with the corporation endorsing this shift and advocating for hybrid work models that offer an ideal blend of mobile and on-site working benefits. This strategy aims to boost productivity and reduce work-related stress, with the responsibility for the hybrid model's design resting with management. Managers collaborate with their teams to shape this model and are supported by the corporation through digital process design, training initiatives, and documentation, fostering a work environment grounded in trust, personal accountability, and autonomy.

Employees also have the flexibility to work remotely from various European locations for up to 20 days, depending on the requirements of their job. This research probes the significant impact that the transition to flexible working models has had on the leadership approaches of senior executives, the evolution of the corporate mission and strategy, and organisational and individual performance, as well as cultural transformation in this new operational context. The study also aims to uncover the external drivers of the shift toward remote or hybrid working models. The case-study participants, who are responsible for teams that mostly work remotely with sporadic office interactions, offer deep insights into managing the subtleties and challenges of remote work leadership.

6.3.2 Data Sample and Collection Process

The investigation aligns with the methodological framework delineated by Yin (2009), which covers strategic planning, design, preparation, extensive data gathering, meticulous analysis, and clear communication of results. The study follows these guidelines in a qualitative interview process to establish a rich narrative base to inform further statistical analysis and academic discourse while furnishing actionable insights for professionals in the field (Wiesche et al. 2017).

A diverse group of representatives is selected from various corporate entities to obtain a holistic view of organisational reactions to remote work directives. These representatives, defined as individuals with insightful views on their firm's remote work policies, primarily consist of managers who utilise knowledge as a fundamental business resource (Davenport 2005). In alignment with Yin's (2017) advice, a diverse purposive sampling method is used in order to select interviewees. This is anchored by three specific (but not exclusive) criteria: managerial status, in-depth knowledge of the firm's remote work policy, and a minimum of three years' experience within the company.

Potential participants were engaged through platforms like LinkedIn, and ten comprehensive interviews were conducted. The collected data regarding the participants' roles and experiences are systematically catalogued in Table 9. The number of interviews conducted is adequate to meet the study's goals, as qualitative research emphasises the depth and detail of data rather than volume. The interactions with senior executives yielded rich, expert-level insights, which allowed to achieve a state of theoretical saturation where further interviews would not contribute additional novel data. This approach is efficient and feasible, allowing for in-depth exploration within the available resources and timeframe. Participants received detailed invitations outlining the study and the interview framework. An interview guide with fifteen open-ended questions was prepared, and optional probing questions were included to delve into specific areas as needed. When participants addressed topics spontaneously, their input was acknowledged, and they were encouraged to expand on their thoughts if they so wished.

ID	Position	Experience (Y)
M-1	Senior Manager Finance Analytics	17
M-2	Chief Information Officer Insurance and Tech.	11
M-3	Senior Manager Digital Products	14
M-4	Head of Marketing	8
M-5	Senior Manager Media and Content	15
M-6	Senior Manager DT	5
M-7	Lead in Electric Drive and Digital Experience	8
M-8	User/Customer Experience Leader	6
M-9	Leader Development of On-Demand Functions	7
M-10	Team Lead Sales and Marketing	10

Table 9: Description of the Representatives

The interview guide was developed by leveraging the organisational performance and change model in Burke and Litwin (1992) as a framework for creating open-ended questions. The transformational dimensions of this model inform the question structure and serve as a reference point rather than as a restrictive framework for participant responses.

This design encourages interviewees to engage in introspection and express their individual viewpoints; the intention is to uncover aspects of the topic that are potentially beyond the scope of the existing model. Virtual interviews were conducted from November 2023 to February 2024, with each session facilitated on an individual basis by one of the authors and lasting approximately 45 to 60 minutes.

These sessions were recorded using the built-in functionalities of the Microsoft Teams or Zoom communication platforms. Before recording commenced, each participant provided verbal consent for their interview to be recorded, stored, and utilised in the study, thus eliminating the requirement for written consent. The interviewer who conducted each session was responsible for transcribing the recorded content.

6.3.3 Data Analysis

The data are analysed using structured content analysis, guided by the approaches of Lacity and Janson (1994) and Mayring (2002) and incorporating the interpretive field research principles outlined by Klein and Myers (1999). Insights are extracted regarding the impact of remote work on organisational performance and change through iterative examination of managers' viewpoints. The analysis process entails open coding across the dataset, followed by a round of selective coding to synchronise the identified codes with the categories in the Burke and Litwin (1992) model.

	EE	**MS**	**L**	**IOP**	**OC**	**T**	**Total**
# Total	65	48	63	90	70	94	**453**
# Duplicates	38	32	34	47	39	48	**238**
% Duplicates	58%	67%	54%	52%	56%	51%	**53%**

Legend: EE – External Enviroment | **MS** – Mission and Strategy | **L** – Leadership | **IOP** – Individual and Organisational Performance | **OC** – Organisational Culture | **T** – Technology

Table 10: Overview of Duplicate Ratios in Coding (Remote Work Study)

This phase includes the inductive creation of new categories that more accurately capture the insights related to the effects of remote work and that refine the existing theoretical framework. Coding units are identified as complete sentences and paragraphs that provide clarity on the modifications prompted by remote work. New categories are only recognised when referenced by at least five participants, accounting for a minimum of 50 per cent of interviewees, to ensure the integrity and robustness of the analytical process.

Analytical rigour and reliability are enchanced by having two authors coding independently using MAXQDA (Kuckartz et al. 2019). Of the 453 statements processed, coder congruency varied from 50–70 per cent, with a dupliation rate of 53 per cent, as shown in Table 10, categorising duplicates according to their principal categories.

The variation in coder congruency, attributable to the authors' different professional backgrounds impacting their interpretations, aligns with the literature (Armstrong et al. 1997). In acknowledgement of these variations, the findings from the two coding were merged, and any discrepancies, such as divergent categorisations or coding decisions, were discussed to reach a consensus.

6.4 Results

In following, the detailed impacts of remote work on each transformational dimension is presented, highlighting their significant influence on organisational performance and change. These dimensions are thoroughly outlined in Table 11, which presents the categories identified within each transformational dimension alongside examples of the corresponding codes. Notably, the findings reveal that as a result of remote work, technology is an important transformational factor; technology has a vital role in enhancing organisational performance and change, facilitating connectivity, fostering collaboration, and ensuring operational continuity across geographically dispersed work environments.

Environment. The COVID-19 pandemic saw a rapid transition to remote work, which significantly influenced the adoption of digital tools and technologies; these became imperative for organisational continuity. Interviewees note that during the lockdown, they were hiring people from all over Germany: 'During Corona […] we hired for skills and not location' (M-6). However, organisations need to take into account strict legal mandates regarding rest periods and work locations that persist in remote settings, and compliance with labour laws and contractual agreements is essential.

This is especially important because employees must take care of their health. As one manager pointed out: 'We don't have the 10 hours rule under control as people are just typing in their home office hours, and we do believe they were working more' (M-2); this can be challenging in the remote work environment. While employees are granted the flexibility to work remotely, they are obliged to adhere to German labour laws, which mandate specific rest periods. For example, if an employee chooses to work until 10 p.m., they must not resume work before 9 a.m. the following day, thereby introducing a structured limitation to the perceived flexibility of remote work.

Mission and Strategy. The mission and strategy of an organisation, crucial for attracting and retaining talent, must adapt to incorporate remote work, and the organisation's core values must nurture employee attachment and empowerment: 'I think looking at [the] current war for talent, this [hiring from everywhere] is very important for us to realise and to stay more flexible here to really get the best talents attracted' (M-7). Remote work, while it has expanded the talent pool and offers flexibility, necessitates a blend of in-person and virtual interactions to ensure effective collaboration and task completion: 'My team members would like to have the flexibility and to decide for themselves where they want to work […] I feel for them it's a sign of empowerment' (M-1). Organisations must balance flexibility while observing guidelines to maintain productivity and team cohesion, and company events and support systems can be used to bolster morale and engagement: 'An arranged day of attendance is not considered effective in our organisation, but personal presence and social contact are welcomed on special occasions such as workshops and team events' (M-5).

Leadership. As M-7 explains, 'I'm getting into the role of a coach trying to reflect, hey, how is the team member not only performing […] but how is he feeling? Are there challenges? How is [the] development trajectory going on?' In a remote work setting, leaders should focus on clear communication and accessibility, fostering trust and avoiding micromanagement while experimenting with different leadership styles, such as coaching. They must prioritise team motivation and well-being, ensuring regular interactions and check-ins and addressing the psychological health of employees through flexible and supportive practices: 'We'll spend maybe the first 15 minutes just chatting. Or if we're in a group dynamic, I do check-in questions' (M-8). Finally, another interviewee notes, 'I have switched to much shorter communication cycles because [this] is much more effective and nowadays, with chat functions, possible' (M-6). Effective remote leadership requires adapting to shorter communication cycles and leveraging digital tools to maintain engagement and facilitate collaboration.

Individual and Organisational Performance. One interviewee notes the impact on performance: 'when they [employees] need to concentrate on topics, they do it at home […] and then their output was higher' (M-5). Most interviewees claim that remote work has increased individual efficiency. However, they also raise concerns about employees' sense of belonging and alignment with the organisation's mission and values. Remote work raises many questions around innovation: 'How could we be more effective in brainstorming new ideas, sharing ideas […] having creative minds all together in one room is a different spirit and a different flow than when we do this only digital way' (M-10). Organisations in this study adopted flexible work models and invested in activities and digital tools to support team cohesion and ensure clear communication. Nevertheless, maintaining a clear distinction between work and leisure time remains a concern.

Organisational Culture. Remote work has necessitated a re-evaluation of organisational culture, emphasising the need for flexibility, autonomy, and innovative approaches to foster a sense of belonging and alignment with the company's values and mission: 'This [remote working] gives a lot of freedom and flexibility to the employee, which is very, very positive, to decide whether I go to the office or not, which is a new working culture' (M-9). Despite high levels of job satisfaction among remote employees, the organisation in our study face challenges in maintaining a cohesive culture and ensuring that employees feel connected to the broader corporate objectives and each other: 'It is a challenge to reach out to the people if they're completely remote, to really build up a culture and a fit and create a warm feeling […] this is how it feels to work for us […] this has been much easier when you stay in the office and you have some hangouts' (M-3). However, managers have implemented various initiatives, such as team-building activities, social events, and physical meetups, to maintain a positive culture and facilitate bonding, even in a remote environment.

Technology. The shift toward remote work has catalysed a fundamental transformation in organisational structures, where technology has emerged as a pivotal enabler, integrating and aligning various facets of work with the organisation's mission and values. Advanced technological platforms and digital tools have become indispensable in maintaining connectivity and fostering a cohesive culture across dispersed workforces, ensuring that employees remain engaged with the company's broader objectives: 'Tool-wise, it's really made easy because we have the common tools like Microsoft Teams where it is really easy to connect or schedule meetings, chat, do video calls […] infrastructure wise, we have a VPN connection that has been upgraded to a level where it's ensured that everybody in the company can work from the outside while still ensuring good data collections.' (M-2)

The reliance on technology for team-building activities, virtual events, and seamless communication underscores its role in bridging physical distance, enabling a shared organisational experience that resonates with employees' need for belonging and collaboration.

As organisations navigate this new landscape, the strategic integration of technology is critical for adapting to diverse work styles and generational preferences, ensuring that the organisational culture remains vibrant and inclusive despite the lack of physical proximity. As one interviewee points out, 'Technology changed everything […] there is no one [working] model for everybody... I think in the future we will have several models to adapt to different needs and stay flexible.' (M-6).

Factors		Code Examples
External Environment	COVID-19 Pandemic	transition to remote work; accelerated adoption of digital technologies
	Legal Regulations	regulations regarding rest periods; working location; 10-hour rule
Mission and Strategy	Employee Empowerment	maintaining motivation and trust
	Working Flexibility	allowing for better work-life balance
	Work Environment	welcoming office environment
	Work Arrangements	need for customized work schedules
Leadership	Personalized Support	individual support for different needs
	Communication Dynamics	decrease in email communication; increase in chat communication
	Coaching Style	being a role-model for employees
Individual and Organisational Performance	Creativity and Innovation	silos have become deeper
	Networking	lack of personal connections
	Productivity	in some projects efficiency increased
	Results Orientation	focus on the quality of the outcome
	Work Dynamics	tension within traditional management
Organisational Culture	Globalization of Work	sourcing skills from distant locations
	Mindset	remote work as inevitable requirement
	Organisational Cohesion	willingness to engage is personal decision
	Work-life Balance	increased happiness and satisfaction
Technology	Technology Adoption	collaboration via digital platforms
	IT Infrastructure	rapid upgrade of the IT infrastructure
	Technology Development	technological upgrades, development of new digital tools

Table 11: Overview of the Transformational Factors

6.5 Discussion of the Results

This study explores the significant impacts of remote work on organisational performance and transformation, and the analysis is anchored in the framework proposed by Burke and Litwin (1992). Contemporary studies that integrate this model validate the ongoing significance of its transformational elements in modern digital and remote work environments. These scholars advocate for inclusion of technology as an important element of transformation. Remote work departs from conventional work paradigms and is driven by advancements in IT that support alternative organisational structures (Olson 1983; Davison 2020; Popovici and Popovici 2020). The COVID-19 pandemic accelerated the trend towards remote work, and there is a clear need to reassess organisational change frameworks – these must account for underlying technologies that facilitate and maintain new and varied work settings. Various analyses demonstrate how remote work influences each transformational dimension in Burke and Litwin's model, positioning technology as both a supportive backdrop and a significant catalyst for organisational transformation.

Considering the environmental dimension of the framework, it reveals how the pandemic-driven move to remote work necessitated swift uptake of various technologies to secure operational continuity and allow organisations to source talent without geographical limitations. The competitive labour market and a scarcity of individuals with essential skills and proficiencies have led to what is often termed a 'talent war' (Dery et al. 2017; Subel et al. 2022). The interviewees within this study suggest a strategic shift toward skill-based hiring practices during and post-pandemic. As regards the mission and strategy impacts of remote work, there is a need for adaptive strategies to ensure organisational alignment and enhance employee engagement in the face of remote work. Companies must devise solutions that resonate with individual employee preferences; doing so is essential for defining workplace structures in the post-pandemic period (Weritz et al. 2022).

The role of leadership is also evolving in the remote-work setting, with a focus on coaching, communication, and trust to effectively support geographically dispersed teams. Organisational policies and executive backing are essential in the execution of remote work strategies (Chatterjee et al. 2022). As regards individual and organisational performance impacts, there is improved efficiency and satisfaction among remote workers, but there are also challenges in unifying organisational culture and promoting innovation remotely. Technology's transformative role is underscored here. It anchors all other dimensions, facilitating connectivity, collaboration, and continuity in remote work settings. The integration of digital platforms and tools for maintaining organisational unity is a substantial shift in work structure and execution.

By incorporating technology as a transformational factor, this study extends Burke and Litwin's model to reflect the integral role of digital infrastructure in modern organisational practices. This is a response to the immediate demands of remote work and acknowledges the broader technological evolution influencing contemporary work practices and organisational strategies.

The research affirms the relevance of Burke and Litwin's model in the era of digital and remote work, offering an important refinement to include technology's transformative role; the latter is pivotal for organisations navigating the complexities of remote work and DT to effectively manage organisational change and maintain performance in a dynamic, interconnected business environment.

6.6 Conclusion, Limitations and Future Research

This examination of the profound impacts of remote work on organisational performance and change makes a significant theoretical contribution by expanding the framework established by Burke and Litwin (1992). It emphasises the crucial role of technology as a transformational element within the organisational change framework and in the burgeoning area of remote work. By analysing the transformational dimensions posited by Burke and Litwin (1992), the investigation clarifies the relationship between remote work practices and organisational dynamics. In addition, it illustrates the need for a reconfiguration of conventional organisational change models to integrate technology's critical role. The augmented model resonates with the contemporary context of digital and remote work and offers an expansive perspective for examining and navigating the intricacies of organisational transformation in an era dominated by technological influence over all aspects of work.

While offering substantial insights into the integration of technology as a transformational factor in remote work contexts, the study has certain limitations. The fact that this research is centred on a singular automotive organisation might limit its broader applicability. Future inquiries could widen this scope by including diverse case studies from various sectors to corroborate the expanded model and examine sector-specific dynamics. The study's interpretative nature suggests that its outcomes are significantly shaped by researcher perspectives. Future endeavours might focus on refining the categorisation or adopting different methodological frameworks to bolster the objectivity and replicability of the findings. Since the research is confined to a single organisation in Germany and focused exclusively on information workers, the outcomes might not capture the full spectrum of global and sectoral variation in remote work. Subsequent research could address these gaps by extending the geographic and occupational scope, offering a more comprehensive view of the impacts of remote work on organisational change across different contexts and industries.

7 Technological Facets of Digital Transformation: Unleashing Business Model Innovation in the IoT Era[5]

The studies presented above concentrate on the organisational dimensions of DT in traditional organisational contexts. Following study though focuses on the technological aspect of DT. Specifically, it addresses the integration of IoT technologies and the associated BMs. With a rigorous SLR, five literature clusters are defined that evaluate existing research. The analysis highlights significant gaps and proposes directions for future research, emphasising the need for an ecosystem-based perspective to research the intersection of IoT technologies and BM innovation. This study advocates for a deeper investigation into how IoT redefines market dynamics and value creation; the study offers insights for scholars and practitioners aiming to leverage IoT in DT strategies.

7.1 Introduction

The IoT technologies have a significant effect on business relationships and, as a result, on BMs. A typical example is the story of the General Electric Company (GE), which today faces non-traditional competitors such as SAP and IBM. These new competitors use the IoT applications to shift the value proposition from plain equipment to the additional efficiencies and benefits obtained through advanced analytics and data (Iansiti and Lakhani 2014). Nowadays, we see many automotive manufacturers transforming from mere car producers to providers of holistic solutions, enhancing their products with digital features and platforms. For instance, Mercedes Benz Vans opened a project house known as ‘Future Transportation’ that focuses on the digitalisation of services and products.

These applications and state-of-the-art possibilities promise business profits. According to the Internet of Everything (IoE) Index, businesses generate $613 billion in additional profits annually as a result of connected devices (Bradley et al. 2013). Multiple forecasters promise IoT applications will have an exceptional economic impact, namely a revenue of $11.1 trillion per year by 2025 (Greengard 2015; Manyika et al. 2015). These numbers might be overly optimistic given the complexity and heterogeneity of IoT; businesses are striving to develop BMs that reflect the interconnected nature of those technologies (Leminen et al. 2012). The transformative power of IoT requires a complete shift in mindset regarding how value is created and captured, and this presents significant challenges (Westerlund et al. 2014). These shifts and other obstacles are hindering IoT-driven BM realisation.

[5] This chapter is based on the study “*Unlashing the Next Wave of Business Models in the Internet of Things Era: A Systematic Literature Review and New Perspectives for a Research Agenda*” published in the *Proceedings of the Hawaii International Conference on System Sciences*.

For instance major technical challenges such as scalability, resource scarcity and security (Abdmeziem et al. 2016; Haller et al. 2009), general obstacles to business development (Westerlund et al. 2014) and the inertia of incumbent firms (Teece 2010).

On the other hand, IoT creates the foundation for the design of new profitable BMs and value exchange mechanisms (Engelbrecht et al. 2016; Fleisch et al. 2015; Porter and Heppelmann 2014; Weinberger et al. 2016). It has the potential to reshape BMs and entire industry boundaries (Qin et al. 2016). Nevertheless, there are few conceptualisations of IoT-driven BMs (Leminen et al. 2012; Sun et al. 2012; Turber et al. 2014), and the literature is still largely technology-focused (Whitmore et al. 2015). There is little generalised knowledge on what these BMs are and how they should be constructed (Dijkman et al. 2015; Leminen et al. 2012; Turber et al. 2014).

Studies in organisational strategy highlight the importance of three kinds of dynamic capabilities: innovation capabilities, capabilities for environmental scanning and sensing, and integrative capabilities (Helfat and Raubitschek 2018). Integrative capabilities in the context of DT and broader IS research remain largely underexplored (Vial 2019). Integrative capabilities refer to the capacity to enable consistent and reliable communication and coordination activities aimed at introducing and altering products, resources, capabilities, and BMs (p. 1395); these may function internally or externally across different firms, such as through alliances and partnerships. Knowledge of integrative capabilities is emerging from diverse fields of research, and there is no uniform understanding of how such BMs should be conceptualised, defined or adopted. This study provides a common ground for understanding and motivating new perspectives for practice and research by exploring the current literature on BMs in the field of the IoT technologies and the implications of studies for future work.

The scope of the study is twofold. First, it provides a comprehensive and up-to-date literature review of the existing research, contributing to the establishment of a common body of knowledge. This will, in turn, help further conceptualise BMs within the IoT environment (Veit et al. 2014). Second, the study relates future research directions to each of the literature streams, building space for theory development and uncovering areas where research is needed (Webster and Watson 2002). From a practical perspective, this study adds value for businesses, notably incumbent firms; the insights on the existing IoT-driven BM literature lead to an improved understanding of the IoT environment. Without a well-developed BM, any organisation will fail to deliver or capture value (Teece 2010).

Finally, this overview is of value for IS practitioners designing the information and communication tools supporting the BM processes (e.g., UML; Eriksson and Penker 2000). In summary, the SLR and the outlook for future research contribute to current debates and the initiation of novel, intriguing discussions..

7.2 Theoretical Background

7.2.1 Business Model Definition

The diversity of BM definitions has resulted in multiple annotations (see, for example, Chesbrough and Rosenbloom 2002; Magretta 2002; Teece 2010; Timmers 1998; Veit et al. 2014, etc.). However, many researchers agree that the BM helps them interpret how a specific firm is conducting its business (Casadesus-Masanell and Ricart 2010; Osterwalder and Pigneur 2010; Tiwana et al. 2010). In this study, it is argued that the firm-centric view has to be broadened. Two definitions, from Zott et al. (2011) and Zott and Amit (2010), are merged and BM is defined as 'a value creation tool that depicts the content, structure, and governance of transactions enabling a system of interdependent activities that transcends the focal firm and spans its boundaries.' IoT technologies bundle applications that cross firm boundaries and represent an assemblage that is irreducible to its individual parts. Therefore, it is of crucial importance to include the firm and ecosystem perspective when analysing IoT-driven BMs (Leminen et al. 2012; Ng et al. 2017; Zott and Amit 2007).

The firm-centric concept began to evolve with the widespread adoption of computer networks in the 1990s (El Sawy and Pereira 2013; Ghaziani and Ventresca 2005; Hedman and Kalling 2003; Klang et al. 2014; Zott et al. 2011). Over time, the focus has shifted from e-businesses (Applegate 2001; Cherian 2001; Timmers 1998) to the BM; this research has been situated in multiple disciplines such as strategy, innovation, management, and IS (Casadesus-Masanell and Ricart 2010; Lindgardt et al. 2009; Osterwalder et al. 2005). Most of the research is generic (Veit et al. 2014), but there are scholars who introduce domain-specific taxonomies of particular subtypes (Hartmann et al. 2016; Remane et al. 2017; Schief and Buxmann 2012). Some identify and analyse BM components (Pateli and Giaglis 2004; Shafer et al. 2005), and others use these to provide a method with which technology entrepreneurs can develop BMs (Muegge 2012).

Some scholars claim that recent research to clarify the BM concept and its constitutive elements or components (Hedman and Kalling 2003; Osterwalder et al. 2005) has helped establish 'an increasingly uniform understanding' of the BMs (Wirtz et al. 2016). However, many academics argue that the academic research on BM remains underdeveloped (Zott et al. 2011), arguing that the narrow firm-centric approach is not suitable for the new, highly interconnected environment.

BMs based on today's largely static and firm-centric information architecture face challenges as new methods of creating value arise, for example, a specific location, dynamic pricing, or usage fees (Chui et al. 2010).

The literature on business ecosystems highlights the need for a deeper network view on BMs (Carbone 2009; Muegge 2013), as existing templates and frameworks are inadequate to examine the interdependent nature of the growth and success of companies sharing an ecosystem (Wurster 2014). Considering the development of the IoT field, it is evident that the interdependence of different actors through technical and business ties is becoming essential (Weinberger et al. 2016).

7.2.2 Internet of Things Concept

The concept of the IoT has been around for over two decades and touches upon every sphere of our lives (Whitmore et al. 2015); there is no consensus on the IoT concept and how it should be understood. When first presented in 1998, the IoT was focused on social communities and industries (Qin et al. 2016). However, there is still no commonly accepted definition, and in this study it is used as an expression of the concept of connecting objects for various purposes, including identification, communication, sensing, and data collection across the Internet (Whitmore et al. 2015).

From a technical perspective, the IoT applications enable physical objects to transform analogue information into digital form (Yoo 2010). We reaffirm the definition introduced in Haller et al. (2009) that the IoT is a world where physical objects seamlessly integrate into the information network and can become active participants in business processes.

Such utilisation of the IoT technologies introduces new business opportunities. There have been remarkable improvements in the IoT sensor and actuator technologies, and alongside decreasing costs, this has allowed companies data insights, advanced offerings (Weinberger et al. 2016), and completely new IoT-enabled BMs (Porter and Heppelmann 2014). For instance, companies might use consumer data to personalise and standardise their offerings, resulting in new profit opportunities (Ng et al. 2017). In other words, digitally enhanced products will allow companies to offer entirely new solutions, enhance value propositions, or target new customer segments (Fleisch et al. 2015). The success of such opportunities depends on dedicated BM conceptualisations, frameworks, tools and methods. Given the disruptive nature of the IoT (Hognelid and Kalling 2015), current approaches should be reinvented to fit the dynamic and flexible nature of the IoT environment (Vermesan et al. 2016).

7.3 Process of Systematic Literature Review

In conducting the SLR, a rigorous protocol, consisting of a replicable, scientific and transparent process, as introduced in Tranfield et al. (2003), is follwed. This is a highly cited and standard reference for the SLR method in IS. The SLR allows us to synthesise past knowledge about the topic, identify important biases and gaps in the literature, and, finally, propose future research directions (Mulrow 1994). By applying this method, it is possible to identify the gaps in the literature on IoT-driven BMs. The following detailed description of the method and process supports the reproducibility of the research (Mayring 2014). The first phase comprises interviews with four experts in the IoT field from two leading European manufacturers dedicated to DT; in parallel, an initial screening of the relevant literature is conducted. In the second stage, the relevant search terms are established.

The following terms, already known in the field, proved relevant: IoT business model and Internet of Things AND Business Model. These search terms were used to query the title, abstract and keyword fields of various publications using the INFORMS and ACM databases that cover the publications of the Association for IS journals and the top 50 IS journals (Vom Brocke et al. 2015). Additionally, three leading practitioner-oriented journals are considered, namely, the California Management Review, Harvard Business Review, and MIT Sloan Management Review; this adds practical value to the study and a broader perspective to the research paradigm (Zott et al. 2011). The initial list was comprised of 120 highly ranked publications in all sources. After reading through the abstracts and conclusions, the publications are filtered based on topic relevance. Out of this process, 80 studies were selected as the focus of analysis. The studies have been read and, based on the topic and the journal's relevance, twenty publications are selected. A backward and forward search led to six additional studies. The resulting (and final) list, including journal articles, conference proceedings, and completed research studies, consists of 25 publications. The process of publication extraction is depicted in Figure 6.

The literature clusters are created from the streams of IoT-driven BMs research (n=25) and follow the inductive approach introduced in Miles et al. (2013) using the MAXQDA software for coding the material. The inductive approach allows to search for patterns (clusters) through observation and the development of theories. The approach consists of two coding cycles. First, categories for each stream of the IoT BM literature are established. For this, the definitions and descriptions in the research sub-domains presented in Pateli and Giaglis (2004), are used.

Using the five expert judgements and reliability testing, the authors propose eight sub-domains: definitions, components, taxonomies, conceptual models, design methods and tools, adoption factors, evaluation models, and change methodologies.

Accepting these domains as 'a validated instrument that classifies BM research' (Pateli and Giaglis 2004), the definitions of existing categories are used as a reference point.

The analysis of the literature on IoT-driven BMs follows the benchmarking process, with each selected publication tested against all existing sub-domains. Each author conducts this process individually, with the outcomes being merged and the results consolidated. In a second cycle, three additional experts specialising in BMs and the IoT, are included to critically revise the clustering process and assign the studies to particular sub-domains according to their abstracts. In this process, a consensus is reached: five out of eight existing sub-domains appear to satisfy the criterion developed in Pateli and Giaglis (2004).

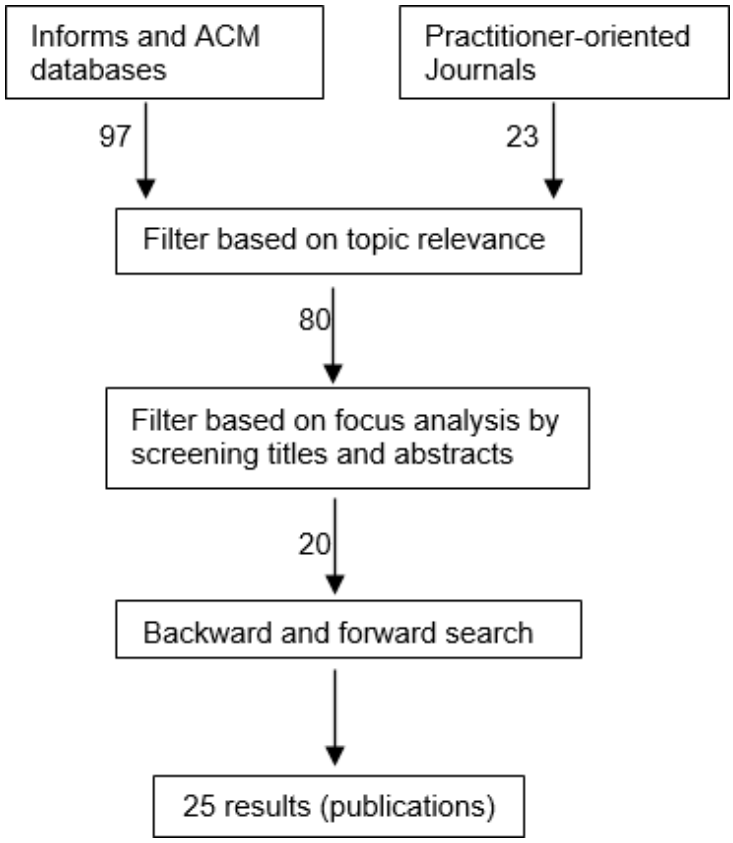


Figure 6: Publications Extraction Process

The information is structured by aggregating the codes into five main categories. **'Conceptualisation'** is the category capturing the literature dedicated to presenting viable IoT-driven BM frameworks or patterns. **'Components'** is the category capturing the literature concerned with analysing the decomposed constructs of the IoT-driven-BM concept. **'Design methods and tools'** is the category concerned with the development and use of IoT-driven BM modelling tools for automating the design process.

'Taxonomies' is the category for studies that consider possible categorisations of IoT-driven BMs into types based on various criteria. **'Adoption factors'** is the category for the literature analysing challenges that affect the organisational adoption of IoT-driven BMs.

7.4 Literature Review Results on IoT-driven Business Models

This section presents an overview of existing research on BMs within the IoT technologies, extracted from 25 publications identified through the SLR. The publications are organised into five sub-domains following the research framework introduced in Pateli and Giaglis (2004): conceptualisation, components, methods and tools, taxonomies, and adoption factors. Table 12 represents an overview of the findings, relating the authors to the sub-domains. The black shading indicates the domain that is deeply analysed, the grey shading indicates a limited analysis, and the white shading indicates that there is no analysis of those domains.

7.4.1 Conceptualisation

This cluster refers to studies presenting IoT-driven BM frameworks or patterns. Research in this domain aims to organise information about the relationships between various BM components from numerous perspectives (Pateli and Giaglis 2004). In the literature on IoT-driven BMs, two distinct streams are identified. First, there is research that tries to capture the value interactions within the IoT. Iivari et al. (2016), for instance, propose a framework for understanding the dynamics of value co-creation and co-capture in the context of the industrial Internet. The authors use two dimensions, the stage and the scope and scale of value co-creation and co-capture, to identify the corresponding BM type and introduce the so-called 'oblique' model that simultaneously incorporates value co-creation and co-capture within the IoT ecosystem. Similarly, Weinberger et al. (2016) build the concept based on value components: exchanges, extract (monetised part of the ecosystem), and design. Vermesan et al. (2016) consider eight layers to classify IoT value creation and identify participating stakeholders. For each layer, they propose the corresponding BM type most common across markets.

Second, there are scholars who mostly focus on specific characteristics of the IoT technologies. Hognelid and Kalling (2015) build a concept based on three constructs: transaction structure, content, and governance. For each construct they assign four capabilities of smart and connected products: monitoring, control, optimisation and autonomy. Schladofsky et al. (2016) introduce a framework that considers the heterogeneity of smart node devices at the edge, network technologies, multiple standardisation initiatives, immaturity of innovation, and unstructured ecosystems. Finally, Ehret and Wirtz (2017) build industrial IoT-driven BM clusters based on the concept of non-ownership contracts. They introduce three possible BMs for the IoT environment in the manufacturing industry.

Author/s	Conceptualis-ation	Components	Design Methods and Tools	Taxonomies	Adoption Factors
Bucherer and Uckelmann (2011)					
Turber et al. (2014)					
Sun et al. (2012)					
Schladofsky et al. (2017)					
Iivari et al. (2016)					
Li and Xu (2013)					
Ehret and Wirtz (2017)					
Leminen et al. (2012)					
Ju et al. (2016)					
Dijkman et al. (2016)					
Bock and Wiener (2017)					
Brynjolfsson and Saunders (2009)					
Mejtoft (2011)					
Weinberger et al. (2016)					
Chan (2015)					
Chui et al. (2010)					
Teece (2010)					
Fleisch et al. (2015)					
Vermesan and Friess (2016)					
Westerlund et al. (2014)					
Wurster (2014)					
Bilgeri and Wortmann(2017)					
Haller et al. (2009)					
Klein et al. (2017)					
Saarikko et al.(2017)					
Onar et al. (2017)					

Table 12: Overview of the Studies on the IoT-driven BMs

Finally, there are scholars who design conceptual models assuming the ecosystem perspective as the defining scheme. For instance, Leminen et al. (2012) use the ecosystem and customer dimensions to identify four IoT-driven BM types. Turber et al. (2014) set out a 'Framework for IoT BMs'. Based on the service-dominant logic (Vargo and Lusch 2008) and using the design-science approach (Peffers et al. 2007), they establish an IoT-driven BM framework that covers three dimensions: identifying stakeholders, benefits of participation, and sources of value co-creation. Sun et al. (2012) introduce a so-called DNA model addressing three elements of IoT-driven BMs: 'how', 'what' and 'why'. Using the three blocks, design, needs, aspirations and smart logistics, as the use case, they demonstrate the cause-and-effect of existing relationships. This analysis shows that there is a strong emphasis on different dimensions of IoT-driven BMs but few assessments of the actors and mutual dynamic interactions.

For instance, Vermesan et al. (2016) affirm that the stakeholders involved in the IoT businesses might be participants in more than one layer; however, they do not describe the existing relationships nor the overlaps between different layers. In addition, many of the conceptualisations apply the firm-centric parameters to different actors in the IoT ecosystem. It is urged for the further development of ideas regarding how to derive a contemporary concept that takes account of all actors and their respective relationships. Specifically, it is needed that the research is directed to discovering the relationships among the various stakeholders included in the IoT ecosystem and dynamic exchanges.

7.4.2 Components

This sub-domain in Pateli and Giaglis's (2004) framework represents the cluster of literature analysing decomposed BM components and their fundamental constructs. Here, studies analysing the elements of the IoT-driven-BM concept are analysed. In the literature on BMs, the most commonly analysed components are customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure (Osterwalder et al. 2005). In the literature on IoT-driven BMs, the analysis of the components is quite narrow. Many scholars examine the value component as the crucial profit driver. However, there is a divergence of views regarding the importance of different value components. Bucherer and Uckelmann (2011) stress that information and its exchange play a crucial role in the IoT network. Similarly, Bock and Wiener (2017) evaluate customer data as the main IoT-driven BM value ingredient. Brynjolfsson and Saunders (2009) describe digital infrastructure as the core component, claiming that the focus should be on digital infrastructure, which is extremely scalable and can be upgraded or replaced with relative ease and at low costs.

Several scholars offer a comprehensive analysis of value creation without weighting particular propositions. For instance, Mejtoft (2011) analyses the value contributed by (i) manufacturing, (ii) supporting, (iii) and co-creation. The manufacturing layer denotes the hardware aspect of the IoT, the supporting layer reflects the process of data collection for further value creation, and the co-creative layer uses IoT as a co-creative partner. In a similar manner, Onar et al. (2018) evaluate the IoT value proposition with respect to novelty, efficiency, lock-in power and complementarity parameters. Revising the previous IoT-driven BM components cluster, one might conclude that the current research is value-focused and sparse. In line with the findings of Dijkman et al. (2015), in which the value proposition appears to be the most significant building block of IoT-driven BMs, these research efforts are highly advantageous for further studies. By contrast, the analysis of other components, such as infrastructure and data ingredients, is marginal and unfocused.

Additionally, there is virtually no targeted analysis of other important components such as customer relationships and key partners (Dijkman et al. 2015). Given the heterogeneity of research, we encourage further studies and empirical validation of the various IoT-driven BM components (e.g., how dimension of value exchange) and recommend particular attention to be given to ‘data’ as one of the crucial drivers of future businesses.

7.4.3 Methods and Tools

In this sub-domain, Pateli and Giaglis (2004) include research referring to tools used to leverage the BM design process. It includes studies that explore the development and use of mechanisms to describe the process and, eventually, the components of IoT-driven BM design. In this analysis of the literature on IoT-driven-BMs, several viable solutions are found. Chui et al. (2010) introduce the tool that answers the ‘how’ question regarding the process of IoT business development. In other words, they aim to describe the most important actors and factors of the model development, building upon the framework in Höller et al. (2014). Dijkman et al. (2015) introduce BM components for IoT applications based on BM Canvas (BMC; Osterwalder and Pigneur 2010); key partners include hardware producers, software developers, data interpreters, and launching customers.

In a similar fashion and also using the BMC, Ju et al. (2016) introduce the generic IoT-driven BM framework that consists of nine building blocks and their constituent elements. Some of the building blocks affirm the findings of Dijkman et al. (2015). In others, and based on interviews, they add or remove particular elements. Finally, Chan (2015) introduces a tool to facilitate the visualisation and arrangement of different IoT-driven BM components.

Despite many scholars calling for an ecosystem perspective when designing tools for IoT-driven BMs, most simply apply existing methods and consider several different stakeholders. We argue that future research must embrace the ecosystem perspective when building or evaluating specific BM design tools and methods for the IoT environment.

7.4.4 Taxonomies

In Pateli and Giaglis (2004), this cluster relates to categorising BMs into typologies based on various criteria. They argue that in the field of e-BMs, there is a relatively significant share of work to derive a list of generic BM types. In the IoT context, several efforts have been made to cluster different BMs using various criteria. Teece (2010), for instance, demonstrates different BM configurations that businesses in the IoT could adopt. One of the possible options is the 'razor/razor blade model', which involves pricing the razors (IoT hardware) inexpensively but aggressively marking up the blades (e.g., data). Fleisch et al. (2015) use the 55 BM patterns introduced in Gassmann et al. (2014) to test the IoT application against existing patterns.

Following their iterative process, Fleisch et al. (2015) introduce two additional models: (i) digitally charged products representing new possibilities in the DT of manufacturing and (ii) the sensor as a service to capture the idea of collecting, processing, and selling the data. Vermesan et al. (2016) also use the BM Navigator (Gassmann et al. 2014) to propose different IoT-driven BM combinations pursued by today's most successful IoT companies. For instance, the 'Amazon combination' employs affiliation, cash machine, e-commerce, leveraging customer data, long tail, make-more-of-it, user-designed, and two-sided-market BM options. This fairly limited taxonomy indicates the need to further research and properly classify different types of IoT-driven BMs. In line with the e-BM analysis (Pateli and Giaglis 2004), there is a need for a holistic parameter for the development of IoT-driven BM taxonomy. Therefore, we urge that the classification criteria be studied further to ensure this area is properly developed.

7.4.5 Adoption Factors

Pateli Pateli and Giaglis (2004) argue that research on key factors potentially affecting BM adoption is motivated by the desire to contribute, identify, and assess promising BMs in different organisational contexts. In this analysis, eight studies are identified, which analyse the challenges or opportunities affecting the adoption of the IoT technologies within these new BMs. First, there are scholars who argue that these technologies encourage collaboration. For instance, Vermesan and Friess (2013) claim that the IoT is forcing the movement from vertical to multi-purpose and collaborative solutions.

Similarly, Loebbecke and Picot (2015) find that IoT-driven BM challenges are particularly significant as organisations convert from industry-specific vertical IoT applications to horizontal ones spanning multiple industries.

Second, there is a stream of literature focusing on crucial challenges specific to the introduction of an IoT-driven BM. Westerlund et al. (2014) note three major obstacles to engaging with the IoT: (i) diversity of objects, (ii) immaturity of innovation, and (iii) unstructured ecosystems. Vargo and Lusch (2008) extend this study, adding (i) the heterogeneity of network technologies and (ii) multiple standardisation initiatives. Supporting Westerlund et al. (2014), Vargo and Lusch (2008) underline the need to understand drivers of value that are integrated (i.e., shared overall value for an entire IoT ecosystem) rather than fragmented (i.e., individual actors' value derived from specific applications or services). They suggest shifting the focus of value creation and value capture in BMs from the company to the ecosystem. Other scholars, for example, Wurster (2014) and Haller et al. (2009), focus on particular business or technical obstacles for IoT-driven businesses.

Wurster (2014) describes (i) identifying horizontal needs and opportunities, (ii) internal team alignment, and (iii) overcoming the market maturity problem for IoT technologies, while Haller et al. (2009) group technical issues into four clusters: (i) internet scalability, (ii) identification and addressing, (iii) heterogeneity, and (iv) service paradigms. Saariko et al. (2017) raise a number of fundamental issues related to the development of IoT-driven BMs, including partnership strategy, data ownership, and technology diffusion. They pose several questions and draw upon observations from the field to demonstrate that a financially sustainable solution needs to have the full support of all participants to create the preconditions for value creation. Bilgeri et al. (2015) provide the template for developing BMs for IoT offerings; Bilgeri and Wortmann (2017) identify sixteen barriers to that process, and these are structured according to the four high-level innovation stages described in Luchs et al. (2015). They argue that while some of the resulting barriers appear to be fairly discussed in the BM innovation literature, others remain severely under-researched, despite their significance for the IoT environment.

There are also scholars who tend to describe rather than address the impact of IoT technologies on BMs. For example, Chui et al. (2010) propose six distinct types of emerging IoT applications and their respective uses. They distinguish between two broad categories: (i) information and analysis and (ii) automation and control. Weinberger et al. (2016) claim that organisations can make use of the IoT in three different ways: 1) application of the IoT-generated data to improve the internal and external processes (high-resolution management), 2) enrichment of the product portfolio with sensor and actuator technologies (digitally charged products), and 3) supply of the IoT technologies.

7.5 Discussion of Results

IoT technology is unlikely to ensure sustainable profitability if the corresponding BMs are not properly developed and adapted to its complex environment (Schief and Buxmann 2012). While some existing forms and tools might apply, the IoT is essentially disruptive (Hognelid and Kalling 2015) and can change the entire BM paradigm (e.g., the new ecosystem perspective); there is thus a need for a better understanding of the impact of the IoT on business development. Simply adding 'digital features' to the theory could be a trap since this would constitute applying known BM tools (e.g., BMC) to an environment that requires entirely new design rules.

Attempts have been made to develop the theoretical frameworks through the analysis of concepts related to BMs driven by the IoT (e.g., Leminen et al. 2012; Turber et al. 2014). However, the correlations and dynamic interactions must still be investigated. The application of firm-centric parameters to different ecosystem IoT players should be avoided to allow entirely new conceptualisations to emerge. BM components have long been neglected in research (Wirtz et al. 2016), and it is unsurprising that there are so few studies tackling components of IoT-driven BMs. Some scholars describe and evaluate value components (e.g., Bucherer and Uckelman 2011; Mejtoft 2011), and others focus on specific elements such as infrastructure and data [e.g., Bock and Wiener 2017; Brynjolfsson and Saunders 2009).

Taxonomy is the starting point for the application of the broad BM literature to the IoT context. For instance, Fleisch et al. (2015) and Vermesan et al. (2016) use the 55 BM patterns introduced in Gassmann et al. (2013) to introduce the BM taxonomies within the IoT environment. When it comes to design methods and tools, there are several helpful and practical approaches that focus on the ideation and development of IoT-driven BMs (Bilgeri et al. 2015). However, these do not include the relevant component descriptions and their respective roles. Finally, compared to other domains, the literature on IoT adoption factors seems more extensively researched. Several studies introduce the technical and technological challenges of adopting IoT technologies (e.g., Vermesan et al. 2016; Whitmore et al. 2015), while others tackle the obstacles of introducing appropriate BMs in the IoT context (Bilgeri and Wortmann 2017).

It is also noticeable that many scholars argue for the significance of the ecosystem perspective when discussing IoT-driven BMs. Originally presented by James F. Moore (2014), the concept of a business ecosystem stems from the insight that innovative businesses rely on various resources. Horizontal movements of value creation and capture are ramifying BMs, and some scholars argue that the existing frameworks are unable to reflect the ecosystem complexity of the IoT environment. Therefore, it is necessary to account for the network and mutual dependence of different stakeholders.

7.6 Conclusion, Limitations and Future Research

The results of the literature review obtained by clustering existing IoT-driven BM research lead to the conclusion that this field has great potential for further research. IoT technologies have the power to affect overarching BMs (Timmers 1998). However, only the enterprises able to overcome the challenges posed by this phenomenon will benefit from its opportunities (Fleisch et al. 2015). Although some scholars claim that recent research on the BM concept has helped establish 'an increasingly uniform understanding' of BMs (e.g., Hedman and Kalling 2003; Osterwalder et al. 2005; Wirtz et al. 2016), narrow, firm-centric approach is unsuitable for the new, highly interconnected environment. IoT-driven BMs should not be based on largely static information architectures or be firm-centric – the IoT produces a high degree of interdependency of actors through technical and business ties (Weinberger et al. 2016). Moreover, there are scholars who introduce the crucial issue of transformation from vertical to horizontal dimensions within the IoT introduction, but there are still no specificities on the nature of those challenges and their respective influence on BMs.

Cluster	Research direction
Conceptualization	Derivation of a contemporary IoT- driven BM concepts that merge all existing actors and their respective relationships; discovering the mutual relationships of various stakeholders included in the IoT ecosystem and dynamic exchanges.
Components	Studies and empirical validations of the various IoT-driven BM components (e.g. dimension of value exchange); particular attention to be given to "data" as one of the crucial drivers of future BM.
Methods and Tools	Embracement of the ecosystem perspective when building/evaluating the specific BM design tools and methods for the IoT environment.
Taxonomies	Need for a holistic parameter for the development of the IoT-driven BM taxonomy; further studies on the classification criteria for a proper development of the taxonomy.
Adoption Factors	Heading the future research towards the analysis of the particular obstacles related to the dimension transformation (from vertical to horizontal); the ecosystem dimension of the IoT-driven BMs and its defining boundaries; test the adoption of the IoT-driven BMs within different organisation systems or structures.

Table 13: Future Research Directions

Businesses need to explore the ecosystem dimension of IoT-driven BMs and to delineate the boundarie of such ecosystems. Understanding the ecosystem perspective is crucial as it encompasses the various stakeholders, technologies, and processes that interact within an IoT environment. The adoption and effectiveness of these IoT-driven BMs should be empirically tested across different organizational systems and structures to ensure their viability.

Two general ways to advance the study of IoT BMs are suggested. First, the research directions proposed in Table 13 should be actively pursued to develop a comprehensive body of knowledge that is both theoretically and practically relevant for enterprises currently encountering barriers in implementing IoT-driven BMs. This includes addressing key challenges such as integration, interoperability, and data management within IoT ecosystems.

Businesses must appreciate the networked nature of the IoT and its broader surroundings (James 2014; Loebbecke and Picot 2015). This networked perspective highlights the importance of seamless connectivity and collaboration among various IoT devices and systems. Additionally, the significance of customer co-creation processes and their associated challenges must be recognized and addressed (Tilson et al. 2010). Customer co-creation involves engaging customers in the design and development of IoT solutions, which can lead to more user-centric and innovative products and services. However, it also presents challenges such as managing customer expectations and ensuring data privacy.

This review has several limitations that need to be acknowledged. First, much of the literature reviewed appears in the form of conference proceedings, with few studies currently published in highly-ranked academic journals. This indicates a nascent field that is still gaining traction in the academic community. Second, although the study follows a ‘validated instrument that classifies BM research,’ as introduced in Pateli and Giaglis (2004), the classification process is inherently subjective, following our understanding and perspective of ‘what makes sense.’ This is a common methodological approach in IS research but may introduce bias.

It is strongly recommended that future research adopts a more rigorous method of taxonomy development. For instance, the method described in Nickerson et al. (2013) offers a systematic approach to developing taxonomies that can enhance the clarity and precision of BM classifications. By following such rigorous methods, future studies can contribute to a more robust and reliable body of knowledge, ultimately aiding organizations in navigating the complexities of IoT-driven BMs.

In conclusion, while this study provides a foundational understanding of the ecosystem dimension of IoT BMs, it also highlights the need for further empirical research and methodological rigor.

8 Technological Facets of Digital Transformation: Reusable Artificial Intelligence in Business Practices[6]

This final study makes a significant contribution to the analysis of the technological facets of DT by focusing on the sustainable implementation of AI. It acknowledges the resource-intensive nature of AI and addresses this challenge by offering tailored design principles (DPs) to enhance the reusability of AI systems. Utilising design science research (DSR) and leveraging Wenger's (1998) Community of Practice (CoP) framework, the study involves iterative refinement of design knowledge through methods such as design thinking workshops, focus group discussions, and expert interviews. It examines how DPs for reusable AI solutions can support socially and environmentally sustainable business practices. This exploration is intended to stimulate further research in the IS field, particularly concerning sustainable technological advancements and their integration into business strategies.

8.1 Introduction

Organisations are increasingly turning to AI to gain business value and to cope with the deluge of data and the substantial increase in computational capacity (Collins et al. 2021). One of the most widely discussed challenges of developing AI solutions is its substantial resource demands (Chatterjee et al. 2022). Data preparation and collection incur high costs and make substantial resource demands, as does training and maintaining AI models (Baier et al. 2019; Davenport and Ronanki 2018; Snoek et al. 2012; Wamba-Taguimdje et al. 2020).

Indeed, AI is accelerating natural resource extraction and the distancing of waste (Dauvergne 2022) since it runs on technology, machines, and infrastructures that deplete scarce resources in their production, consumption, and disposal (Brevini 2020). At the same time, organisations are facing increasing pressure to be sustainable and to use their resources efficiently (Chatterjee et al. 2022). This may involve organisations reducing their energy consumption, minimising waste, using environmentally friendly materials, and considering the social and ethical implications of their activities (Wamba-Taguimdje et al. 2020).

The reusability of AI models and data may offer a solution to the lack of resources and the negative environmental and social impacts of AI (Watson et al. 2010). By sharing data and models, organisations can reduce the costs associated with developing their own (Flynn et al. 2022), including the negative impacts of high energy and natural resource consumption.

[6] This chapter is based on the study "*Building Sustainable Business Practices: Design Principles for Reusable Artificial Intelligence*" published in *Proceedings of the International Conference on Wirtschaftsinformatik.*

Organisations may be reluctant to share their knowledge and resources for fear of losing their competitive advantage and internal business secrets. The tension between the benefits of reusability and the need to remain competitive is challenging and requires careful consideration.

In particular, this paper serves to the call for research that proposes DPs that consider the technology–human interaction so that developers can create reusable AI solutions and develop opportunities for organisations to use AI technologies for sustainability (e.g., Dwivedi et al. 2020; Enholm et al. 2021). Thus, the aim is to answer the following research question: How to develop AI solutions that are reusable across different contexts and how such practices might contribute to socially and environmentally sustainable business practices? In this paper, there is an initial step in studying the technological feasibility of reusable AI solutions. It is further considered the usefulness of the existing DPs for developing reusable AI solutions to foster social and environmentally sustainable business practices.

8.2 Theoretical Background

8.2.1 Artificial Intelligence

According to Russell and Norvig (2021), AI can perform tasks that would normally require human intelligence. AI systems are designed to be like intelligent agents that can perceive their environment and take action to achieve their goals. AI systems accomplish this by employing algorithms and models capable of acquiring knowledge from data and adjusting to novel circumstances. AI systems can then perform tasks such as recognising images and understanding natural language and support data-based decision-making using the capabilities of self-learning and problem-solving (Mikalef and Gupta 2021; Berente et al. 2021). AI represents a wide-ranging set of technologies with these unique capabilities. These include machine learning, robotic process automation, deep learning, and rule-based expert systems. These promise several advantages for organisations (Benbya et al. 2021; Enholm et al. 2021) but also signal a new set of barriers and challenges (Duan et al. 2019). Such challenges include bridging cross-domain knowledge to develop models that are accurate and meaningful (Duan et al. 2019), identifying and integrating diverse sources of data (Mikalef and Gupta 2021), and integrating AI applications with existing processes and systems (Davenport and Ronanki 2018).

Unfortunately, recent research on AI is more focused on a technological understanding of AI adoption than tackling the organisational challenges associated with its development (Alsheibani et al. 2020). There are several studies that identify research gaps (Dwivedi et al. 2020) and important aspects of being able to leverage AI technologies (Mikalef and Gupta 2021). However, there is no holistic understanding of how reusable AI could be developed in organisations (Duan et al. 2019).

There is a growing body of literature that focuses on how AI contributes to the development of sustainable business practices (e.g., Alsheibani et al. 2020; Borges et al. 2021; Rajput and Singh 2019), but few studies consider how is the AI sustainably designed (Baier et al. 2019).

8.2.2 Reusable Artificial Intelligence

The development of AI requires separate analysis due to its distinct characteristics; AI involves different business processes, technologies, and knowledge than traditional software solutions (Grennan et al. 2022). Given the autonomy, self-learning, and inscrutability of AI, the reusability of AI solutions needs careful consideration (Berente et al. 2021). While there are some initial studies on reusable AI, these primarily focus on enabling AI-reusability technologies (Dragert et al. 2012; Snoek et al. 2012). The IS has no established concrete definition of reusable AI that captures its technical and organisational aspects. Consequently, our understanding of reusable AI is based on real-world examples of models and algorithms being utilised across multiple applications, thereby saving time and resources and potentially reducing the energy consumption and carbon emissions associated with building and training new AI models (McKinsey and Company 2020).

By integrating environmental, social, and economic considerations, reusable AI solutions can contribute to sustainable business practices (Watson et al. 2010; Seidel et al. 2013; vom Brocke et al. 2013). IS plays a crucial role in enabling sustainable practices by facilitating the collection, analysis, and dissemination of environmental and social performance data, as well as supporting decision-making processes that incorporate sustainability criteria (Melville 2010; Watson et al. 2010; Seidel et al. 2013; vom Brocke et al. 2013). However, no existing study utilises the DSR methodology to develop DPs specifically for reusable AI solutions that would support sustainable business practices.

8.2.3 Software Reuse

The IS scholars have extensively investigated the topic of software reusability (Padhy et al. 2018) with a wide range of studies across software domains (Kim and Stohr 1998; Ravichandran 2012; Apte et al. 1990; Banker and Kauffman 1991). These show that software reusability can enhance automated programmer productivity tools (Ewers and Vessey 1981) and improve process flexibility and predictability (Nidumolu and Knotts 1998), thereby positively impacting cost efficiency. The primary focus has been on the financial aspects of reusability, such as cost and effort reduction and accelerated time to market (Singh et al. 2015).

Reuse involves the combination of high-level specifications and existing component artefacts to generate new designs (Setliff et al. 1993). Various tools and techniques have been developed to support reuse-based software design (Purao and Storey 1997).

Class libraries, components, frameworks, and patterns have been created as reusable artefacts (Szyperski 1998), and research has been conducted to facilitate reuse in object-oriented conceptual design through the development of tools (Purao and Storey 1997; Sugumaran and Storey 2000). High-level design fragments and models have also been developed (Jain et al. 2006).

The use of software components has greatly enhanced the capacity of companies to create high-quality business solutions on a large scale. Reusability is key in developing software components for use in multiple programs to avoid reinventing existing software. Existing research emphasises the importance of systematic software reuse, which has proved to be highly effective in software engineering, offering benefits in productivity, quality, and cost reduction (de Almeida 2019).

8.3 Design Science Research

To develop design knowledge in the form of DPs, Peffers et al. (2007) provide a processual overview of the DSR method. This method is particularly suitable here as it offers a synthesised general model that is enabling to follow and describe each step of the DSR process in a transparent manner. The method includes following: (1) problem identification, (2) objectives definition, (3) design and development, (4) demonstration and evaluation, and (5) communication (see Figure 7). In the following, there is a detailed overview of the DSR process.

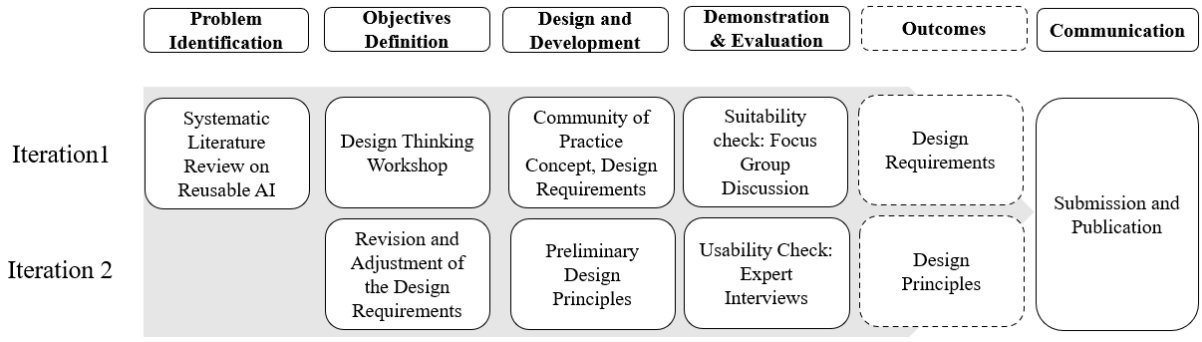


Figure 7: Application of the DSR Methodology as described in Peffers et al. (2007)

8.3.1 Iteration 1

The first iteration involves identifying the problem, defining the objectives, and designing, developing, and evaluating the design requirements (DRs).

Problem Identification – a systematic review of literature on reusable AI. This step follows a rigorous protocol that comprises the replicable, scientific, and transparent process introduced in Webster and Watson (2002). The SLR allows to synthesise knowledge about reusable AI solutions and identify important biases and gaps in the literature. Figure 8 depicts the screening process.

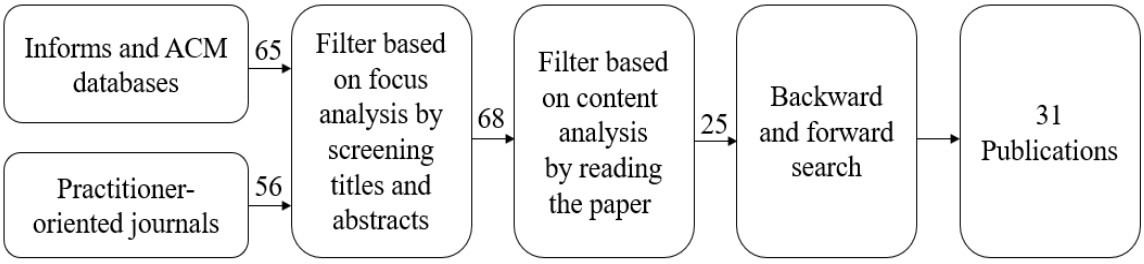


Figure 8: Systematic Literature Review on Reusable AI

Objectives Definition – design thinking workshop. Design thinking is the creative element of the DSR methodology in this study to i) encourage direct exchange between the researchers, ii) set out the problems and define project objectives, and iii) define the objectives for the DSR methodology, as recommended by Hevner et al. (2004). Design thinking is generally used as a scientific method to develop practical design solutions (Cross 2007). It is a creative method with a defined framework rather than a series of ordered steps. Brown (2008) proposes three elements of design thinking: inspiration, ideation, and implementation.

For this study, authors met for three full days in person. The inspiration phase took place before the workshop; where various problems (P1–P5) have been identified through the SLR. The workshop alternated between individual and small group activities that were used to generate knowledge, and discuss the motivations and objectives of DPs. In general, Schön's (1983) recommendation that design thinking be understood as the thinking of 'reflective practitioners' has been followed.

Design and Development – community of practice and design requirements. The community of practice (CoP) concept, supported by various studies (Wenger et al. 2002; Wenger and Snyder 2000; Lefebvre and Legner 2022; Tremblay 2004; Iivari 2020), serves as a kernel theory. It is based on three pillars: the domain of shared interest within a community, the community's shared understanding created through discussion and learning, and the development of a shared practice repertoire. The CoP allows individuals to transcend their original boundaries, benefit from collective knowledge, and identify with a larger body of knowledge.

In the organisational context, where the generation and sharing of knowledge are crucial, CoP is a suitable kernel theory. It addresses the problem of silo thinking, where functional structures hinder a holistic approach to problem-solving and innovation (Pumplun et al. 2019; Enholm et al. 2021; Bannister 2001). This theory is particularly applicable when studying data-related phenomena in a community (Wenger 1998); it emphasises the need for collective empowerment in implementing reusable AI solutions and recognises networking as a prerequisite for successful implementation.

Demonstration and Evaluation – suitability check through focus group discussions. The DRs are elaborated through the two focus group discussions, following the recommendations of Tremblay et al. (2010). For the first group, four researchers whose ongoing interests are in the development of AI and organisational learning have been recruited. The goal was to expand the understanding of the previously defined DRs and their suitability and, in particular, what aspects should be adjusted or added. One author moderated the focus group discussion, and the conversation lasted about 75 minutes. The participants developed a shared understanding by discussing their responses to the following open-ended question: What is important in the development of reusable AI? The moderator then presented the DRs to the participants, who separately discussed their usefulness and viability.

In the second focus group, a practical perspective have been incorporated. There was a Zoom call with three AI experts working as data scientists and AI specialists for prominent corporations, primarily in image recognition technologies, natural language processing, and deep learning projects. Their technical proficiency, while valuable in these discussions, is importantly supplemented by their managerial responsibilities, which afford them technical and organisational insights regarding the practicality of creating reusable AI solutions. Working with practitioners can lead to better solutions and generate knowledge that is useful for practice (Rai 2019). Finally, the focus group discussions were documented using keywords, and the core statements were filtered with the help of statement coding (Ryan and Bernhard 2003).

8.3.2 Iteration 2

The second iteration entails adjusting the DRs following the suitability check. The preliminary DPs were defined and presented to the AI experts for evaluation. Following Peffers (2008) and embracing the usability concept, the significance of including potential system users in the DSR process have been acknowledged (Hoehle and Venkatesh 2015). Thus, nine AI experts were interviewed. These interviews aimed to assist in formulating the eight DPs that address the design requirements. Overall, the DPs are thus informed by the SLR, the design thinking workshop, the CoP concept, the focus group discussion, and the expert interviews.

Demonstration and Evaluation – usability check of design principles through expert interviews. The qualitative interviews were conducted following the principles suggested by Myers and Newman (2007). First, the experts received a one-page summary of the research goal that we used to contact the data scientists and AI experts. Following Yin (2017), the interviewee selection followed a heterogeneous purposive sample approach applying two pre-defined criteria: a) more than three years of experience (YoE) in working with AI technologies and b) solid knowledge of the reusability aspect of AI development.

ID	Role	Field	YoE	Country
i-1	Head of Strategic AI	Strategic AI & Politics	11	Germany
i-2	AI Quality Consultant	IT Development	7	Germany
i-3	AI Product Manager	IT Development	4	Spain
i-4	Data Scientists	Automotive Industry	7	Germany
i-5	Data Scientists	IT Development	3	Germany
i-6	Head of Sustainable AI	Strategic AI	15	Finland
i-7	Project Lead	Sustainable AI	5	Netherlands
i-8	Research Fellow	AI in Politics	4	UK
i-9	AI Advisor	AI Development	4	Germany

Table 14: Overview of the AI Interviewees

The interview guide includes questions related to the interviewee's AI background and expertise, the reusability aspects of AI, and an evaluation of the DPs. After the evaluation, the interviewees were asked about aspects that may have been neglected. Table 14 provides the details about the participants. The interview data have been assessed by using a structured content analysis, as described in Lacity and Janson (1994). This is guided by the seven principles of interpretive field research introduced by Klein and Myers (1999). Specifically, the understanding of participants' views on the usability of each DP is developed through the iterations of their individual opinions. Open coding has been used throughout the interview analysis to establish a uniform system for evaluation and subsequent category creation (Ryan and Bernhard 2003). The unit of coding is complete sentences and paragraphs that refer to the DP characteristics. To maintain validity and reliability, only the aspects that were mentioned by at least five participants have been added. Two of the authors performed the coding process independently to increase rigour and reliability, using QCAMap (Mayring and Fenzl 2016).

8.4 Results

8.4.1 Results from the Iteration 1

Problem Identification - identified problems. P1: not every organisation has the resources and knowledge to implement AI solutions and automate their processes (Snoek et al. 2012).

P2: trained AI models often do not perform well, and the AI development process must thus be performed repeatedly (Yao et al. 2017). **P3**: organisations structured in functional silos encounter challenges when deploying AI as these do not facilitate a holistic approach to problem-solving (Pumplun et al. 2019; Enholm et al. 2021). **P4**: in developing AI solutions, organisations struggle to operate sustainably (Mikalef and Gupta 2021). **P5**: complying with data protection requirements is challenging (Pumplun et al. 2019). **P6**: organisations must balance the need to implement AI solutions for optimising processes and achieving sustainability goals; there are also concerns around sharing knowledge about training AI models.

Objectives. Objective **O1** is that the DPs facilitate the implementation of reusable AI solutions. This is complemented by Objective **O2**, which is the establishment of a theoretical foundation and incorporation of practitioners' perspectives to ensure diverse viewpoints are reflected in design knowledge. Objective **O3** is to investigate the potential impacts of the established DPs for developing reusable AI solutions on the promotion of socially and environmentally sustainable business practices.

Design and Development – design requirements. AI solutions are referred to as general-purpose technology that can be deployed across teams and departments internally and across organisations (Brynjolfsson and Mcafee 2017).

DR1: Organisations should design AI solutions that are applicable to different organisational functions across multiple domains of interest and beyond boundaries. While organisations are constantly generating new knowledge, siloed thinking limits knowledge to particular departments or organisations (Bannister 2001). Studies show that sharing knowledge is essential to innovation (e.g., Brynjolfsson et al. 2017). Most importantly, resources can be saved when knowledge is shared rather than having to be developed from scratch (e.g., Garbuio et al. 2011). There is a need to work together to build a shared understanding through discussions, activities, and learning, which leads us to the following DRs.

DR2: Organisations benefit from community exchange and should mutually engage, regularly interact, and share their knowledge when they design AI solutions. **DR2a**: Organisations should integrate an easily accessible platform for employees to manage the knowledge related to AI development. **DR2b**: The ownership of the sharing platforms with knowledge related to AI development and solutions should be clearly defined with the aim of maintaining that content. Since the goal of organisations is maximising profit and increasing revenue while saving resources (e.g., Watson et al. 2010), reusability should ideally be viewed as a productivity enhancement. A central location is required to store knowledge to allow the reuse of AI solutions within and across organisations. This repository can be established within or across organisations.

DR3: Organisations should share a repository of documented processes, algorithms, and other documents to enable easier and faster access to AI-specific knowledge. **DR3a**: Organisations should provide technical and non-technical documentation of their reusable AI solutions. **DR3b**: Organisations should have an extraction mechanism in place to ensure access to the data. **DR3c**: Organisations should adhere to pre-defined standards.

Based on the second focus group, the DRs are extended as follows. **DR4**: The development of reusable AI solutions must be supported by accessible training data that follow principles like FAIR to provide developers with suitable (e.g., domain or application-specific) and high-quality data at a low cost. **DR5**: When developing reusable AI, organisations should adhere to privacy and other applicable laws.

Demonstration and Evaluation – adjusted design requirements. During the sustainability check, the focus group participants confirmed the existing requirements and offered adjustments for DR2 and DR3. The focus group participants found DR2 very intriguing since merging data from different sources while cohering to the data protection laws presents serious obstacles. For DR2, the participants added that there should be an easily accessible platform for interested employees to share knowledge. They also noted that there should be a clearly defined owner for such initiatives or platforms.

Based on this discussion, DR2 has been extended with DR2a and DR2b. For DR3, the participants emphasise the need for i) comprehensive technical and non-technical documentation, ii) a mechanism for extracting data, and iii) adherence to standards and best practices should be considered. Thus, DR3a-DR3c. have been added. The focus group participants also discussed global initiatives that democratise AI deployment. For instance, there are several initiatives that support standardised and open data management, for example, the 'FAIR – Forward Artificial Intelligence for All' project in Germany and the global initiative 'AI and Data Commons' (GIZ 2022; ITU 2021). DR4 was added because responsible and standardised data management emerged as an important topic in the groups. The issue of privacy and compliance with laws was discussed in both focus groups; as a result, DR5 is included to ensure regulatory compliance.

8.4.2 Results from the Iteration 2

Demonstration and Evaluation – Design Principles. Design principles based on the design requirements and objectives for the development of reusable AI solutions that can be deployed in different contexts with fewer resources are presented within this chapter. To formalize the DPs we adhere to, we have adopted the recommendation put forth by Gregor et al. (2020) and present them in Table 15.

DP	Description For the development of reusable AI, it is essential to ensure that	DR
DP1	**Collaboration and Knowledge Exchange.** … employees should actively facilitate collaborations and expertise-sharing across diverse departments, disciplines, and industries because it enhances knowledge-intensive processes like data preparation and AI model training.	DR1 DR2
DP2	**Open Data.** … employees should make data available on an open platform because it allows quick, easy, and equitable access to large amounts of data.	DR2 DR2a
DP3	**Transfer Learning.** DP3a: … employees should use and provide pre-trained AI models and transfer learning to specify pre-trained AI models quickly and with less proprietary data for one's own application purpose. DP3b: … organisations should clearly define the ownership of the training data and the department who maintains the AI solution (M) to define clear responsibilities.	DR2 DR2a DR2b
DP4	**Standards for Data Formats and Exchange.** … employees should use standard data formats, such as JSON, and exchange frameworks, such as FHIR to store and share data in a standardized way.	DR3 DR3b DR3c
DP5	**Standards for Algorithms.** ...employees should use and support standard algorithm libraries, such as Scikit-learn, Pytorch, Tensorflow, etc. to build AI solutions efficiently.	DR3 DR3c
DP6	**Provenance Documentation.** … employees should use provenance documentation (documenting "who-what-where") during AI development process to trace the origin of data, to prove the steps of the data processing, and to determine the trustworthiness of results.	DR3 DR3a DR3c
DP7	**Data Management.** … developers should follow data management principles, such as FAIR to identify, access, interoperate, and reuse data with none or minimal human intervention in ISs.	DR4
DP8	**Data Protection.** … organisations should consider data protection law to be compliant with these laws helps safeguard individuals' privacy rights, fosters trust among customers and stakeholders, mitigates the risk of legal and reputational consequences, and promotes responsible and ethical handling of personal data.	DR5

Table 15: Design Principles for the Development of Reusable AI

8.5 Discussion

The field of IS has a rich history of exploring methods and technologies that might contribute to achieving sustainability goals (vom Brocke et al. 2013). Nevertheless, few scholarly investigations focus on the means by which these technologies can be developed sustainably (Schoormann et al. 2023).

Specifically, there is a dearth of scholarship on the strategies for designing AI solutions with reusability in mind and that consider the potential impact of these solutions on sustainable business practices (Catovic et al. 2021; Melville 2010; Walshe et al. 2020). Objective of this study is thus to cultivate design knowledge, explain the eight DPs pertaining to the development of reusable AI from a technical perspective, and explore their potential contribution to the attainment of social and environmentally sustainable business practices..

8.5.1 Design Principles and related sustainability Dimensions

First DP1 emphasises the need to develop a community around a common depository or knowledge-exchange platform that will, in turn, enable the sharing and building of expertise. The literature shows that organisational learning is a critical aspect of the effective deployment of AI technologies (Mikalef et al. 2017). In general, avoiding functional silos within and across different domains and organisations allows continuous knowledge development (Pumplun et al. 2019). This might, in turn, contribute to the social aspect of sustainable business practices since enhanced collaboration can lead to more sustainable AI solutions by leveraging a wider range of insights and best practices. For instance, communities can play a crucial role in establishing ethical guidelines and best practices for AI development (Askell et al. 2019).

DP2 addresses the need for democratisation of the data employed. However, integrating data from a variety of sources presents a serious obstacle for contemporary organisations (Ransbotham et al. 2018). From a sustainability perspective, data democratisation contributes to socially sustainable development by empowering communities, promoting participatory development, and fostering social innovation (Walshe et al. 2020). Our research community is strongly advocating for data democratisation (Lefebvre et al. 2021), but we must bear in mind that the protection of user privacy makes the responsible development of AI imperative (Arietta et al. 2020). Therefore, DP2 is demarcated with DP7 and DP8, which address the need for responsible data handling when developing AI solutions.

DP3 addresses knowledge transfer and ensures that the actor's roles are well-defined and ownership of knowledge is clearly delineated. DP4 addresses the importance of utilising standard data formats. There is an increasing demand for infrastructures that are findable, accessible, interoperable, and reusable – this is driven by the need to enhance information access in society (Wilkinson et al. 2016). Well-defined responsibilities mitigate the risk of conflicts and can streamline project execution and resource allocation (Schwindt 2005). These practices have the potential to enhance resource efficiency, minimise redundant efforts, and optimise operations, decreasing the negative environmental impact of AI solutions.

Furthermore, clearly defining responsibilities can enhance collaboration and engagement and foster a knowledge-sharing culture, thereby promoting social responsibility and ethical conduct.

DP5 focuses on utilising standard algorithm libraries for efficient training of cutting-edge AI solutions. DP6 promotes the adoption of provenance documentation during AI development. Provenance documentation enables the tracing of data origins, the validation of processing steps, and the assessment of result reliability, satisfying the demand that AI solutions must be explicable. Provenance documentation allows employees to reproduce implementation and supports responsible AI practices, traceability, and accountability. Transparent documentation fosters social sustainability and the extension and improvement of existing models (Rzepka and Berger 2018).

DP7 is concerned with the need for standardised data management when developing reusable AI solutions. The International Organization for Standardization (ISO) has been actively involved in an AI standardisation project since 2018, as Zielke (2020) documents. This initiative signifies a collective effort towards standardised data management and data systems in the AI field. Standardisation efforts contribute to efficient resource utilisation, ease compliance with privacy regulations, and facilitate collaboration. Such practices hold the potential to support the development of environmentally and socially responsible AI solutions, consequently fostering sustainable business practices (Walshe et al. 2020). Finally, DP8 emphasises the need for organisations to comply with data protection laws and promote responsible handling of personal data. Taking such responsibility in developing AI solutions promotes socially sustainable business practices by safeguarding privacy rights, fostering customer and stakeholder trust, and demonstrating ethical and responsible behaviour.

8.5.2 Theoretical and Practical Contributions

The existing literature on AI within our IS community is primarily focused on a technological understanding of AI adoption (Alsheibani et al. 2020). Although there is a growing literature that focuses on how AI contributes to the development of sustainable business practices (e.g., Borges et al. 2021; Rajput and Singh 2019), there is little on how those AI solutions should be sustainably designed (Catovic et al. 2021; Melville 2010). Therefore, the theoretical contribution of this study is manyfold. First, by producing DPs, there is a contribution to DSR studies that develop and evaluate design knowledge by extending the scope to reusable AI development (e.g., Kane et al. 2021).

Second, the literature on sustainability in IS research is enlarged by addressing reusable AI development (e.g., Setliff et al. 1993; Purao and Storey 1997). The potential contributions of the established DPs to developing reusable AI solutions that support socially and environmentally sustainable business practices have been considered.

Hopefully, this discussion catalyses further exploration and examination of this topic within the IS field. Finally, by focusing on reusable AI development, the design knowledge in this study, in the form of DPs, validates Wenger's (1998) CoP concept for the AI context.

From a practical perspective, DPs defined in this study offer instructions that have been evaluated for use across domains and organisations when developing reusable AI solutions. This will, in turn, help in creating sustainable organisations and innovation. With the introduction of these DPs, there is a hope to foster AI adoption in industries since reusable AI might help in overcoming the numerous challenges to AI adoption, such as limited knowledge, lack of AI expertise, and scarce financial resources (e.g., Yao et al. 2017; Chan et al. 2020).

8.6 Conclusion, Limitations and Future Research

The IS research community has a responsibility to contribute to the development of sustainable business and IT practices. Given the intersection of computational and social sciences, this paper develops and evaluates design knowledge consisting of DPs for creating reusable AI solutions. Despite careful execution, the study has several limitations.

Firstly, these DPs are introduced considering the technical feasibility of developing reusable AI. However, exploring the managerial perspective and researching how organizations weigh the potential benefits of reusability against the risks of sharing knowledge and resources would be valuable. Managers' concerns about competitive advantage and intellectual property could impact the adoption of reusable AI solutions, offering insights into broader adoption challenges.

The DPs were not evaluated within a third iteration, which could provide deeper insights into their practical applicability. Developing an instantiation to demonstrate the applicability of these principles and quantitatively evaluate their effectiveness is recommended, as suggested by Gregor and Hevner (2013). This would help validate the utility of the DPs in real-world scenarios, ensuring robustness and practicality.

The potential impact of DPs on socially and environmentally sustainable business practices is presented, but correlations based on large data sets and statistical evaluations would be beneficial. Analyzing environmental and social outcomes of organizations that have adopted reusable AI principles compared to those that have not could provide empirical evidence supporting the benefits for sustainability.

Examining the differences in applying these DPs across public and private sectors, and identifying intersections and opportunities, would be insightful. The public sector might prioritize transparency and public welfare, while the private sector may focus on profitability and competitive advantage. Understanding these differences could help tailor the DPs to various organizational contexts better.

Further research could also explore the scalability of these principles in different organizational sizes and industries. Large enterprises might have more resources for implementing reusable AI solutions, whereas SMEs might face unique challenges. Investigating these nuances can refine the DPs to be more inclusive and adaptable.

Examining the long-term effects of implementing reusable AI solutions on organizational performance and innovation through longitudinal studies could provide insights into the principles' impact on business success over time. Additionally, exploring cultural factors influencing the adoption of reusable AI solutions can offer a more global perspective, as different regions may have varying attitudes towards technology sharing and sustainability.

Furthermore, it is essential to explore the intersection of these DPs with emerging regulatory frameworks and standards for AI and data use. Regulations such as the GDPR and upcoming AI-specific regulations could significantly impact how reusable AI solutions are developed and deployed. Understanding the regulatory landscape can help in designing DPs that are compliant with legal requirements, thereby facilitating smoother adoption by organizations.

Research should also consider the ethical implications of reusable AI solutions. Ensuring that AI systems are developed and used ethically involves addressing issues such as bias, transparency, and accountability. Investigating how these ethical considerations can be integrated into the DPs can enhance the trustworthiness and acceptance of AI solutions.

In addition, cross-disciplinary collaborations could enrich the research on reusable AI solutions. Engaging with experts from fields such as ethics, law, and environmental science can provide comprehensive insights into the multifaceted challenges of developing sustainable and reusable AI. Such collaborations can lead to more holistic and robust DPs that address a wide range of considerations.

Moreover, the role of education and training in promoting the adoption of reusable AI principles cannot be overstated. Organizations need to develop skills and knowledge related to AI technologies and sustainable practices among their workforce. Research on effective training programs and educational frameworks can support the successful implementation of the proposed DPs.

While this study provides a foundational understanding of DPs for developing reusable AI solutions, numerous avenues for further research exist. Addressing these limitations and expanding the investigation can contribute to more sustainable and effective business practices in the evolving digital landscape. By advancing this body of knowledge, the IS research community can play a pivotal role in shaping the future of sustainable technology and business models.

9 Contributions, Implications and Future Research Outlook

This doctoral dissertation contributes to the academic field of IS by providing a comprehensive analysis of digital transformation within traditional organisations. It offers a dual perspective, exploring managerial and technological aspects of DT and providing theoretical and practical insights into how traditional organisations can navigate the complexities of digital disruption. The thesis thus enhances our understanding of DT by clearly defining and distinguishing between the often-conflated terms of digitisation, digitalisation, and digital transformation.

This research adopts a clear definition of DT as a process that enhance an entity by inducing substantial changes through the synergy of information, computing, communication, and connectivity technologies, helping to resolve some of the conceptual ambiguities that have plagued the field. The research also contributes to theoretical discourse through an integrated approach to the study of DT; it examines how digital technologies interact with various organisational dimensions such as strategy, structure, and culture. This enriches the IS research field and provides a framework for understanding the broader impacts of DT on organisational ecosystems.

The study addresses the fragmented understanding of DT within the academic community by systematising different schools of thought and proposing a cohesive framework that captures the multifaceted nature of DT. On a practical level, the thesis offers valuable guidance to traditional organisations striving to implement DT. The study highlights the importance of aligning business and IT strategies to overcome the inherent challenges of digital service development within automotive manufacturing. It underscores the need for alignment of business values and technological functionalities and shows how misalignment can lead to operational challenges such as diminished trust and misalignment.

The research further examines the role of management in fostering an environment conducive to DT. By exploring how managerial practices need to adapt to support a digitally-enabled workforce, the thesis provides actionable recommendations for organisations' leaders. It also offers valuable insights into the strategic changes required in the areas of leadership, communication, and organisational culture for organisations looking to enhance their digital agility and responsiveness. Technologically, the thesis considers how the adoption and integration of digital technologies like IoT and AI reshape organisational structures, processes, and strategies. This aspect of the research is important for understanding how traditional organisations can effectively integrate advanced technologies to remain competitive in a digitally driven market.

9.1 Theoretical Contributions

The first part of the dissertation enhances the theoretical understanding of the organisational aspects of DT. A comprehensive framework is developed that identifies and categorises the key factors influencing DT. This framework draws on insights from foundational and current literature, organising these factors into six critical dimensions: digital leadership, the culture of innovation, capabilities, strategy, technical infrastructure, and product and service fit. This structured approach allows for a more thorough analysis of DT initiatives, extending the definitions and conceptualisations from influential studies such as Gurbaxani and Dunkle (2019) and Matt et al. (2015).

The first study integrates various organisational factors that drive DT, such as leadership commitment, cultural adaptiveness, and strategic alignment (Dremel et al. 2017; El Sawy et al. 2016). It explores how these elements interact to influence the direction and effectiveness of DT efforts, enriching the theoretical discourse on how digital capabilities are developed and utilised within organisations to boost digital maturity and transformation success (Porter and Heppelmann 2015; El Sawy et al. 2016).

The second study identifies novel factors that emerged due to the COVID-19 pandemic and their impact on DT. Interviews suggest that these factors could become permanent fixtures in the post-pandemic environment. The analysis extends the current literature by exploring how the pandemic has reshaped established DT drivers and introduced new ones (Boland et al. 2020). A key theoretical contribution confirms the critical role of executive understanding and commitment in DT success, corroborating previous findings (Ancarani et al. 2019; Dremel et al. 2017; Gurbaxani and Dunkle 2019; Herri and Handika 2019; Karimi and Walter 2015).

This study emphasizes that executive leadership underpins organisational support and encouragement, crucial during times of crisis. Additionally, a significant theme is the steep learning curve in the shift to remote leadership, with executives noting the issues of managing productivity and trust in a remote workforce (Bartik et al. 2020; Bartsch et al. 2020; Waizenegger et al. 2020; Kane et al. 2021).

The study further notes the increased relevance of digital competencies during the pandemic. The lockdowns catalysed the enhancement of digital skills through structured internal knowledge exchange and a shift from informal to more systematic learning approaches (Tynjälä 2008; Kyndt and Baert 2013). This transformation suggests an evolving focus within IS research on developing virtual capabilities using engaging and interactive online learning methods (Soto-Acosta 2020).

The third study considers the dynamics of business and IT collaboration, highlighting how the intersection of divergent perspectives on business values, technological functionalities, and development strategies can lead to misalignment. From a theoretical perspective, this research extends the applicability of the TFR theory, demonstrating its relevance in analysing business-centric perspectives in digital service development. It highlights the utility of the theory in analysing the interactions between business and IT domains within DT, underscoring the strategic importance of IT in business strategy and supporting integrated approaches in digital service development. This study aligns with Dijkman et al. (2015) and Islam et al. (2017) on integrating IT strategies into broader business frameworks.

As DT becomes increasingly critical for an organisation's strategic orientation, aligning business and IT functions is essential. Further IS research is needed to develop effective strategies for managing digital service complexities in established firms. Supporting Matthies et al. (2016) and Lin and Silva (2005), the study advocates for a deeper understanding of how digital technologies interact with organisational dimensions like strategy, structure, and culture, as well as their broader societal impacts.

The final study within a first part investigates the impacts of remote work on organisational performance and transformation, utilising the Burke and Litwin (1992) framework as a foundational analytical tool. The study extends the model's traditional application by integrating contemporary findings regarding the ongoing relevance of its transformational elements in today's digital and remote work environments.

An important theoretical enhancement suggested by this research is the incorporation of technology as a transformational element. The shift to remote work, accelerated by the COVID-19 pandemic, represents a significant departure from traditional work paradigms and was primarily facilitated by advancements in information technology that support alternative organisational structures (Olson 1983; Davison 2020; Popovici and Popovici 2020). This transition underscores the need to revisit organisational frameworks to incorporate the technological underpinnings important to maintaining diverse new work settings.

Second part of the dissertation tackles the technological aspects of DT. The first study reviews the literature on IoT-driven business models (BMs), noting the significant opportunities for advancing research in this domain. This field is poised for further exploration due to the transformative potential of IoT technologies to redefine overarching BMs (Timmers 1998). Scholars have established a more uniform understanding (Hedman and Kalling 2003; Osterwalder et al. 2005; Wirtz et al. 2016) of BMs.

However, their studies often adopt a narrow, firm-centric approach that does not fully accommodate the highly interconnected nature of modern IoT environments. This review suggests that IoT-driven BMs should move beyond a largely static information architecture and embrace the high degree of interdependence of stakeholders, facilitated by their technical and business ties (Weinberger et al. 2016).

Finally, the review argues that there is a critical need to understand the networked nature of the IoT and its implications (James 2014; Loebbecke and Picot 2015), as well as to acknowledge the importance of customer co-creation processes and the challenges they present (Tilson et al. 2010).

The final study expands the IS literature on sustainable technology development, particularly as it concerns AI. Drawing on established frameworks (vom Brocke et al. 2013; Schoormann et al. 2023), this study explores how AI technologies can be developed sustainably, emphasising the design of AI solutions with reusability in mind (Catovic et al. 2021; Melville 2010; Walshe et al. 2020).

A significant theoretical advancement is the identification and application of DPs that prioritise sustainability in AI development, highlighting the shift from vertical to horizontal dimensions within organisational structures as AI technologies become more integrated. The discussion extends beyond the firm-centric approach criticised by some scholars, proposing a broader, interconnected perspective suitable for the highly networked nature of modern AI environments. This theoretical contribution enriches the discourse around sustainable AI, suggesting a comprehensive framework for addressing the complexities of designing reusable AI systems.

The exploration of these DPs also underscores the need to develop community platforms for knowledge exchange, aligning with the findings in Mikalef et al. (2017) and Pumplun et al. (2019). Enhancing understanding of organisational learning and its impact on sustainable AI development is essential. By promoting standardised data management and the adoption of established data systems (Zielke 2020), these DPs facilitate efficient resource utilisation and adherence to regulatory standards, crucial for developing environmentally and socially responsible AI solutions. Additionally, the principles support provenance documentation and the use of standard algorithm libraries, enhancing transparency, accountability, and the reproducibility of AI solutions (Rzepka and Berger 2018).

9.2 Practical Implications

Practically, the first part of this dissertation provides valuable insights for managers and decision-makers in traditional organisations initiating or currently managing DT initiatives. The identification of critical influencing factors offers a strategic roadmap for prioritising resources, crafting targeted interventions, and aligning organisational activities toward effective DT. This systematic identification and categorisation of factors serve as a strategic guide, helping organisations navigate the complexities of DT more effectively.

The first study highlights the importance of leadership and organisational culture in fostering digital innovation. The critical role of executive support, a culture that champions innovation, and the empowerment of employees are identified as key drivers of DT success. The second study focuses on additional critical areas requiring strategic attention and resource allocation to enhance organisational resilience and agility. The findings underscore the need for structural reassessment and strategic reorientation to leverage post-crisis opportunities effectively. The increased reliance on technical infrastructure, particularly remote IT support, emerged as a crucial enabler for DT during the pandemic.

This shift necessitates a re-evaluation of traditional IT support models to sustain remote operations and DT initiatives. The pandemic also prompted a significant realignment of products and services with market demands, prioritising organisational agility and responsiveness to rapidly evolving customer needs. This realignment has led companies to reassess their operational and strategic approaches to maintain relevance and competitiveness in a dynamically changing market landscape.

The third study underscores the need for a proactive management approach to reconcile business and IT collaboration, a necessary aspect of a successful DT. The study highlights traditional structural divides between business and IT units, suggesting that these may exacerbate alignment challenges. A re-evaluation of team interactions and collaboration practices is recommended to mitigate these issues.

The final study in this part offers actionable insights for managing the transformational impacts of remote work within organisations. The analysis underlines the need for adaptive strategies to ensure organisational alignment and enhance employee engagement, emphasising the importance of tailoring solutions to individual employee preferences—a crucial consideration for redefining workplace structures in the post-pandemic era. Leadership roles also evolve significantly in remote settings, requiring an increased focus on coaching, communication, and trust, which are vital for supporting geographically dispersed teams. Organisational policies and executive support are essential to the effective implementation of remote work strategies.

The study further examines individual and organisational performance impacts, noting improvements in efficiency and job satisfaction among remote workers. However, challenges in cultivating a unified organisational culture and promoting innovation in remote settings are also identified. By emphasising technology's role in anchoring all other transformational dimensions, the study provides practical guidance for leveraging digital platforms and tools to maintain organisational cohesion and continuity in dispersed work environments.

Second part of the dissertation tackles the technological facets of DT. The first study underscores the need to expand the discussion on the ecosystem dimension of IoT-driven BMs, focusing on identifying system boundaries and testing models across different organisational systems and structures. The study facilitates a deeper understanding of how IoT technologies can be integrated into and transform BMs, helping organisations navigate the complexities associated with these transformative technologies. Exploring these avenues allows researchers and practitioners to collaborate, overcoming barriers to effective IoT implementation and leveraging the full potential of IoT-driven business model innovation.

The final study outlines specific DPs that encourage the development of reusable AI solutions, emphasising the role of the community in fostering an environment conducive to sustainable AI practices. The establishment of common depositories or knowledge-exchange platforms enhances collaboration and continuous learning within and across organisations, supporting the social sustainability of business practices. The study addresses the democratisation of data and the challenges associated with integrating data from diverse sources, highlighting the importance of data protection and responsible data handling as essential components of sustainable AI development.

In summary, the practical contributions of this study provide robust principles in real-world settings that support the development of AI solutions that are technologically advanced and socially and environmentally responsible. This study aims to catalyse further exploration of these matters and promote the adoption of sustainable AI practices.

9.3 Future Research Outlook

This dissertation has laid a substantial foundation for future exploration of DT across various dimensions. Several areas of future research could build on the insights gained to deepen the understanding of DT's impact and integration into traditional organisations. First, exploring how key factors influencing DT manifest across different industries or cultural contexts would be beneficial. Highlighting sector-specific and cross-cultural variations in DT dynamics would enrich the academic discourse. Factors identified within this dissertation as affecting DT would benefit from empirical testing through case studies, surveys, or longitudinal studies.

This approach would validate the relationships and impacts suggested, providing more robust evidence for the theoretical constructs developed. Given the significant changes brought about by the COVID-19 pandemic, examining its long-term effects on organisations' digital strategies and operations is essential.

Second, focusing on the capabilities needed to effectively leverage advanced technologies such as AI, IoT, and blockchain is crucial for enhancing competitive edge and operational efficiency. Further IS research is needed to uncover effective organisational and managerial strategies for navigating the complexities of digital service development in established firms. Following methodologies outlined in Matthies et al. (2016) and Lin and Silva (2005), this research could also consider the interaction between digital technologies and organisational dimensions such as strategy, structure, and culture.

The study of sustainable AI development practices should continue to evolve, addressing both technical and managerial aspects of creating reusable AI. This includes quantitatively evaluating the effectiveness of DPs and exploring their application across different organisational contexts, including the public and private sectors. Expanding the theoretical and practical understanding of DT is imperative for ensuring that the academic and business communities can effectively respond to the challenges and opportunities presented by digital technologies.

Research should aim to provide actionable insights that help organisations navigate their DT journeys more effectively. Investigating the role of leadership in fostering a culture of innovation, examining the impact of digital competencies on organisational agility, and identifying best practices for managing remote work are critical areas for further study. Additionally, exploring the long-term implications of DT on BMs and value creation strategies can offer valuable perspectives for both scholars and practitioners.

By pursuing these research paths, the academic community can contribute to developing sustainable business and IT practices. Addressing the evolving nature of digital technologies and their impact on traditional organisations will enhance the strategic roadmap for DT initiatives. Future studies should focus on sector-specific challenges, cross-cultural comparisons, and the development of integrated frameworks that align technological advancements with sustainable business practices. This comprehensive approach will support the ongoing evolution of digital transformation and its integration into the fabric of contemporary business operations.

References

Abbu, H. R., Fleischmann, D., and Gopalakrishna, P. 2021. “The DT of the Grocery Business-Driven by Consumers, Powered by Technology, and Accelerated by the COVID-19 Pandemic,” Trends and Applications in ISs and Technologies 3:9, pp. 329-339.

Abdmeziem, M. R., Tandjaoui, D., and Romdhani, I. 2016. Architecting the internet of things: state of the art. In Robots and Sensor Clouds (pp. 55-75). Springer, Cham.

Agarwal, R., Guodong, G., DesRoches, C., and Jha, A. K. 2010. "The DT of healthcare: Current status and the road ahead," ISs Research (21:4).

Ågerfalk, P., Conboy, K., and Myers, M. D. 2020. “ISs in the Age of Pandemics: COVID-19 and Beyond,” European Journal of ISs 29:3, pp. 203-207.

Allen, J. P., & Kim, J. 2005. IT and the video game industry: tensions and mutual shaping. Journal of Information Technology, 20(4), 234-244.

Ali, M. A., Rahman, M. A., Siddiqua, S. N., Begum, F., Shaheen, A., Rahman, H., Yousuf, T. B., Majumder, A. & Rahman, M. M. 2019., ‘Application of Burke-Litwin model for capacity assessment of city corporations for sanitation services in Bangladesh’, Waterlines 3, 217–235.

Almeida, F., Santos, J. D., and Monteiro, J. A. 2020. “The Challenges and Opportunities in the Digitalization of Companies in a Post-COVID-19 World,” IEEE Engineering Management Review 48:3, pp. 97-103.

Alos-Simo, L., Verdu-Jover, A. J., and J.-M. Gomez-Gras. 2017. “How Transformational Leadership Facilitates E-Business Adoption.” Industrial Management & Data Systems 117 (2), 382-397.

Alsheibani, S., Messom, D., Cheung, Y., and Alhosni, M. 2020. Reimagining the strategic management of artificial intelligence: Five recommendations for business leaders. “In Proceedings Americas Conference on ISs”, Salt Lake City, US.

Altman, E. J., Schwartz, J., Kiron, D., Jones, R., & Kearns-Manolatos, D. 2021. ‘Workforce Ecosystems: A New Strategic Approach to the Future of Work’ MIT Sloan Management Review 62(2), 1-4.

Ameri, M., & Kurtzberg, T. R. 2022. ‘Leveling the Playing Field Through Remote Work’MIT Sloan Management Review 63(3), 1-3.

Anderson, C. L., and Agarwal, R. 2011. The Digitization of Healthcare: Boundary Risks, Emotion, and Consumer Willingness to Disclose Personal Health Information. ISs Research (22:3), pp. 469-490.

Andriole, S. J. 2017. Five myths about DT. MIT Sloan Management Review, 58(3), 20–22.

Ancarani, A., Di Mauro, C., and F. Mascali. 2019. “Backshoring Strategy and the Adoption of Industry 4.0: Evidence from Europe.” Journal of World Business 54 (4), 360-371.

Applegate, L. M. 2001. E-BMs: Making sense of the Internet business landscape. Information technology and the future enterprise.

Apte, U., Sankar, C. S., Thakur, M., & Turner, J. E. 1990. Reusability-based strategy for development of ISs: Implementation experience of a bank, MIS Quarterly14 (4), 421–432.

Arrieta, A.B., Díaz-Rodríguez, N., Del Ser, J., Bennetot, A., Tabik, S., Barbado, A., García, S., Gil-López, S., Molina, D., Benjamins, R. and Chatila, R., 2020. Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. Information fusion, 58, pp.82-115.

Armstrong, D., Gosling, A., Weinman, J., and Marteau, T. 1997. “The Place of Inter-Rater Reliability in Qualitative Research: An Empirical Study,” Sociology 31:3, pp. 597-606.

Askell, A., Brundage, M. and Hadfield, G., 2019. The Role of Cooperation in Responsible AI Development." arXiv:1907.04534.

Athanasopoulou, A., Bouwman, W. A. G. A., Nikayin, F. A., & de Reuver, G. A. 2016. The disruptive impact of digitalization on the automotive ecosystem: a research agenda on BMs, platforms and consumer issues. The 29th Bled eConference.

Babatunde, O., and Oshodi, O. S. 2019. Organisational Culture for Construction Enterprises in the Fourth Industrial Revolution. In: Aigbavboa, C & Thwala, W. (eds.) The Construction Industry in the Fourth Industrial Revolution, 305-315. Cham: Springer.

Baier, L., Jöhren, F., and Seebacher, S. 2019. Challenges in the deployment and operation of machine learning in practice, "In Proceedings European Conference on ISs", Stockholm, Sweden.

Bannister, F. 2001. Dismantling the silos: Extracting new value from IT investments in public administration, ISs Journal, 11 (1), 65–84.

Banker, R. D., and Kauffman, R. J. 1991. Reuse and productivity in integrated computer-aided software engineering: An empirical study, MIS Quarterly 15 (3), 375–398.

Barrett, A.K. and Stephens, K.K., 2017. The pivotal role of change appropriation in the implementation of health care technology. Management Communication Quarterly, 31(2), pp.163-193.

Bartik, A. W., Cullen, Z. B., Glaeser, E. L., Luca, M., and Stanton, C. T. 2020. "What Jobs are Being Done at Home During the COVID-19 Crisis? Evidence from Firm-Level Surveys," National Bureau of Economic Research, w27422.

Bartsch, S., Weber, E., Büttgen, M., and Huber, A. 2020. "Leadership Matters in Crisis-Induced DT: How to Lead Service Employees Effectively During the COVID-19 Pandemic," Journal of Service Management 32:1, pp. 71-85.

Battleson, D. A., West, B. C., Kim, J., Ramesh, B., & Robinson, P. S. 2016. Achieving dynamic capabilities with cloud computing: an empirical investigation. European Journal of ISs, 25(3), 209-230.

Benbya, H., Pachidi, S., and Jarvenpaa, S. 2021. Special issue editorial: Artificial Intelligence in organisations: Implications for ISs research, Journal of the Association for ISs 22 (2).

Bentley, T. A., Teo, S. T. T., McLeod, L., Tan, F., Bosua, R. & Gloet, M. 2016., 'The role of organisational support in teleworker wellbeing: a socio-technical systems approach', Applied Ergonomics 52, 207–215.

Berente, N., Gu, B., Recker, J., and Santhanam, R. 2021. Managing Artificial Intelligence, MIS Quarterly 45 (3), 1433-1450.

Berg, A. 2020. "Digitization of the Economy - Effects of the Corona Pandemic." URL: https://bit.ly/3bKN25d (visited on 15 March 2021).

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. 2013. Digital Business Strategy: Toward a Next Generation of Insights. *MIS Quarterly*, 37(2), 471-482.

Bilgeri, D., Brandt, V., Lang, M., Tesch, J., and Weinberger, M. 2015. The IoT BM builder. A White Paper of the Bosch IoT Lab, Bosch Software Innovations GmbH.

Bilgeri, D.; Wortmann, F. 2017. Barriers to IoT BM Innovation, in Leimeister, J.M.; Brenner, W. (Hrsg.): Proceedings der 13. Internationalen Tagung WI.

Birchmeier, Z. P. 2004. Exploring the conditional benefits of team diversity: The interaction of task requirements and team composition on tacit coordination efficiency (Doctoral dissertation).

Bloom, N., Liang, J., Roberts, J. & Ying, Z. J. 2015. 'Does Working from Home Work? Evidence from a Chinese Experiment', The Quarterly Journal of Economics 130(1), 165–218.

Bock, M., and Wiener, M. 2017. Towards a Taxonomy of Digital BMs–Conceptual Dimensions and Empirical Illustrations. 38th International Conference on IS.

Bogner, A., Littig, B. and Menz, W. eds., 2009. Interviewing experts. Springer.

Boland, B., de Smet, A., Palter, R., and Sanghvi, A. 2020. "Reimagining the Office and Work life After COVID-19," McKinsey & Company, URL: https://mck.co/3b2b0s2 (visited on 15 March 2021).

Borges, A. F., Laurindo, F. J., Spínola, M. M., Gonçalves, R. F., and Mattos, C. A. 2021. The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions, International Journal of Information Management, 57.

Bradley, J., Loucks, J., Macaulay, J. and Noronha, A., 2013. Internet of everything (IoE) value index. White Paper CISCO and/or its affiliates.

Bravhar, K., and Juric, R. 2017. "Personalized drug administration to patients with Parkinson's disease: Manipulating sensor generated data in Android environments," Hawaii International Conference on System Sciences, Waikoloa Beach, HI, pp. 3489-3498.

Brevini, B. 2020. Black boxes, not green: Mythologizing artificial intelligence and omitting the environment, Big Data & Society, 7(2), 2053951720935141.

Brookes, Richard, and Patricio Pagani. 2014. What becomes a car. Proposed Paper for: BIT 2014 Conference Workshop-Technology Enabled BMs: Platforms, Analytics and Performance.

Brown, T. 2008. Design Thinking. URL: www.hbr.org. Accessed: 14.11. 2022.

Broy, M., Kruger, I. H., Pretschner, A., & Salzmann, C. 2007. Engineering automotive software. Proceedings of the IEEE, 95(2), 356-373.

Brynjolfsson, E. and McAfee, A., 2014. The second machine age: Work, progress, and prosperity in a time of brilliant technologies. WW Norton & Company.

Brynjolfsson, E., and Saunders, A. 2009. Wired for innovation: how information technology is reshaping the economy. MIT Press.

Burke, W.W., 2011. A perspective on the field of organisation development and change: The Zeigarnik effect. The Journal of Applied Behavioral Science, 47(2), pp.143-167.

Burke, W. W., and Litwin, G. H. 1992. A causal model of organisational performance and change. Journal of management, 18(3), 523-545.

Bucherer, E., Uckelmann, D. 2011. BMs for the IoT. In: Architecting the IoT. Springer, Berlin.

By, R. T. 2005. 'Organisational change management: A critical review', Journal of Change Management 5(4), 369–380.

Caillouet, O., Harder, A., Bunch, J. C., Roberts, G. & Radunovich, H. 2022., 'Expanding Landgrant Universities' Community Engagement: An Exploration of the Transformational Factors Affecting the Performance of Intercollegiate Extension Programs', NACTA Journal 66(1), 103–112.

Campbell, B. R. 2005. Alignment: Resolving ambiguity within bounded choices. In Pacific Asia Conference on ISs. University of Hong Kong.

Carroll, N., and Conboy, K. 2020. "Normalizing the 'New Normal': Changing Tech-Driven Work Practices Under Pandemic Time Pressure," International Journal of Information Management 55, 102186.

Carbone, P. 2009. The emerging promise of business ecosystems. Open Source Business Resource.

Casadesus-Masanell, R., and Ricart, J. E. 2010. From strategy to BMs and onto tactics. Long range planning, 43(2-3), 195-215.

Catovic, A., Cartwright, C., Gebreyesus, Y. T., & Ferlin, S. 2021. "Linnaeus: A highly reusable and adaptable ML based log classification pipeline," IEEE/ACM 1st Workshop on AI Engineering-Software Engineering for AI, IEEE.

Cenfetelli, Ronald. 2004. Inhibitors and Enablers as Dual Factor Concepts in Technology Usage. In: JAIS 5 (11), S. 472–492. DOI: 10.17705/1jais.00059.

Chan, Y. E., and Reich, B. H. 2007. IT alignment: what have we learned? Journal of Information technology, 22(4), 297-315.

Chan, Y. E., Krishnamurthy, R., and Desjardins, C. 2020. "Technology-Driven Innovation in Small Firms," MIS Quarterly Executive, 19 (1), 39–55.

Chanias, S., and Hess, T. 2016. Understanding DT Strategy formation: Insights from Europe's Automotive Industry. In: *Pacific Asia Conference on ISs.*

Charmaz, K. 2006. Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis. Sage Publishing.

Chatterjee, S., Chaudhuri, R., and Vrontis, D. 2022. 'Does remote work flexibility enhance organisation performance? Moderating role of organisation policy and top management support', Journal of Business Research, 139, 1501-1512.

Chatterjee, S., Chaudhuri, R., Kamble, S., Gupta, S., & Sivarajah, U. 2022. Adoption of Artificial Intelligence and Cutting-Edge Technologies for Production System Sustainability: A Moderator-Mediation Analysis. ISs Frontiers, 1-16.

Chan, H. C. 2015. Internet of things BMs. Journal of S.S. and Management.

Cherian, E. 2001. Electronic business: the BM makes the difference. In Proceedings of the Eighth European Conference on IT Evaluation.

Chesbrough, H., and Rosenbloom, R. S. 2002. The role of the BM in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies. Industrial and corporate change, 11(3), 529-555.

Chudaeval, A. A., Svetkina, I. A., and Zotova, A. S. 2020. The Process of Production DT at the Industrial Enterprise. In: Ashmarina, S. I., Vochozka, M. & Mantulenko, V. V. (eds.) Digital Age: Chances, Challenges and Future.

Chui, M., Löffler, M., and Roberts, R. 2010. The internet of things. McKinsey Quarterly

Coate, P. 2021. 'Remote work before, during, and after the pandemic', National Council on Compensation Insurance (NCCI): Quarterly Economics Briefing-Q4 2020.

Collins, C., Dennehy, D., Conboy, K., and Mikalef, P. 2021. "Artificial Intelligence in ISs research: A systematic literature review and research agenda," International Journal of Information Management, 60.

Cragg, P., King, M. and Hussin, H., 2002. IT alignment and firm performance in small manufacturing firms. The Journal of Strategic ISs, 11(2), pp.109-132.

Cross, N. 2007. "From a design science to a design discipline: Understanding designerly ways of knowing and thinking," in: Design Research Now, Birkhäuser, Basel 41–54.

Dahlander, L., and Wallin, M. 2018. "The Barriers to Recruiting and Employing Digital Talent," Harvard Business Review.

Dauvergne, P. 2022. “Is artificial intelligence greening global supply chains? Exposing the political economy of environmental costs.” Review of International Political Economy, 29(3), 696-718.

Davenport, Thomas H. 2005. Thinking For A Living: How to Get Better Performance and Results From Knowledge Workers. Boston: Harvard Business School Press. ISBN 1-59139-423-6.

Davenport, T. H., and Ronanki, R. 2018. “Artificial intelligence for the real world,” Harvard Business Review, 96 (1), 108-116.

Davison, R. M. 2020. ‘The Transformative Potential of Disruptions: A Viewpoint’, International Journal of Information Management 55, 102149.

Davidson, R. J. 2000. Affective style, psychopathology, and resilience: brain mechanisms and plasticity. American Psychologist, 55(11), 1196.

Davidson, E. J. 2002. Technology frames and framing: A socio-cognitive investigation of requirements determination. MIS Quarterly, 329-358.

Davidson, E. 2006. A technological frames perspective on information technology and organisational change. The journal of applied behavioral science, 42(1), 23-39.

de Almeida, E. S. 2019.”Software reuse and product line engineering.” In S. Cha, R. Taylor, and K. Kang (Eds.), Handbook of software engineering. Springer.

De, R., Pandey, N., & Palc, A. 2020. ‘Impact of digital surge during covid-19 pandemic: a viewpoint on research and practice’, International Journal of Information Management, 55, 102171.

Delaney Kevin and Levy Eran. 2017. Internet of Things: Challenges, Breakthroughs and Best Practices. Cisco Report.

Dery, K., Sebastian, I. M., and van der Meulen, N. 2017. ‘The digital workplace is key to digital innovation’, MIS Quarterly Executive 16(2), 135-152

Dey, B. L., Al-Karaghouli, W., and Muhammad, S. S. 2020. “Adoption, Adaptation, Use and Impact of ISs During Pandemic Time and Beyond: Research and Managerial Implications,” ISs Management 37:4, pp. 298-302.

Dijkman, R. M., Sprenkels, B., Peeters, T., & Janssen, A. 2015. BMs for the Internet of Things. *International Journal of Information Management*, 35(6).

Dingel, J. and Neiman, B. 2020. ‘How Many Jobs Can be Done at Home?’, Cambridge, MA, National Bureau of Economic Research.

Dougherty, D., and Dunne, D. D. 2012. Digital Science and Knowledge Boundaries in Complex Innovation. Organisation Science (23:5), pp. 1467-1484.

Downes, L., & Nunes, P. F. (2013). Big Bang Disruption. Harvard Business Review, 91(3).

Dragert, C., Kienzle, J. and Verbrugge, C. 2012. Reusable components for artificial intelligence in computer games. In 2012 Second International Workshop on Games and Software Engineering: Realizing User Engagement with Game Engineering Techniques (GAS) (pp. 35-41). IEEE.

Dremel, C., Wulf, J., Herterich, M. M., Waizmann, J.-C., and Brenner, W. 2017. "How AUDI AG established big data analytics in its DT," MIS Quarterly Executive (16:2), pp. 81-100.

Drnevich, P. L., & Croson, D. C. 2013. Information Technology and Business-Level Strategy: Toward an Integrated Theoretical Perspective. MIS Quarterly, 37(2), 483-509.

Dudezert, A., Laval, F., Shirish, A. & Mitev, N. 2023. ’When Companies Make Your Day’, Journal of Global Information Management 31(5), 1–35.

Duan, Y., Edwards, J. S., and Dwivedi, Y. K. 2019. “Artificial intelligence for decision making in the era of Big Data–evolution, challenges and research agenda,” International Journal of Information Management, 48, 63–71.

Duerr, S., Holotiuk, F., Beimborn, D., Wagner, H.-T., and Weitzel, T. 2018. "What is digital organisational culture? Insights from exploratory case studies," Hawaii International Conference on System Sciences, Waikoloa Beach, HI, pp. 5126-5135.

Dwivedi, Y. K., Hughes, L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., ... & Galanos, V. 2020. Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. International Journal of Information Management, 57, 101994.

Eads, Audrey. 2023. ‘100 of the Best Remote Work Companies in 2024’, *https://www.indeed.com/career-advice/finding-a-job/best-remote-work-companies.* Acessed: 05.03.2024.

Ehret, M., and Wirtz, J. 2017. Unlocking value from machines: BMs and the industrial internet of things. Journal of Marketing Management, 33(1-2), 111-130.

Eidhoff, A. T., Stief, S. E., Voeth, M., and S. Gundlach. 2016. “Drivers of Digital Product Innovation in Firms: An Empirical Study of Technological, Organisational and Environmental Factors.” International Journal of Economics and Management Engineering 10 (6), 1888-1892.

El Sawy, O. A., and Pereira, F. 2013. Digital BMs: review and synthesis. In BMling in the dynamic digital space (pp. 13-20). Springer, Berlin.

El Sawy, O. A., Kraemmergaard, P., Amsinck, H. and Vinther, A. L. 2016. How LEGO Built the Foundation and Enterprise Capabilities for Digital Leadership. MIS Quarterly Executive (15:2), pp. 143-166.

Engelbrecht, A., Gerlach, J., and Widjaja, T. 2016. „Understanding the anatomy of Data-driven BMs–towards an empirical taxonomy,“ in: *Proceedings of the European Conference on ISs.* Research Papers. 128.

Enholm, I.M., Papagiannidis, E., Mikalef, P., and Krogstie, J. 2021. “Artificial Intelligence and business value: A literature review,” ISs Frontiers.

Errichiello, L. and Pianese, T. 2019. ‘Toward a theory on workplaces for smart workers’, Facilities, 38(3), 298–315.

Errida, A. and Lotfi, B. 2021., ‘The determinants of organisational change management success: Literature review and case study’, International Journal of Engineering Business Management, 13, 18479790211016273.

Eriksson, H. E., and Penker, M. 2000. BMing with UML. New York, 1-12.

Ewers, J., and Vessey, I. 1981. “The systems development dilemma - A programming perspective,” MIS Quarterly 5 (2), 33–44.

Fenzl, T., and Mayring, P. 2017. “QCAmap: eine interaktive Webapplikation für Qualitative Inhaltsanalyse,” (transl.: “QCAmap: An Interactive Web Application for Qualitative Content Analysis”) Zeitschrift für Soziologie der Erziehung und Sozialisation ZSE 37:3, pp. 333-340.

Fichman, R. G., Dos Santos, B. L., & Zheng, Z. E. 2014. Digital innovation as a fundamental and powerful concept in the ISs curriculum. MIS Quarterly, 38(2).

Fink, L. 2020. “Conducting ISs Research in the Midst of the COVID-19 Pandemic: Opportunities and Challenges,” ISs Management 37:4, pp. 256-259.

Firnkorn, J., & Müller, M. 2012. Selling mobility instead of cars: new business strategies of automakers and the impact on private vehicle holding. Business Strategy and the environment, 21(4).

Fitzgerald, M., Kruschwitz, N., Bonnet, D., and Welch, M. 2014. "Embracing digital technology: A new strategic imperative," MIT Sloan Management Review (55:2), pp. 1-12.

Fiol, C. 1994. Consensus, Diversity, and Learning in Organisations. Organisation Science.

Fleisch, E., Weinberger, M., and Wortmann, F. 2015. „BMs and the IoT," in: *Interoperability and Open Source Solutions for the IoT Springer.*

Fletcher, G., and Griffiths, M., 2020. DT During a Lockdown. International Journal of Information Management 55, 102185.

Flynn, D., & Du, Y. 2012. A case study of the legitimation process undertaken to gain support for an IS in a Chinese university. European Journal of ISs, 21(3).

Flynn, P., Vanderbruggen, T., Liao, C., Lin, P., Emani, M., and Shen, X. 2022. "Finding reusable machine learning components to build programming language processing pipelines," Lawrence Livermore National Lab, Livermore, CA, United States.

Fonner, K. L. & Roloff, M. E. 2010. 'Why Teleworkers are More Satisfied with Their Jobs than are Office-Based Workers: When Less Contact is Beneficial', Journal of Applied Communication Research 38(4), 336–361.

French, R., Mahat, M., Kvan, T. & Imms, W. 2022., 'Viewing the transition to innovative learning environments through the lens of the burke-litwin model for organisational performance and change' , Journal of Educational Change, 1–16.

Ganz, W., Dworschak, B., and Schnalzer, K. 2019. Competences and Competence Development in a Digitalized World of Work. In: Nunes, I. L. (ed.) Advances in Human Factors and Systems Interaction, 312-320.

Gassmann, Oliver; Frankenberger, Karolin; Csik, Michaela. 2014. The BM navigator: 55 models that will revolutionise your business: Pearson UK.

Gerow, J.E., Thatcher, J.B. and Grover, V. 2014. Six Types of IT-Business Strategic Alignment: An investigation of the constructs and their measurement, European Journal of ISs 24(3): 1–27.

Ghaziani, A., and Ventresca, M. J. 2005. Keywords and cultural change: Frame analysis of BM public talk, 1975–2000. Kluwer Academic Publishers-Plenum.

Gilchrist, A., Burton-Jones, A. and Green, P., 2018. The process of social alignment and misalignment within a complex IT project. International Journal of Project Management, 36(6), pp.845-860.

Gibbert, M., Ruigrok, W., & Wicki, B. 2008. What passes as a rigorous case study? Strategic management journal, 29(13), 1465-1474.

GIZ, 2022. FAIR forward – Artificial Intelligence for all. URL: https://www.giz.de/expertise/html/61982.html Accessed: 12.11.2022.

Goerzig, D., and T. Bauernhansl. 2018. "Enterprise Architectures for the DT in Small and Medium-Sized Enterprises." Procedia CIRP 67, 540-545.

Goes, P. 2013. Editor's Comments: ISs Research and Behavioral Economics. MIS Quarterly, 37 (3), iii-viii.

Golden, T. D. and Raghuram, S. 2010. 'Teleworker knowledge sharing and the role of altered relational and technological interactions', Journal of Organisational Behavior 31(8), 1061–1085.

Golestan, K., Sattar, F., Karray, F., Kamel, M., & Seifzadeh, S. 2015. Localization in vehicular ad hoc networks using data fusion and V2V communication. Computer Communications, 71, 61-72.

Greenstein, S., Lerner, J., and Stern, S. 2013. Digitization, Innovation, and Copyright: What Is the Agenda?. Strategic Organisation (11:1), pp. 110-121.

Greengard, S. 2015. The internet of things. *MIT Press*.

Grennan, L., Kremer, A., Singla, A., and Zipparo, P. 2022. Why businesses need explainable AI—and how to deliver it. URL: Explainable AI: Getting it right in business | McKinsey. Accessed 12.11.2022.

Gregory, R. W., Keil, M., Muntermann, J., & Mähring, M. 2015. Paradoxes and the nature of ambidexterity in IT transformation programs. ISs Research, 26(1)

Gregor, S., Chandra Kruse, L., and Seidel, S. 2020. "Research perspectives: the anatomy of a design principle," Journal of the Association for ISs, 21(6).

Griffith, T. L. 1999. Technology features as triggers for sensemaking. Academy of Management review, 24(3), 472-488.

Gurbaxani, V., and D. Dunkle. 2019. "Gearing Up for Successful DT." MIS Quarterly Executive 18 (3), 209-220.

Gürkan, G. Ç., and Çiftci, G. 2020. Developing a Supportive Culture in DT. In: Hacioglu, U. (ed.) Digital Business Strategies in Blockchain Ecosystems, 83-102. Cham: Springer.

Gust, G., Flath, C. M., Brandt, T., Ströhle, P., and Neumann, D. 2017. "How a traditional company seeded new analytics capabilities," MIS Quarterly Executive.

Hacker, J., vom Brocke, J., Handali, J., Otto, M., and Schneider, J. 2020. "Virtually in This Together – How Web-Conferencing Systems Enabled a New Virtual Togetherness During the COVID-19 Crisis," European Journal of ISs 29:5, pp. 563-584.

Haffke, I. and Benlian, A., 2013. To understand or to be understood? A dyadic analysis of perceptual congruence and interdependence between CEOs and CIOs. Darmstadt Technical University, Department of Business Administration, Economics and Law.

Haller, S., Karnouskos, S., Schroth, C. 2009. The Internet of Things in an Enterprise Context. In: Domingue, J., Fensel, D., Traverso, P. (eds.) Springer, Heidelberg.

Hanelt, A., Bohnsack, R., Marz, D. and Antunes Marante, C., 2021. A systematic review of the literature on DT: Insights and implications for strategy and organisational change. Journal of management studies, 58(5), pp.1159-1197.

Hanelt, A., Piccinini, E. Gregory, R. Hildebrandt, B. & Kolbe, L. 2015. DT of preliminary Industries. Exploring the impact of Digital trends on BMs of Automobile Manufacturers. Proceedings of the 12th Internationalen Tagung Wirtschaftsinformatik. Osnabrück.

Harnisch, S., Kaiser, J., & Buxmann, P. 2013. Technological Frames of Reference in Software Acquisition Decisions: Results of a multiple case study.

Hartmann, P. M., Zaki, M., Feldmann, N., and Neely, A. 2016. Capturing value from big data–a taxonomy of data-driven BMs used by start-up firms. International Journal of Operations & Production Management.

Hedman, J., and Kalling, T. 2003. The BM concept: theoretical underpinnings and empirical illustrations. European journal of ISs, 12(1).

Helfat, C.E. and Raubitschek, R.S., 2018. Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems. Research policy, 47(8).

Henfridsson, O., & Bygstad, B. 2013. The Generative Mechanisms of Digital Infrastructure Evolution. *MIS Quarterly*, 37(3), 907-931.

Henfridsson, O., and Yoo, Y. 2014. The Liminality of Trajectory Shifts in Institutional Entrepreneurship. Organisation Science (25:3), pp. 932-950.

Henfridsson, O., Mathiassen, L., and Svahn, F. 2014. Managing Technological Change in the Digital Age: The Role of Architectural Frames. Journal of Information Technology.

Herath, T. & Herath, H. S. B. 2020. 'Coping with the New Normal Imposed by the COVID-19 Pandemic: Lessons for Technology Management and Governance', ISs Management 37(4), 277-283.

Herri, J. A. P., and Handika, R. F. 2019. DT: Insight from Leaders in the Mid-Rank Universities in Indonesia. In: Proceedings of the 3rd International Conference on Education and E-Learning, 52-55.

Herterich, M. M., Uebernickel, F., and W. Brenner. 2016. "Stepwise Evolution of Capabilities for Harnessing Digital Data Streams in Data-Driven Industrial Services." MIS Quarterly Executive 15 (4), 297-318.

Hess, T., Matt, C., Benlian, A. and Wiesböck, F., 2016. Options for formulating a DT strategy. MIS Quarterly Executive, 15(2).

Hess, T., and Barthel, P. 2017. "How Much DT is in Information Management? On the Interaction Between an Established and a New Management Concept," (transl.) HMD Praxis der Wirtschaftsinformatik 54:3, pp. 313-323.

Hevner, A., March, S., Park, J., and Ram, S. 2004. "Design science in ISs research," MIS Quarterly, 28 (1), 75–105

Hinings, B., Gegenhuber, T., & Greenwood, R. 2018. Digital innovation and transformation: An institutional perspective. Information and Organisation, 28(1), 52–61.

Ho, C., Weil, V., Mu, J., and Chabria, S. 2020. "Innovating in Challenging Times. Research During COVID-19," in: Game Changers, IPSOS.

Hognelid, P., and Kalling, T. 2015. Internet of things and BMs. In Standardization and Innovation in Information Technology (SIIT), 2015 IEEE.

Hoehle, H., and Venkatesh, V. 2015. Mobile Application Usability: Conceptualization and Instrument Development. MIS Quarterly, 39(2), 435–472.

Horlach, B., Drews, P. and Schirmer, I., 2016. Bimodal IT: Business-IT alignment in the age of DT. Multikonferenz Wirtschaftsinformatik (MKWI).

Horvath, D., and Szabo, ´ R. Z. 2019. Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? Technological Forecasting and Social Change, 146, 119–132.

Höller, J., Boyle, D., Karnouskos, S., Avesand, S., Mulligan, C., and Tsiatsis, V. 2014. From machine-t0 machine to the internet of things. Cambridge: Academic P.

Hsu, C. W. 2009. Frame misalignment: interpreting the implementation of ISs security certification in an organisation. European Journal of ISs.

Hu, M. and Lee, A. D. 2020. "Airbnb, COVID-19 Risk and Lockdowns: Local and Global Evidence," URL: http://bit.ly/3rgdjwO (visited 17 March 2021).

Huang, P. Y., Pan, S. L., & Ouyang, T. H. 2014. Developing information processing capability for operational agility: implications from a Chinese manufacturer. European Journal of ISs, 23(4), 462-480.

Huang, C. D., & Hu, Q. 2007. Achieving Business - IT strategic alignment via enterprisewide implementation of balanced scorecards. ISs Management, 24.

Iansiti, M. and Lakhani, K.R., 2014. Digital ubiquity: How connections, sensors, and data are revolutionizing business. Harvard business review, 92(11), p.19.

Islam, N., Buxman, P., and Eling, N. 2017. "Why should incumbent firms jump on the start-up bandwagon in the digital era? - A qualitative study," Wirtschaftsinformatik Conference, St. Gallen, Switzerland: AIS Electronic Library, pp. 1378-1392

Iivari, M. M., Ahokangas, P., Komi, M., Tihinen, M., and Valtanen, K. 2016. Toward ecosystemic BMs in the context of industrial internet. Journal of BMs.

Iivari, J. 2020. "A critical look at theories in design science research," Journal of the Association for ISs 21(3), 502-519.

ITU, 2021. Global initiative on AI and data commons. URL: https://www.itu.int/en/ITU-T/extcoop/ai-data-commons/Pages/default.aspx. Accessed: 15.10.2022.

Jain, H., Rothenberger, M., & Sugumaran, V. 2006. "Flexible software component design using a product platform approach," International Conference on ISs, Milwaukee, Wisconsin, USA.

James, R. 2014. The internet of things: a study in hype, reality, disruption, and Growth. Raymond James US Research, Technology and Communications, Industry Report.

Ju, Jaehyeon, Mi-Seon Kim, and Jae-Hyeon Ahn. 2016. Prototyping BMs for IoT Service. Procedia Computer Science 9: 882-890.

Juehling, E., Torney, M., Herrmann, C. and Droeder, K., 2010. Integration of automotive service and technology strategies. CIRP Journal of Manufacturing Science and Technology.

Kahre, C., Hoffmann, D., and Ahlemann, F. 2017. "Beyond business-IT alignment-digital business strategies as a paradigmatic shift: A review and research agenda," Hawaii International Conference on System Sciences, Waikoloa Beach, HI, pp. 4706-4715.

Kaiser, J., & Buxmann, P. 2012. Organisational design of IT supplier relationship management: a multiple case study of five client companies. Journal of Information Technology, 27(1), 57-73.

Kamal, M. M. 2020. "The Triple-Edged Sword of COVID-19: Understanding the Use of Digital Technologies and the Impact of Productive, Disruptive, and Destructive Nature of the Pandemic," ISs Management 37:4, pp. 310-317.

Kandathil, G., Wagner, E. L., & Newell, S. 2011. Translating es-embedded institutional logics through technological framing: an Indian-based case example. In ECIS (p. 47).

Kane, G.C., Palmer, D., Phillips, A.N., Kiron, D. and Buckley, N., 2015. Strategy, not technology, drives DT. MIT Sloan Management Review.

Kane, G. C. 2016. How Facebook and Twitter are reimagining the future of customer service. MIT Sloan Management Review (55:4), pp. 1-6.

Kane, G. C., Nanda, R., Phillips, A., and Copulsky, J. 2021. "Redesigning the Post-Pandemic Workplace," MIT Sloan Management Review 62:3, pp. 12-14.

Kaplan, A. and Haenlein, M., 2019. Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. Business horizons, 62(1), pp.15-25.

Karabasz, I. 2020. "The Boost to Digitization Caused by Corona is a Myth," (transl.) URL: https://bit.ly/38Ip60G (visited on 15 March 2021)

Karimi, J., and Walter, Z. 2015. The role of dynamic capabilities in responding to digital disruption: A factor-based study of the newspaper industry. Journal of Management ISs (32:1), pp. 39-81.

Kim, Y. and Stohr, E. A. 1998. "Software reuse: Survey and research directions," Journal of Management ISs 14(4), 113-147.

Kilduff, M., Angelmar, R., & Mehra, A. 2000. Top management-team diversity and firm performance: Examining the role of cognitions. Organisation science, 11(1), 21-34.

Klang, D., Wallnöfer, M., and Hacklin, F. 2014. The BM paradox: A systematic review and exploration of antecedents. International Journal of Management Reviews.

Klein, H. K., and Myers, M. D. 1999. A set of principles for conducting and evaluating interpretive field studies in ISs. MIS Quarterly, 23(1), 67-94.

Kodama, M. 2020. "Digitally Transforming Work Styles in an Era of Infectious Disease," International Journal of Information Management 55, 102172.

Kohli, R., and Johnson, S. 2011. "DT in latecomer industries: CIO and CEO leadership lessons from Encana Oil & Gas (USA) Inc.," MIS Quarterly Executive (10:4), pp. 141-156.

Kohli R, and Melville NP. 2019. Digital innovation: a review and synthesis. Inf Syst J 29(1).

Kossek, E. E., Lautsch, B. A. and Eaton, S. C. 2006., 'Telecommuting, control, and boundary management: Correlates of policy use and practice, job control, and work–family effectiveness', Journal of Vocational Behavior, 68(2), 347–367.

Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N., and Roig-Tierno, N. 2021. DT: An Overview of the Current State of the Art of Research. SAGE Open, 11(3).

Krotov, V., 2017. The Internet of Things and new business opportunities. Business horizons, 60(6), pp.831-841.

Kruppa, Miles. 2023. 'Google Gets Stricter About Employees' Time in Office', *https://www.wsj.com/articles/google-gets-stricter-about-employees-time-in-office-9a20f2e*. Accessed: 12.12.2023.

Kuckartz, U., Rädiker, S., Kuckartz, U. and Rädiker, S., 2019. Introduction: analyzing qualitative data with software. Analyzing qualitative data with MAXQDA: text, Audio, and video.

Kudyba, S., 2020. "COVID-19 and the Acceleration of DT and the Future of Work," ISs Management 37:4, pp. 284-287.

Kyndt, E., and Baert, H. 2013. "Antecedents of Employees' Involvement in Work-Related Learning: A Systematic Review," Review of Educational Research 83:2, pp. 273-313.

Kyriazis, D., & Varvarigou, T. 2013. Smart, autonomous and reliable Internet of Things. Procedia Computer Science, 21, 442-448.

Lacity, M.C., and Janson, M. A. 1994. "Understanding Qualitative Data: A Framework of Text Analysis Methods," Journal of Management ISs 11:2, pp. 137-155.

Lebowitz, S., Ward, M., Canal E., Knight R., & York A. 2023. 'Here's a list of major companies requiring employees to return to the office', Available at: *https://www.businessinsider.com/companies-making-workers-employees-return-to-office-rto-wfh-hybrid-2023-1*. Accessed: 12.12.2023.

Lefebvre, H., Legner, C., and Fadler, M. 2021. "Data democratization: toward a deeper understanding," International Conference on ISs, Austin, Texas, USA.

Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P. & Ahlemann, F. 2017. Digitalization: opportunity and challenge for the business and ISs engineering community. Business & ISs engineering.

Leite, M. P., Mihajlovski, T., Heppner, L., Branco, F., and Au-Yong-Oliveira, M. 2019. The Impact of the Digital Economy on the Skill Set of High Potentials. In: Rocha, Á., Adeli, H., Reis, L. P. & Constanzo, S. (eds.) New Knowledge in ISs and Technologies, 726-736. Cham: Springer.

Leminen, S., Westerlund, M., Rajahonka, M., and Siuruainen, R. 2012. „Towards IOT ecosystems and BMs," in: *Internet of things, smart spaces, and next generation networking* (pp. 15-26). Springer, Berlin.

Leidner, D. E. 2020. "Editorial Reflections: Lockdowns, Slow Downs, and Some Introductions," Journal of the Association for ISs 21:2, 10.

Levallet, N., and Y. E. Chan. 2018. “Role of Digital Capabilities in Unleashing the Power of Managerial Improvisation.” MIS Quarterly Executive 17 (1), 3.

Lin, A., & Silva, L. 2005. The social and political construction of technological frames. European Journal of ISs, 14(1), 49-59

Lindgren, R., Andersson, M., and Henfridsson, O. 2008. Multi-Contextuality in Boundary Spanning Practices. ISs Journal (18:6), pp. 641-661.

Lindgardt, Z., Reeves, M., Stalk, G., and Deimler, M. S. 2009. BM innovation. When the Game Gets Tough, Change the Game, The Boston Consulting Group.

Liu, D.-Y., Chen, S.-W., & Chou, T.-C. 2011. Resource fit in DT: Lessons learned from the CBC Bank global e-banking project. Management Decision, 49(10), 1728–1742.

Loebbecke, C., and Picot, A. 2015. Reflections on societal and BM transformation arising from digitization and big data analytics: A research agenda. The Journal of Strategic ISs.

Luchs, M. G., Swan, K. S., & Creusen, M. E. 2015. Perspective: A review of marketing research on product design with directions for future research. Journal of PIM.

Luftman, J., and Brier, T. 1999. Achieving and sustaining business - IT alignment. California management review, 42(1), 109-122.

Lusch, R.F. and Nambisan, S., 2015. Service innovation: A service-dominant logic perspective. MIS Quarterly, 39(1), pp.155-176.

Ma, M.S. & Ding, Y. 2023. ‘Return-to-Office Mandates. Yuye, Return-to-Office Mandates’, (December 25, 2023).

Madakam, S., Holmukhe, R. M., & Jaiswal, D. K. 2019. ‘The future digital work force: Robotic process automation (RPA)’, Journal of ISs and Technology Management 16, 1-7.

Magretta, J., 2002. Why BMs matter. *Harward Business Review.*

Manyika, J., Chui, M., Bisson, P., Woetzel, J., Dobbs, R., Bughin, J., & Aharon, D. 2015. Unlocking the Potential of the Internet of Things. *McKinsey Global Institute*.

Maedche, A. 2016. Interview with Michael Nilles on "What Makes Leaders Successful in the Age of the DT?“ Business & ISs Engineering.

Mahut, F., Daaboul, J., Bricogne, M., & Eynard, B. 2015. Survey on Product-Service System applications in the automotive industry. IFAC-PapersOnLine, 48(3), 840-847.

Mancl, D. and Fraser, S. D. 2020. “COVID-19’s Influence on the Future of Agile” in ‘Agile Processes in Software Engineering and Extreme Programming Workshops: XP 2020 Workshops’, Copenhagen, Denmark International Publishing; Imprint: Springer, pp. 309–31.

Marabelli, M., Vaast, E., and Li, J. L. 2021. Preventing the Digital Scars of COVID-19. European Journal of ISs 30:2, pp. 176-192.

Markus, M. L., & Bjørn-Andersen, N. 1987. Power over users: its exercise by system professionals. Commun. ACM, 30(6), 498-504.

Martins, N. & Coetzee, M. 2009., ‘Applying the Burke–Litwin model as a diagnostic framework for assessing organisational effectiveness’, SA Journal of Human Resource Management 7(1).

Matthies, B. D., D'Amato, D., Berghäll, S., Ekholm, T., Hoen, H. F., Holopainen, J. & Valsta, L. 2016. An ecosystem service-dominant logic - integrating the ecosystem service approach and the service-dominant logic. Journal of Cleaner Production, 124, 51-64.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. 2000. The influence of shared mental models on team process and performance. *Journal of applied psychology.*

Matt, C., Hess, T. and Benlian, A., 2015. DT strategies. Business & ISs engineering, 57, pp.339-343.

Mayring, P., 2014. Qualitative content analysis: theoretical foundation, basic procedures and software solution.

Mayring, P., and Fenzl, T. 2016. "Qualitative content analysis program qcamap–an open access text analysis software," Conference for Research on Learning and Instruction.

Mayring, P. 2000. "Qualitative Content Analysis," Forum Qualitative Social Research 1:2, 2.

McAfee, A. and Brynjolfsson, E., 2017. Machine, platform, crowd: Harnessing our digital future. *WW Norton & Company*.

McKinsey 2023. „What is DT?" URL: https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-digital-transformation#/ Accessed: 19.03.2024.

McKinsey and Company 2020. "The State of AI in 2020" URL: https://www.mckinsey.com/capabilities/quantumblack/ourinsights/global-survey-the-state-of-ai-in-2020 Accessed: 17.12.2020

McKeeby, J. W., Siwy, C. M., Revoir, J., Carlson, S. D., Joyce, M. D., Bailin, H., Frank, K. M., Krumlauf, M., Matlock, A. M., Lee, L. M., Sparks, M., Barnes, T., Liu, Y., Row, C.-H., Schmitt, J. M., Smith, D., Zelazny, A. M., Lonnerdal, D. & Coffey, P. S. 2021., 'Unveiling the silent threat among us: leveraging health information technology in the search for asymptomatic COVID 19 healthcare workers', Journal of the American Medical Informatics Association : JAMIA 28(2), 377–383.

McKibbin, W., and Roshen, F. 2020. "The Global Macroeconomic Impacts of COVID-19: Seven Scenarios," in CAMA Working paper 19, Australian National University.

Mejtoft, T. 2011. Internet of Things and Co-creation of Value. In Internet of Things (iThings/CPSCom), 4th International Conference on Cyber, Physical and Social Computing (pp. 672-677). IEEE.

Melville, N. P. 2010. "ISs innovation for environmental sustainability," MIS Quarterly 1-21.

Mergel, I., Edelmann, N., & Haug, N. 2019. Defining DT: Results from expert interviews. Government Information Quarterly, 36(4), 101385.

Mikalef, P. and Gupta, M. 2021. "Artificial Intelligence Capability: Conceptualization, measurement calibration, and empirical study on its impact on organisational creativity and firm performance," Information and Management 58(3), 103434.

Mikalef, Patrick; Framnes, Vetle Augustin; Danielsen, Frank; Krogstie, John; and Olsen, D, 2017. "Big Data Analytics Capability: Antecedents and Business Value". PACIS 2017 Proceedings. 136.

Miles, M. B., Huberman, A. M., Huberman, M. A., & Huberman, M. 1994. Qualitative data analysis: An expanded sourcebook.

Miles, M. B., Huberman, A. M. and J. Saldana. 2013. Qualitative Data Analysis. 3rd Edition. Sage.

Muegge, S. 2012. BM discovery by technology entrepreneurs. Technology Innovation Management Review, 2(4).

Muegge, S. 2013. Platforms, communities, and business ecosystems: Lessons learned about technology entrepreneurship in an interconnected world.

Mulrow, C.D., 1994. Systematic reviews: rationale for systematic reviews. Bmj, 309(6954), pp.597-599.

Myers, M. D. and Newman, M. 2007. "The qualitative interview in IS research: Examining the craft," Information and organisation 17(1), 2-26.

Nambisan, S. 2013. Information Technology and Product/Service Innovation: A Brief Assessment and Some Suggestions for Future Research. Journal of the Association for ISs (14:4), pp. 215-226.

Nambisan, S., Lyytinen, K., Majchrzak, A. and Song, M., 2017. Digital Innovation Management: Reinventing innovation management research in a digital world. MIS Quarterly, 41(1).

Nardon, L., & Aten, K. 2012. Valuing virtual worlds: The role of categorization in technology assessment. Journal of the Association for ISs, 13(10), 4.

Neumeier, A., Wolf, T., and Oesterle, S. 2017. "The manifold fruits of digitalization - Determining the literal value behind," Wirtschaftsinformatik Conference, St. Gallen, Switzerland: AIS Electronic Library, pp. 484-498.

Newell, S., and Marabelli, M. 2015. "Strategic opportunities (and challenges) of algorithmic decision-making: A call for action on the long-term societal effects of 'datification'," The Journal of Strategic ISs (24:1), pp. 3-14.

Ng, I.C. and Wakenshaw, S.Y., 2017. The Internet-of-Things: Review and research directions. International Journal of Research in Marketing, 34(1), pp.3-21.

Nickerson, R. C., Varshney, U., and Muntermann, J. 2013. A method for taxonomy development and its application in ISs. European Journal of IS.

Nidumolu, S. R., and Knotts, G. W. 1998. "The effects of customizability and reusability on perceived process and competitive performance of software firms," MIS Quarterly 22 (2), 105–128.

Nylén, D. and Holmström, J., 2015. Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation. Business horizons, 58(1).

Olson, M. H. 1983. 'Remote office work: Changing work patterns in space and time', Communications of the ACM, 26(3), 182–187.

Omerović M., Islam N., and Buxmann P. 2020. Unlashing the next wave of BMs in the internet of things era: A systematic literature review and new perspectives for a research agenda. Proceedings of the 53rd Hawaii International Conference on System Sciences, 2020.

Onar, Sezi Cevik, and Alp Ustundag. 2018. "Smart and Connected Product BMs." Industry 4.0: Managing The DT. Springer, Cham.

Orlikowski, W. J. 1988. Computer technology in organisations: some critical notes. In New technology and the labour process (pp. 20-49). Palgrave Macmillan, London.

Orlikowski, W. J., & Gash, D. C. 1994. Technological frames: making sense of information technology in organisations. ACM Transactions on ISs (TOIS), 12(2).

Osterwalder, A., and Pigneur, Y. 2010. BM generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons.

Osterwalder, A., Pigneur, Y., & Tucci, C. L. 2005. Clarifying BMs: Origins, present, and future of the concept. Communications of the association for IS.

Padhy, N., Singh, R. P., and Satapathy, S. C. 2018. "Software reusability metrics estimation: Algorithms, models and optimization techniques," Computers and Electrical Engineering 69, 653–68.

Papadopoulos, T., Baltas, K. N., and Balta, M. E. 2020. "The Use of Digital Technologies by Small and Medium Enterprises During COVID-19: Implications for Theory and Practice," International Journal of Information Management 55, 102192.

Pagoropoulos, A., Maier, A., & McAloone, T. C. 2017. Assessing transformational change from institutionalizing digital capabilities on implementation and development of Product Service Systems: Learnings from the maritime industry. *Journal of cleaner production.*

Papagiannidis, S., Harris, J., and Morton, D. 2020. "WHO Led the DT of Your Company? A Reflection of IT related Challenges During the Pandemic," International Journal of Information Management 55, 102166.

Pagani, M. 2013. "Digital business strategy and value creation: Framing the dynamic cycle of control points," MIS Quarterly (37:2), pp. 617-632.

Paré, G., Trudel, M. C., Jaana, M., and S. Kitsiou. 2015. "Synthesizing ISs Knowledge: A Typology of Literature Reviews." Information & Management, 52 (2).

Parviainen, P., Tihinen, M., Kaariainen, J., & Teppola, S. 2017. Tackling the digitalization challenge: How to benefit from digitalization in practice. International Journal of ISs and Project Management, 5(1), 63–77.

Pateli, A. G., and Giaglis, G. M. 2004. A research framework for analysing eBMs. European journal of ISs, 13(4), 302-314.

Peters, P., Ligthart, P. E., Bardoel, A. & Poutsma, E. 2016. ''Fit' for telework'? Cross-cultural variance and task-control explanations in organisations' formal telework practices', The International Journal of Human Resource Management 27(21), 2582–2603.

Piccinini, E., Hanelt, A., Gregory, R., and Kolbe, L. 2015. "Transforming industrial business: The impact of DT on automotive organisations," International Conference of ISs, Forth Worth, TX.

Pillmann, J., Wietfeld, C., Zarcula, A., Raugust, T., & Alonso, D. C. 2017. Novel common vehicle information model (cvim) for future automotive vehicle big data marketplaces. In 2017 IEEE Intelligent Vehicles Symposium (IV).

Popovici, V., and Popovici, A. L. 2020. Remote work revolution: Current opportunities and challenges for organisations. Ovidius Univ. Ann. Econ. Sci. Ser, 20(1), 46

Porter, M. E., and Heppelmann, J. E. 2014. How smart, connected products are transforming competition. Harvard business review, 92(11), 64-88.

Pramanik, M. I., Lau, R. Y., and Chowdhury, M. K. H. 2016. "Automatic crime detector: A framework for criminal pattern detection in big data era," Pacific Asia Conference on ISs, Chiayi, Taiwan.

Prem, E. 2015. A DT BM for innovation. In ISPIM Innovation Symposium. The International Society for Professional Innovation Management.

Preston, D. and Karahanna, E., 2009. How to develop a shared vision: The key to IS strategic alignment. MIS Quarterly Executive, 8(1).

Pumplun, L., Tauchert, C., and Heidt, M. 2019. "A new organisational chassis for artificial intelligence-exploring organisational readiness factors," European Conference on ISs, Stockholm and Uppsala, Sweden.

Purao, S., and Storey, V. C. 1997. "Intelligent support for retrieval and synthesis of patterns for object-oriented design," International Conference on Conceptual Modeling.

Rai, A. 2019. "Editor's Comments: Engaged scholarship: Research with practice for impact," MIS Quarterly, 43 (2), iii–viii.

Rai, A. 2020. "Editor's Comments: The COVID-19 Pandemic: Building Resilience with IS Research," MIS Quarterly 44:2, iii-vii.

Ransbotham, S., Gerbert, P., Reeves, M., Kiron, D., & Spira, M. 2018. Artificial intelligence in business gets real, MIT Sloan Management Review.

Reynolds, P. and Yetton, P., 2015. Aligning business and IT strategies in multi-business organisations. Journal of Information Technology, 30(2), pp.101-118.

Ryan, G. W. and Bernard, H. R. 2003. "Techniques to identify themes in qualitative data," Field Methods 15(1), 85-109.

Tranfield, D., Denyer, D., and P. Smart. 2003. "Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review." British Journal of Management 14 (3), 207-222.

Qin, Y., Sheng, Q. Z., Falkner, N. J., Dustdar, S., Wang, H., and Vasilakos, A. V. 2016. When things matter: A survey on data-centric internet of things. *Journal of Network.*

Peffers, K., Tuunanen, T., Rothenberger, M.A. and Chatterjee, S., 2007. A design science research methodology for ISs research. Journal of management ISs, 24(3), pp.45-77.

Porter, M.E. and Heppelmann, J.E., 2014. How smart, connected products are transforming competition. Harvard business review, 92(11), pp.64-88.

Rajput, S., and Singh, S. P. 2019. "Connecting circular economy and industry 4.0.," International Journal of Information Management, 49, 98–113.

Ravichandran, S. 2012. "A detailed systematic literature review on software reusability metrics for object-oriented software programs," International Journal of Information Technology and Management ISs 3(1), 33-44.

Remane, G., Hanelt, A., Nickerson, R. C., and Kolbe, L. M. 2017. Discovering digital BMs in traditional industries. Journal of Business Strategy.

Reich, B. H., & Benbasat, I. 2000. Factors that influence the social dimension of alignment between business and information technology objectives. MIS Quarterly, 81-113.

Riasanow, T., Setzke, D.S., Böhm, M. and Krcmar, H., 2019. Clarifying the notion of DT: A transdisciplinary review of literature. Journal of Competences, Strategy & Management, 10(1), pp.5-31.

Riasanow, T., Galic, G., & Böhm, M. 2017. DT in the Automotive Industry: Towards a Generic Value Network. In 25th European Conference on ISs (ECIS).

Richter, A., Heinrich, P., Stocker, A., & Schwabe, G. 2018. 'Digital work design. Business and ISs Engineering', 60(3), 259-264.

Richter, G., and N. Mohr. 2020. Digital Sentiment Survey Germany. Understanding the New Digital User. URL: https://bit.ly/3eE0wBV (visited on 14 March 2021).

Robey, D., and Sahay, S. 1996. Transforming work through information technology: Acomparative case study of geographic ISs in county government. ISs research.

Roecker, J., Mocker, M., and Novales, A. 2017. "Digitized products: Challenges and practices from the creative industries," Americas Conference of ISs, Boston.

Rushe, Dominic. 2022. 'Elon Musk tells employees to return to office or 'pretend to work' elsewhere', https://www.theguardian.com/technology/2022/jun/01/elon-musk-return-to-officepretend-to-work-somewhere-else. Accessed: 12.12.2023.

Russell, S. and Norvig, P., 2021. Artificial intelligence, global edition. Pearson Education. https://elibrary. pearson. de/book/99.150005/9781292401171.

Rzepka, C. and B. Berger. 2018. "User interaction with AI-enabled ystems: A systematic review of IS research." International Conference on ISs, San Francisco, U.S.

Saarikko, T., Westergren, U.H. and Blomquist, T., 2017. The Internet of Things: Are you ready for what's coming?. Business Horizons, 60(5), pp.667-676.

Sarker, Nicholson, D. B., & Joshi, K. D. 2005. Knowledge transfer in virtual systems development teams: An exploratory study of four key enablers. IEEE transactions on professional communication, 48(2), 201-218.

Schief, M., and Buxmann, P. 2012. BMs in the software industry. In System Science (HICSS), 2012 45th Hawaii International Conference on (pp. 3328-3337). IEEE.

Schladofsky, W., Mitic, J., Megner, A. P., Simonato, C., Gioppo, L., Leonardos, D., & Bröring, A. 2016. BMs for interoperable IoT ecosystems. In International Workshop on Interoperability and Open-Source Solutions (pp. 91-106). Springer, Cham.

Schmid, A. M., Recker, J., and vom Brocke, J. 2017. "The socio-technical dimension of inertia in DTs," Hawaii International Conference on System Sciences, Waikoloa Beach, HI, pp. 4796-4805.

Schief, M., and Buxmann, P. 2012. BMs in the software industry. In System Science (HICSS), 2012 45th Hawaii International Conference on (pp. 3328-3337). IEEE.

Schoormann, T., Strobel, G., Möller, F., Petrik, D., and Zschech, P. 2023. "Artificial Intelligence for Sustainability—A Systematic Review of ISs Literature," Communications of the Association for ISs, 52(1), 8.

Schwindt, C. 2005. Resource allocation in project management. Springer.

Schön, D. 1983. "The reflective practitioner: How professionals think in action," New York, NY: Basic Books.

Scott Morton, M.S., 1991. The corporation of the 1990s: Information technology and organisational transformation. Sloan School of Management, Oxford University Press.

Seo, D. 2017. "Digital Business Convergence and Emerging Contested Fields: A Conceptual Framework," Journal of the Association for ISs (18:10), pp. 687-702.

Sebastian, I., Mocker, M., Ross, J., Moloney, K., Beath, C. and Fonstad, N. 2017. How big old companies navigate DT. MIS Quarterly Executive, 16, 197–213.

Seetharaman, P. 2020. "BMs Shifts: Impact of COVID-19," International Journal of Information Management 54, 102173.

Seidel, S., Recker, J. and Vom Brocke, J. 2013. Sensemaking and sustainable practicing: functional affordances of ISs in green transformations. MIS Quarterly, 1275-1299.

Setliff, D., Kant, E., and Cain, T. 1993. "Practical software synthesis," IEEE Software, 10 (3).

Shafer, S.M., Smith, H.J. and Linder, J.C., 2005. The power of BMs. Business horizons, 48(3), pp.199-207.

Sia, S. K., Soh, C., and Weill, P. 2016. "How DBS Bank pursued a digital business strategy," MIS Quarterly Executive (15:2), pp. 105-121.

Singh, A., and Hess, T. 2017. "How chief digital officers promote the DT of their companies," MIS Quarterly Executive (16:1), pp. 1-17.

Singh, P. K., Sangwan, O. P., Singh, A. P., and Pratap, A. 2015. A framework for assessing the software reusability using fuzzy logic approach for aspect-oriented software. Int. J. Inf. Technol. Comput. Sci, 7, 12-20.

Sklyar, A., Kowalkowski, C., Tronvoll, B. and Sörhammar, D., 2019. Organizing for digital servitization: A service ecosystem perspective. Journal of Business Research.

Sledgianowski, D., & Luftman, J. 2005. Business - IT strategic alignment maturity: A case study. Journal of Cases on Information Technology (JCIT), 7(2), 102-120.

Smajlovic, M. O., Zöll, A., Alhasan R. 2023. Building Sustainable Business Practices: Design Principles for Reusable Artificial Intelligence. In: *Proceedings of the International Conference on Wirtschaftsinformatik 2023.*

Smajlovic, M. O., Feng, S. 2022. How to Drive Digital Transformation in a Pandemic and Beyond: Learnings from COVID-19 Crisis. In: *Proceedings of the Pacific Asia Conference on Information Systems 2022.*

Smajlovic, M. O., Feng, S. 2021. The Impact of the COVID-19 Lockdown on Digital Transformation in German Organizations. In: *Proceedings of the European Conference on Information Systems 2021. Research in Progress Paper.*

Smajlovic, M. O., Islam, N., and Buxmann, P. 2021. The Path from the Producer to the holistic Solutions Provider: Empirical Investigation of the Digital Service Development in an Automotive Environment. In: *Proceedings of the International Conference on Wirtschaftsinformatik 2021.*

Omerovic, M., Islam, N., and Buxmann, P. 2020. Unlashing the Next Wave of Business Models in the Internet of Things Era: New Directions for a Research Agenda based on a Systematic Literature Review. In: *Proceedings of the Hawaii International Conference on System Sciences 2020.*

Smith, E. F., Gilmer, D. O. and Stockdale, M. S. 2019. 'The importance of culture and support for workplace flexibility: An ecological framework for understanding flexibility support structures', Business Horizons, 62(5), 557–566.

Snoek, J., Larochelle, H., and Adams, R.P. 2012. "Practical bayesian optimization of machine learning algorithms," Advances in Neural Information Processing Systems.

Soto-Acosta, P. 2020. "COVID-19 Pandemic: Shifting DT to a High-Speed Gear," ISs Management 37:4, pp. 260-266.

Spangenberg, H. & Theron, C. 2013. 'A critical review of the Burke-Litwin model of leadership, change and performance', Management Dynamics: Journal of the Southern African Institute for Management Scientists, 22(2), 29–48

Srivastava, S. C., Teo, T. S., and Devaraj, S. 2016. "You can't bribe a computer: Dealing with the societal challenge of corruption through ICT," MIS Quarterly (40:2), pp. 511-526.

Subel, S., Stepanek, M., & Roulet, T. 2022. 'How Shifts in Remote Behavior Affect Em-ployee Well-Being', MIT Sloan Management Review.

Sugumaran, V., and Storey, V. C. 2000. "An approach to intelligent query and component retrieval for web-based respositories," International Conference on ISs.

Sun, Y., Yan, H., Lu, C., Bie, R. and Thomas, P. 2012. A Holistic Approach to Visualizing BMs for the Internet of Things. *Communications in Mobile Computing*.

Svahn, F., Mathiassen, L., and Lindgren, R. 2017. Embracing digital innovation in incumbent firms: How Volvo Cars managed competing concerns. MIS Quarterly (41:1).

Stone, K. B. 2015. 'Burke-Litwin Organisational Assessment Survey: Reliability and Validity', Organisation Development Journal 33(2).

Sun, Y., Yan, H., Lu, C., Bie, R. and Thomas, P. 2012. A Holistic Approach to Visualizing BMs for the Internet of Things. Communications in Mobile Computing.

Szyperski, C. 1998. "Emerging component software technologies—a strategic comparison," Software-Concepts and Tools, 19 (1), 2-10.

Taskin, L. and Bridoux, F. 2010. 'Telework: a challenge to knowledge transfer in organisations', The International Journal of Human Resource Management 21(13), 2503–2520.

Teece, David J. 2010. BMs, Business Strategy and Innovation. In Long Range Planning 43 (2-3), pp. 172–194.

Tilson, D., Lyytinen, K. and Sørensen, C., 2010. Research commentary—Digital infrastructures: The missing IS research agenda. ISs research, 21(4), pp.748-759.

Timmers, P. 1998. BMs for electronic markets. Electronic markets, 8(2), 3-8.

Ting, D. S. W., Carin, L., Dzau, V., and Wong, T. Y. 2020. "Digital Technology and COVID-19," Nature Medicine 26:4, pp. 459–461.

Tiwana, A., Konsynski, B., and Bush, A. 2010. Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. ISs Research (21:4), pp. 675-687.

Töytäri, P., Turunen, T., Klein, M., Eloranta, V., Biehl, S., Rajala, R., and Hakanen, E. 2017. "Overcoming institutional and capability barriers to smart services," Hawaii International Conference on System Sciences, Waikoloa Beach, HI, pp. 1642-1651.

Tranfield, D., Denyer, D. and Smart, P., 2003. Towards a methodology for developing evidence-informed management knowledge by means of systematic review. British journal of management, 14(3), pp.207-222.

Tremblay, D. G. 2004. "Communities of practice: what are the conditions for implementation in a virtual multi-organisation community?," Organizações and Sociedade, 11, 25-39.

Tremblay, M. C., Hevner, A. R., and Berndt, D. J. 2010. "Focus Groups for Artifact Refinement and Evaluation in Design Research," Communications of the Association for ISs, 26 (27), 599–618.

Tumbas, S., Berente, N., Seidel, S., and vom Brocke, J. 2015. "The 'digital façade' of rapidly growing entrepreneurial organisations," International Conference of ISs, Forth Worth, TX.

Tumbas, S., Berente, N., and J. vom Brocke. 2018. "Digital Innovation and Institutional Entrepreneurship: Chief Digital Officer Perspectives of their Emerging Role." Journal of Information Technology 33 (3), 188-202.

Turber, S., Vom Brocke, J., Gassmann, O., and Fleisch, E. 2014. „Designing BMs in the era of internet of things." In: *International Conference on Design Science Research in ISs* (pp. 17-31). Springer.

Tynjälä, P. 2008. "Perspectives into Learning at the Workplace," Educational Research Review 3:2, pp. 130-154.

van der Aalst, W. M., Hinz, O., and Weinhardt, C. 2020. "Impact of COVID-19 on BISE Research and Education," Business and ISs Engineering 62:6, pp. 463-466.

Vargo, S.L. and Lusch, R.F., 2008. Service-dominant logic: continuing the evolution. Journal of the Academy of marketing Science, 36, pp.1-10.

Venkatesh, V., Thong, J. and Xu, X. 2012. Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology. MIS Quarterly, 36 (1), 157-178.

Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Kundisch, D., ... & Spann, M. 2014. BMs. Business & ISs Engineering, 6(1), 45-53.

Vermesan, O., and Friess, P. (Eds.). 2013. Internet of things: converging technologies for smart environments and integrated ecosystems. River Publishers.

Vermesan, O., Bahr, R., Gluhak, A., Boesenberg, F., Hoeer, A. and Osella, M., 2016. IoT BMs framework. Unify-IoT Project.

Vial, G. 2019. Understanding DT: A review and a research agenda. The Journal of Strategic ISmots, 28(2), 118-144.

vom Brocke, J., Watson, R.T., Dwyer, C., Elliot, S. & Melville, N., 2013. Green ISs: Directives for the IS discipline. Communications of the association for ISs, 33(1), p.30.

vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., and Cleven, A. 2009. Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. In: ECIS 2009 Proceedings, 161.

vom Brocke, J., Simons, A., Riemer, K., Niehaves, B., Plattfaut, R., & Cleven, A. 2015. Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in ISs Research. CAIS, 37, 9.

Waizenegger, L., McKenna, B., Cai, W., and Bendz, T. 2020. "An Affordance Perspective of Team Collaboration and Enforced Working from Home During COVID-19," European Journal of ISs 29:4, pp. 429-442.

Walshe, R., Casey, K., Kernan, J., and Fitzpatrick, D. 2020. "AI and big data standardization: Contributing to United Nations sustainable development goals," Journal of ICT Standardization, 77-106.

Walsham, G. 2006. Doing interpretive research. *European journal of ISs.*

Walsham, G. 1995. Interpretive case studies in IS research: nature and method. European Journal of ISs, 4(2), 74-81.

Wamba-Taguimdje, S. L., Wamba, S. F., Kamdjoug, J. R. K., and Wanko, C. E. T. 2020. "Influence of artificial intelligence (AI) on firm performance: The business value of AI-based transformation projects," Business Process Management Journal, 26 (7).

Warner, K. and Wäger, M. 2019. 'Building dynamic capabilities for DT: An ongoing process of strategic renewal'. Long Range Planning, 52, 326–49.

Watson, R.T., Boudreau, M.C. and Chen, A.J., 2010. ISs and environmentally sustainable development: energy informatics and new directions for the IS community. MIS quarterly, pp.23-38.

Webster, J., and R. T. Watson. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review." Management ISs Quarterly 26 (2), xiii-xxiii.

Weinberger, M., Bilgeri, D., and Fleisch, E. 2016. „IoT BMs in an industrial context," in: *Automatisierungstechnik*, 64(9), 699-706

Wenger, E. 1998. "Communities of practice: Learning as a social system," Systems Thinker.

Wenger, E., McDermott, R. A., and Snyder, W. 2002. "Cultivating communities of practice: A guide to managing knowledge - Seven Principles for Cultivating Communities of Practice," Harvard Business Press.

Wenger, E., and Snyder, W. M. 2000. "Communities of practice: The organisational frontier," Harvard Business Review 78 (1), 139-146.

Weritz, P., Matute, J., Braojos, J. & Kane, J. 2022. "How Much Digital is Too Much? A Study on Employees' Hybrid Workplace Preferences", in 'Proceedings International Conference on ISs', ICIS 2022.

Westerman, G., Calméjane, C., Bonnet, D., Ferraris, P., and McAfee, A. 2011. "DT: A roadmap for billion-dollar organisations," MIT Center for Digital Business and Capgemini Consulting, pp. 1-68.

Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J. and Blegind-Jensen, T. 2020. 'Unpacking the difference between DT and IT-enabled organisational transformation'. Journal of the Association for ISs.

Westerlund, M.; Leminen, S.; Rajahonka, M. 2014. Designing BMs for the Internet of Things, Technology Innovation Management Review, July, pp. 5-14.

Whillans, A., Perlow, L., and Turek, A. 2021. "Experimenting During the Shift to Virtual Team Work: Learning from How Teams Adapted Their Activities During the COVID-19 Pandemic," Information and Organisation 31, 100343.

Whitmore, Andrew; Agarwal, Anurag; Da Xu, Li. 2015. „The Internet of Things—A survey of topics and trends,“ In: *ISs Frontiers* 17 (2), pp. 261–274.

Wilkinson, M. D., Dumontier, M., Aalbersberg, I. J., Appleton, G., Axton, M., Baak, A., Blomberg, N., Boiten, J. W., da SilvaSantos, L. B., Bourne, P. E. 2016. “The FAIR Guiding Principles for scientifc data management and stewardship,” Scientific Data 3.

Wirtz, B. W., Pistoia, A., Ullrich, S., and Göttel, V. 2016. BMs: Origin, development and future research perspectives. Long range planning, 49(1), 36-54.

Wiesche, M., Jurisch, M. C., Yetton, P. W. and Krcmar, H. 2017. “Grounded Theory Methodology in ISs Research,” MIS Quarterly 41:3, pp. 685-701.

Williams, K., Chatterjee, S., & Rossi, M. 2008. Design of emerging digital services: a taxonomy. European journal of ISs, 17(5), 505-517.

Wrycza, S., and Maślankowski, J. 2020. “Social Media Users’ Opinions on Remote Work during the COVID-19 Pandemic. Thematic and Sentiment Analysis,” ISs Management.

Wurster, L. F. 2014. Emerging Technology Analysis: Software Licensing and Entitlement Management Is the Key to Monetizing the Internet of Things (Vol. 251790). Gartner

Xue, L., Zhang, C., Ling, H., and Zhao, X. 2013. Risk Mitigation in Supply Chain Digitization: System Modularity and Information Technology Governance. Journal of Management.

Yang, X., Liu, L., and Davison, R. 2012. "Reputation management in social commerce communities," Americas Conference of ISs, Seattle, WA.

Yao, Y., Xiao, Z., Wang, B., Viswanath, B., Zheng, H., & Zhao, B.Y. 2017. “Complexity vs. performance: empirical analysis of machine learning as a service,” Internet Measurement Conference, Online Conference.

Yeow, A., Soh, C., and Hansen, R. 2017. "Aligning with new digital strategy: A dynamic capabilities approach," The Journal of Strategic ISs (27:1), pp. 43-58.

Yin, R. K. 1989. Research design issues in using the case study method to study management ISs. The ISs research challenge: Qualitative research methods, 1, 1-6

Yin, R. K. 2009. Case Study Research: Design and Methods. Essential guide to qualitative methods in organisational research. Vol. 24.

Yin, R. K. 2017. Case study research and applications: Design and methods. Sage publications.

Yoo, Y., Boland Jr, R. J., Lyytinen, K., and Majchrzak, A. 2012. Organizing for Innovation in the Digitized World. Organisation Science (23:5), pp. 1398-1408.

Yoo, Y., Henfridsson, O., and Lyytinen, K. 2010. "Research Commentary—The New Organizing Logic of Digital Innovation: An Agenda for ISs Research," ISs Research.

Yoo, Y. 2010. Computing in everyday life: A call for research on experiential computing. MIS.

Yoon, S., Chan, J., Lin, J. & Nian, T. 2023. “The Value of Remote Work in the Post-Covid Era: An Empirical Assessment of Employee Turnover and Wage" in ICIS 2023 Proceedings.

Zhang, S., Moeckel, R., Moreno, A.T., Shuai, B. & Gao, J. 2020. ‘A work-life conflict perspective on telework’, Transportation Research Part A: Policy and Practice 141.

Zott, C., and Amit, R. 2010. BM design: an activity system perspective. Long range planning.

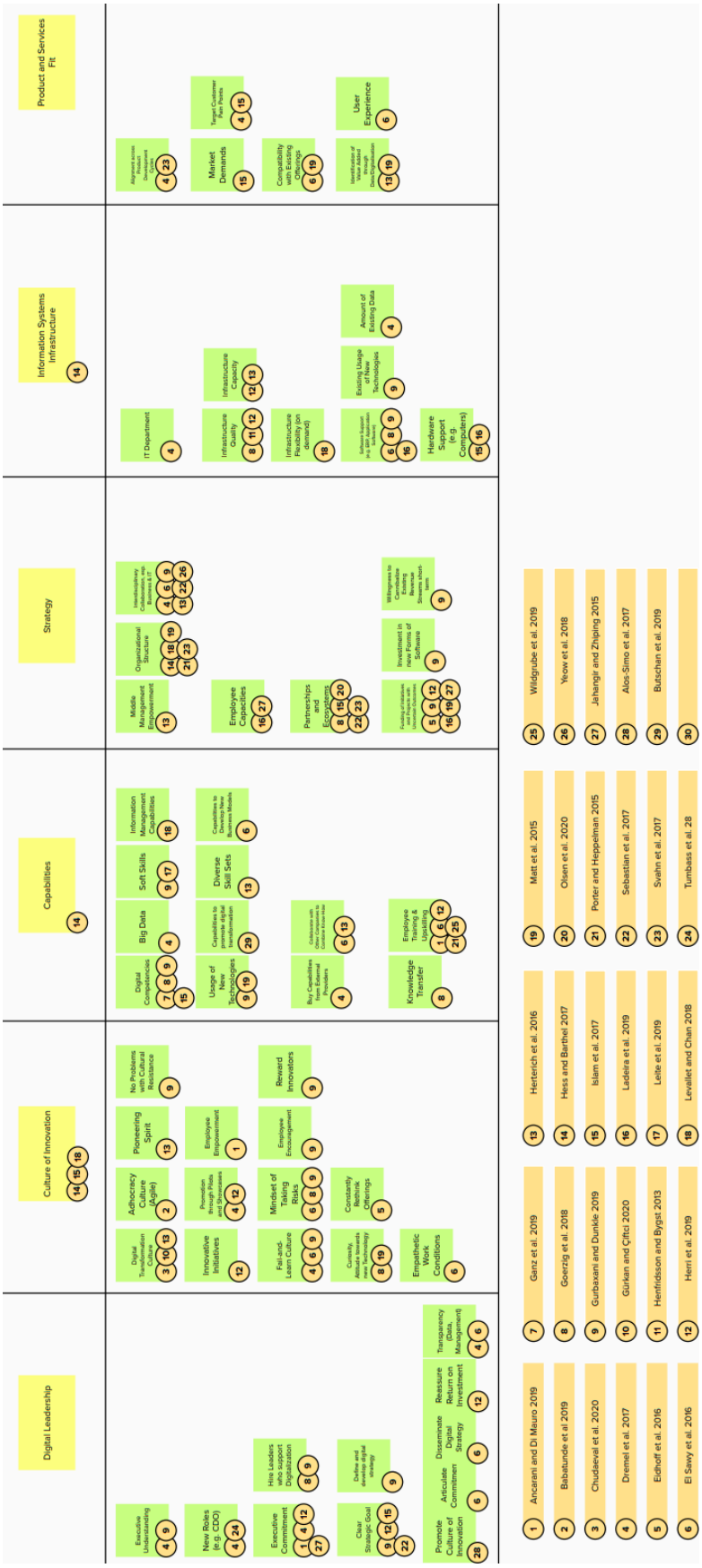
Zott, C., Amit, R., and Massa, L. 2011. The BM: recent developments and future research. Journal of management, 37(4), 1019-1042.

Zott, C. and Amit, R., 2007. BM design and the performance of entrepreneurial firms. Organisation science, 18(2), pp.181-199.

Zielke, T. 2020. “Is Artificial Intelligence Ready for Standardization?” European Conference on Software Process Improvement, Salzburg, Austria.

Appendix

A1. Key Influencing Factors Brainstorming Session



A2. DT Key Influencing Factors Working Sheet

Factor	Type	Source	How
Financial resources	Products	Eidhoff et al. 2016	the unpredictability of financial returns might be a reason for not pursuing digital product innovation
Technological change	Products	Eidhoff et al. 2016	due to technological change firms must constantly rethink their product offerings in order to grasp opportunities arising through the implementation of new digital technologies
Digitalization fit	Products	Eidhoff et al. 2016	describes the feasibility of assimilating digital technologies into existing products or completely digitizing established products
Compliance with standards and legislation	Supply Chain	Simões et al. 2019	uncertainty or instability of legislation might create concerns among managers of the supply chain and block some technology adoptions
Market and industry tendencies	Supply Chain	Simões et al. 2019	a need to follow technology evolution of the supply chain partners
OEMs and Other memebers of the Supply Chain Pressure	Supply Chain	Simões et al. 2019	use of coercive and normative pressures over the other members of the supply chain, through recommendations or requirements to adopt specific technologies
External support	Supply Chain	Simões et al. 2019	governmental funding was recognized as an important source of support
Partnerships with higher education institutions	Supply Chain	Simões et al. 2019	relevant to develop internships or small projects that bring the capabilities needed to use new digitalization technologies
Partnerships with technology suppliers	Supply Chain	Simões et al. 2019	to keep up to date with the technology evolution partnerships with technology suppliers are recognized to contribute for adoption success
Top management involvement	Supply Chain	Simões et al. 2019	their important role as champions for the technology being adopted
Strategic Vision	Products and Services	Gurbaxani and Dunkle 2019	a clearly defined strategic vision; senior executives have a clear understanding and leadership capabilities
Culture of Innovation	Products and Services	Gurbaxani and Dunkle 2019	culture of risk-taking; allow low-risk failures without "black mark" effect; encourage thinking from difference perspectives; reward innovation

Know-how and IP	Products and Services	Gurbaxani and Dunkle 2019	use of software to improve product, operations performance, customer understanding, supplier interactions
Digital Capabilities (Talent)	Products and Services	Gurbaxani and Dunkle 2019	availability of digital expertise; technical and strategic talents
Strategic Alignment	Products and Services	Gurbaxani and Dunkle 2019	funding of digital initiatives with uncertain outcomes; temporarily cannibalize other revenue streams; internal alignment, e.g. with M&A; increase investment in software
Technology Assets	Products and Services	Gurbaxani and Dunkle 2019	usage of technologies in big data, data mining/analytics, mobile technologies, cloud computing, wireless communications
Organisational Structure	Internal Processes	Dremel et al. 2017	align org structures and processes with the dynamics of digital markets; **however:** balance importance of new teams/hub and existing teams to avoid fear of loss of power
Big Data Analytics capabilities	Internal Processes	Dremel et al. 2017	e.g. acquire external capabilities (in the beginning)
Interdisciplinary teams	Internal Processes	Dremel et al. 2017	enable interdisciplinary work through different org structure (or as separate hub)
Understanding of decision makers	Internal Processes	Dremel et al. 2017	e.g. decision makers role in the process
Amount of existing data	Internal Processes	Dremel et al. 2017	e.g. sales and marketing data
Demonstration of big data potential	Internal Processes	Dremel et al. 2017	demonstrate using pilot use cases to gain more commitment from business units
IT support	Internal Processes	Dremel et al. 2017	IT infrastructure to e.g. support analytics
Leadership support	Internal Processes	Dremel et al. 2017	commitment from the higher org levels
Stable financial backing	Internal Processes	Dremel et al. 2017	grant budget directly from executive level, make profitable business cases
Innovative Culture	Manufactured Products	Dremel et al. 2017	car data as a data source requires involves conservative stakeholders with manufacturing background

A3. Interviewees Overview Working Sheet for the DT Key Influencing Factors Study

Industry	Role	Done	Status
home appliance industry	Corporate Director Controlling	x	transcribed
automotive industry	Controlling Team Lead	x	transcribed
original equipment manufacturer	Head of Engineering	x	transcribed
consulting	Manager Smart Technology	x	transcribed
start up	CEO	x	transcribed
consulting	Change Manager	x	transcribed
finance	Compliance Manager	x	transcribed
electric mobility solutions	Managing Director	x	transcribed
digital services and management solutions	Managing Director	x	transcribed
finance	Project Manager	x	transcribed
food industry	Supply Chain Business	x	transcribed
Manufacturing, Sanitary Fittings	Project Manager	x	transcribed
IT (B2B Software)	Digital Demand Executive	x	Translated
Media/Entertainment	Manager Service Comms	x	Translated
IT (B2B Software & Hardware)	IoT Consultant	x	Translated

A4. DT Study Interview Guide

Digital Leadership

1. How does digital leadership look like within the COVID-19 crisis?
2. How is the understanding and commitment of the executives related to the digitalization of products and services within the crisis? Did anything change?
3. Did you maybe get some new roles (e.g. digital officer) during the crisis or lost it?

Culture of innovation

1. Tell me what you know about the digital transformation culture in your company (e.g. pioneering spirit, innovative initiatives etc.)?
2. Did you notice any changes due to the COVID-19 crisis? (Would you say that fail and learn culture is well accepted in your organisation?)
3. How did the attitude of your organisation change (if so) towards new technologies? (Do you (still) constantly rethink the offerings or are there other priorities?

Capabilities

1. How do you understand the digital capabilities of the employees?
2. How does the employee training and upskilling look like within the COVID-19 crisis?
3. Would you mention any other noticed differences related to the digital capabilities of employees due to COVID-19 crisis?

Strategy

1. How do business and IT departments collaborate in your organisation? Did anything change due to the crisis?
2. Do you think that the organisation structure influences the described collaboration? Does your organisation collaborate more/less with partners and customers to drive digitalization projects?
3. Do you perceive that your company changed its willingness to fund such digitalization projects?

Information Systems Infrastructure

1. How would you describe the services of your IT department regarding quality, capacities (e.g. software and hardware support) and flexibility during the crisis?
2. To what extent does your company use data to generate insights about your products or services? What technologies do you use to generate these insights?

Product and Services Fit

1. Do you think that digitalization is generally compatible to your offerings? If so, how?
2. How would you describe the value added through digitalizing offerings through the COVID-19 crisis?
3. How did the customer pain points and market demands in your industry change due to the COVID-19 crisis?
4. Do you target the needs of your customer nowadays differently?

A5. Reading Summary for the Key Influencing Factors of the DT Study

Authors	Summary
Matt et al. 2015	DT is concerned with the changes that digital technologies can bring about in a company's business model, products, processes and organisational structure; Four dimensions of the DT: use of technologies, changes in value creation, structural changes, and financial aspects.
Castells 2009 El Sawy et al. 2016	The term digitalization goes beyond an organisation taking advantage of digital platforms, but rather reflects the way that digital media and platforms influence the restructuring of the economy, society and culture.
Fitzgerald et al. 2014 Liere-Netheler et al. 2018 Hausberg et al. 2019	DT of business leads to three significant changes (1) digitally supported and cross-linked processes, (2) digitally enabled communication, and (3) new ways of value generation based on digital innovations or gained digital data.
Li Chao et al. 2019	DT is seen as a fundamental and disruptive change to all aspects of business, differentiated from the impacts of automation on manufacturing and processing environment.
Hinings et al. 2018; Matt et al. 2015; Gimpel and Röglinger 2015; Jung et al. 2018	DT does not merely refer to technological changes, but also to the impacts thereof on the organisation itself; it leads to "transformations of key business operations and affects products and processes, as well as organisational structures and management concepts" ; the changes that come along with the digitalization affect people, society, communication and the whole business.
Fichman et al. 2014; Legner et al. 2017; Wiesböck 2018	While the transition from an abstract digital technology to a concrete digital solution characterizes an organisation's digitalization, the transition from digital solutions to digital business concepts is also referred to as an organisation's digital transformation and captures the organisational change induced by digital technologies.
Bharadwaj et al. 2013	Time is right to rethink the role of IT strategy, from that of a functional-level strategy - aligned but essentially always subordinate to business strategy - to one that reflects a fusion between IT strategy and business strategy; four key themes to guide our thinking on digital business strategy and help provide a framework to define the next generation of insights; the four themes are (1) the scope of digital business strategy (expanding the scope beyond the firm into the ecosystem perspective), (2) the scale of digital business strategy (rapid possibility of scale up/down as dynamic capability - using cloud services), (3) the speed of digital business strategy, and (4)

	the sources of business value creation and capture in digital business strategy (information value, multisided business).
Legner et al. 2017	The term digitalization has been coined to describe the manifold sociotechnical phenomena and processes of adopting and using these technologies in broader individual, organisational, and societal contexts
Baker 2011	The concept of dynamic capabilities, defined by Eisenhardt & Martin (2000, p. 1107) as: The firm's processes that use resources – specifically the processes to integrate, reconfigure, gain and release resources – to match and even create market change. Dynamic capabilities are therefore the organisational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve and die.
Dannenberg et al. 2020	COVID-19 pandemic has led to a sharp increase in online trade; what extent and why the online grocery retail expanded during the pandemic; focus is on the spatial expansion into rural areas; study shows a general upswing in the grocery trade and disproportionately high growth in online grocery trade and identifies driving and limiting factors.
Ivanov 2020	Specific features that frame epidemic outbreaks as a unique type of SC disruption risks; demonstrate how simulation-based methodology can be used to examine and predict the impacts of epidemic outbreaks on the SC performance using the example of coronavirus COVID-19; an analysis for observing and predicting both short-term and long-term impacts of epidemic outbreaks on the SCs along with managerial insights.

A6. Interview Protocol for the Business-IT Collaboration Study

Introduction

There are no insights in academia related to the specific challenges of the business and IT experts' collaboration in a digital landscape of an established automotive environment. Since a collaboration between business and IT experts is essential for exploiting the potentials of digitalization, it is important to understand the challenges of the development of digital services from your perspectives. The project you are working on started in 2015. In the course of 2018, many other departments of the company became involved in the project. The roles of the experts are different, but your expertise could broadly be divided into business and IT areas.

Interviewees Information

1. How do you identify your role? Are you an IT or a business expert? What is concretely your expertise and function?
2. How long have you been working for this company and for how long do you work on this specific project?

Business Values of a Digital Service

1. What do you think is the most important business value of this digital service you are working on?
2. When you think about the service, how can this company profit from it?
3. What is the focus of the project? Is the digital service somehow considered as a stand-alone solution or do you think about it as an additional value for selling more vehicles? Can you elaborate your answers?

Technological Functionalities of a Digital Service

1. What are the most important technological functionalities of this digital service?
2. When you think about those functionalities, can you relate them to their business or customer value?
3. How important is this (certain) functionality? Can you rate it on the 1-5 scale please?

Strategy for the Development Process of a Digital Service

1. Which factors will make the process of developing digital service successfully?
2. How important is communication between business and IT? What are the obstacles there?
3. Do you think that current strategy in conducting this project is successful? If yes, can you elaborate your answer? What is particularly successful about it? If not, what would you change?

A7. Interview Guide for the Remote Work Study

I PART | Strategy

1. How has the remote work policy at your company affected your team's dynamics and collaboration within the past year? Have there been any notable positive or negative impacts?
2. From your experience, what challenges have you encountered with remote work? How has the company addressed these challenges to ensure smooth operations and team cohesion?
3. In light of the companys` remote work policies, how do you assess its ability to attract and retain top talent? What role do you think the flexible work arrangements play in this regard?
4. As the company continues to embrace remote work, how do you envision the future of work within the organisation?

II PART | Leadership styles

1. As a manager, how have you adapted your leadership style to effectively manage a remote team? What strategies have you found most useful in maintaining engagement and motivation among team members?
2. As a manager leading a team within the context of remote work, what advice or insights would you share with other leaders navigating similar challenges and opportunities in the ever-changing work landscape?
3. How do you ensure that employees remain connected to the company's mission and values while working remotely?
4. Have there been any initiatives or activities to foster a sense of belonging and company culture?

III PART | Organisation productivity

1. In your view, what are the key benefits of the remote work policy in terms of team productivity and employee satisfaction?
2. How has communication and collaboration between different teams and departments been affected by remote work? Have there been any measures taken to enhance interdepartmental coordination?
3. Have you observed any changes in the overall well-being and job satisfaction of your team members?
4. How do you perceive the impact of remote work on employee work-life balance?

A8. Some Field Notes from the Talks with the AI Experts for the Reusable AI Study

Talks Software Engineer and ML expert

Note 1: It is important that you define what does "reusable" for you mean, because there are for example libraries used in ML and they are completely reusable

Note 2: Libraries are also an "ML solution" but are meant to be reusable; So what do you with "reusable" mean and what is "ML solution" in your case is very important to understand

Note 3: There is for example a solution from Microsoft Azure where they sell ML as a Service, maybe that could be your "reusable" product that you show to developers, because that is very reusable However, problem with this ML services is that sometimes they change some structures or codes and of course as an engineer "buying" it only you do not get any information about it; And then suddenly something that worked for you couple of days before does not work anymore

Note 4: The project we are working on regarding ML considers predictive maintenance; We basically have a box that we install in a vehicle and this box turns a vehicle into smart car; We can attach it to sensors and vehicle and read the data; What I am working now is a predictive maintenance for that box; So now we are in the phase where we only gather data from the field; We are still not able to analyse it because we do not have enough data

Talks with data scientists and AI expert

Note 1: We are working on a project of predictive maintenance for cars; But the project is very special, we gather the data from the road so I am not sure that this can be somehow reusable maybe for some similar project

Note 2: Generally it is difficult to say that ML can be reusable, because you always need to make many assumptions and the solution highly depends on the data you have

Note 3: So if your data is based on high assumptions or the function you are using, then the chances are pretty high that at you will make something wrong and that the results will not be accurate

Note 4: But generally I agree, we do not have some common deposits that we use across the company, I mean we do have in our team but for the company I am not sure; It would be cool if we all have some common libraries or maybe some places to exchange knowledge, I mean there are some groups but that is not something formal from the company.

Note 5: Everyone is working a little bit in an own silo and for particular project, so I think people are also not interested in sharing if they do not see benefit for themselves too; That must be some kind of decision from the board or something official so that it works;

A9. Design Thinking Workshop Notes for the AI Reusable Study

Aim	Facilitate direct exchange among researchers; Discuss project problems and define study objectives; Outline objectives for DSR methodology
Why Design Thinking Workshop	Recognized as a scientific method to develop practical solution designs (Cross 2007); Not a linear process but structured within a framework; Brown (2008) outlines three critical elements: Inspiration, Ideation, and Implementation
Workshop Schedule and Activities	Duration: Three full days, conducted in-person; Inspiration phase completed pre-workshop, identifying problems P1-P5 from literature review; Activities include a mix of individual and small group sessions; Focus on generating knowledge, discussing motivations, and starting to define objectives for design principles
Reflective Practice	Following Schön's (1983) model of "reflective practitioners"; Emphasize reflective dialogue, critical examination, and iterative problem-solving throughout the workshop
Outcomes	Develop a clearer understanding of project challenges; Began formulation of specific objectives for DSR methodology;