Digital for the Good:
Leveraging Digital Innovation and Transformation for a Sustainable Future

Dissertation
zur Erlangung des Grades einer Doktorin der Wirtschaftswissenschaft
der Rechts- und Wirtschaftswissenschaftlichen Fakultät
der Universität Bayreuth

Vorgelegt
von
Laura Heim
aus
Bayreuth

Dekan:	*Prof. Dr. Claas Christian Germelmann*
Erstberichterstatter:	*Prof. Dr. Maximilian Röglinger*
Zweitberichterstatter:	*Prof. Dr. Christoph Buck*
Datum der mündlichen Prüfung:	*01. August 2025*

Copyright Statement

The following sections are partly comprised of content from the research papers included in this thesis. To improve the readability of the text, I omit the standard labeling of these citations.

Abstract

Contemporary society faces pressing global challenges such as poverty, limited healthcare access, gender inequality, climate change, and biodiversity loss. These challenges underline the urgency for substantial societal shifts toward sustainability. Organizations play a pivotal role in facilitating this transition, uniquely positioned to leverage their resources and capabilities for responsible and impactful actions (Melville, 2010; Oberländer et al., 2021). In recent years, digital technologies have emerged increasingly, offering new opportunities to support and accelerate sustainability objectives within organizational contexts (Buck, Krombacher, et al., 2023; Gholami et al., 2016). Addressing societal challenges effectively demands that organizations integrate targeted digital innovations and holistic digital transformations, recognizing their interdependence: innovation acts as a catalyst for transformation, and transformation, in turn, fosters a conducive environment for continuous innovation (Appio et al., 2021; Drechsler et al., 2020).

However, current research addressing digitalization and sustainability remains fragmented, often neglecting the synergies between these two domains (Guandalini, 2022; Kotlarsky et al., 2023; Ologeanu-Taddei et al., 2025). Initially, research must prioritize understanding and designing digital innovation for the good, specifically through digital social innovation, a concept merging technological advancement with social value creation (Bonina et al., 2021). The existing literature faces conceptual ambiguities regarding the unique dynamics of digital social innovation and lacks systematic guidance for organizations seeking to design such initiatives (Buck, Krombacher, et al., 2023; Graf-Drasch et al., 2022; Tim et al., 2021). Additionally, research must advance toward understanding and designing digital transformation for the good, particularly the integrated approach of twin transformation, which strategically aligns digital and sustainability transformation (Breiter et al., 2024; Christmann et al., 2024). Current academic insights into twin transformation remain limited, lacking robust guidance for practical implementation.

Addressing these research gaps, this dissertation contributes to the field of digital for the good by aiming at two primary research objectives: (1) understanding and designing digital innovation for the good, and (2) understanding and designing digital transformation for the good. Aligned with these objectives, the dissertation comprises seven research papers. The initial four research papers address the first research objective of digital innovation for the good, focusing on understanding and designing digital social innovation. First, the dissertation lays a conceptual foundation for understanding digital social innovation through synthesizing its

success factors through Research Paper 1. Complementarily, Research Paper 2 provides an overview of the barriers to digital social innovation. This understanding provides a basis for further exploring the successful design of digital social innovation. Therefore, Research Paper 3 provides inspirational digital social innovation patterns of how incumbents can leverage their existing resource base to build digital social innovation. Additionally, Research Paper 4 offers an approach to understanding digital social innovation's impact and, therefore, helps to guide its design while preventing unintended consequences. The subsequent three papers address the second research objective digital transformation for the good, which explores the understanding and design of an integrated digital and sustainable transformation as a twin transformation. Research Paper 5 offers a holistic understanding of the synergistic interplay between digital and sustainability transformation across various organizational layers. Complementing this understanding, Research Paper 6 applies a resource orchestration perspective, examining how firms can effectively mobilize, structure, and align internal resources to design twin transformation. Finally, Research Paper 7 builds on these insights by developing a strategic framework that guides practitioners in formulating a coherent and actionable twin transformation strategy.

Overall, this dissertation contributes to the existing literature on digital sustainability within Information Systems research by introducing and investigating digital social innovation and twin transformation. The findings provide valuable insights for researchers and practitioners, guiding future research endeavors to advance and detail the understanding and design of digital social innovation and twin transformation. Ultimately, this dissertation emphasizes the importance of organizations leveraging the synergies between digitalization and sustainability to secure a resilient and sustainable future.

Table of Contents

I. Introduction 1
I.1 Motivation 1
I.2 Research Objectives 6
I.3 Structure of the Dissertation and Embedding of the Research Papers 7
II. Digital Innovation for the Good 9
II.1 Understanding Digital Innovation for the Good 9
II.2 Developing Digital Innovation for the Good 17
III. Digital Transformation for the Good 26
III.1 Understanding Digital Transformation for the Good 26
III.2 Designing Digital Transformation for the Good 32
IV. Conclusion 42
IV.1 Summary 42
IV.2 Limitations 45
IV.3 Future Research 46
V. References 49
VI. Appendix 78
VI.1 Index of Research Papers 78
VI.2 Individual Contribution to the Included Research Articles 80
VI.3 Research Paper 1: Making the Most of Digital Social Innovation: An Exploration into Success Factors 82
VI.4 Research Paper 2: Barriers along the digital social innovation process: A structured literature review 83
VI.5 Research Paper 3: Know Your Worth: Resource-centric Patterns for Creating Digital Social Innovation 84
VI.6 Research Paper 4: AI in the Web of Trees: A Systems Thinking Approach to Understanding How AI Affects Deforestation 87
VI.7 Research Paper 5: Better Together: The Interplay Between Digital Transformation and Sustainability Transformation to Realize Twin Transformation 90
VI.8 Research Paper 6: Twin to Win: A Resource Orchestration Perspective on Twin Transformation 91
VI.9 Research Paper 7: Navigating Twin Transformation: A Systematic Approach for Twin Transformation Strategy Development 92

List of Figures

Figure 1. Assignment of the research papers to the research areas of the dissertation 6

Figure 2. Digital social innovation success factor framework 14

Figure 3. Digital social innovation barrier framework 17

Figure 4. Digital social innovation pattern map 19

Figure 5. Research design of Research Paper 4 21

Figure 6. Balancing loop “Informed Decision-Making Regarding Current Deforestation” 23

Figure 7. Reinforcing loop “Heightened Demand for Energy” 23

Figure 8. Reinforcing loop “From Mitigation Success to Ecological Overshoot” 24

Figure 9. Twin transformation model 29

Figure 10. Twin transformation resource orchestration pyramid 33

Figure 11. Research design following Peffers et al. (2007) 37

Figure 12. Twin transformation strategy framework 39

List of Tables

Table 1. Overview of the dissertation and the associated research papers 8

Table 2. Research approach 10

Table 3. Digital social innovation success factor overview 13

Table 4. Cause-and-effect relationships between AI and deforestation 22

Table 5. Detailed twin transformation interplay 30

Table 6. Overview of the twin transformation structuring dimensions 34

Table 7. Overview of the twin transformation bundling clusters 35

Table 8. Overview of the twin transformation purposes of resource leveraging 36

Table 9. Overview of the design objectives 38

Table 10. Index of research papers 79

Table 11. Further research papers 79

Acronyms

AI	Artificial Intelligence
CLD	Causal Loop Diagram
DSI	Digital Social Innovation
DT	Digital Transformation
IS	Information Systems
UN	United Nations
SDGs	Sustainable Development Goals
ST	Sustainability Transformation
TT	Twin Transformation
REDD+	Reducing Emissions from Deforestation and Forest Degradation

I. Introduction

I.1 Motivation

Contemporary society faces numerous critical societal challenges, such as poverty, inadequate education, limited healthcare access, gender inequality, climate change, or loss of biodiversity. For instance, in 2023, approximately 9.5% of the global population, about 757 million people worldwide, faced hunger (FAO et al., 2024). At the same time, deforestation contributes significantly to climate change, accounting for around 5.6 billion tons of CO2 equivalent emissions each year (Harris et al., 2021; UNEP, 2024). As a result, deforestation ranks among the leading causes of global warming, with devastating consequences for society and nature through increasingly frequent and intense weather extremes.

To address these pressing societal challenges, the United Nations (UN) introduced the 17 Sustainable Development Goals (SDGs) in 2015, aiming to promote sustainable development on a global scale (United Nations, 2015). Despite these ambitious objectives, recent evaluations indicate that progress remains insufficient. According to recent reports, merely 17% of the SDG targets are progressing as planned, while more than a third are experiencing stagnation or regression (United Nations, 2024). For instance, regarding the second SDG, the level of undernourishment has persisted at nearly the same level for three consecutive years (FAO et al., 2024). Additionally, the global forest area is still decreasing, although the rate of loss has slowed slightly in comparison to previous decades (United Nations, 2024). Consequently, substantial contributions from individuals, organizations, research institutions, and the public sector are urgently required to progress the achievement of the 17 SDGs. Among these actors, organizations play a particularly crucial role, as they possess unique resources to address the SDGs and are increasingly expected to act responsibly, being perceived as social actors (Barakat et al., 2016; Bauman & Skitka, 2012; Oberländer et al., 2021).

Digital technologies have emerged as a promising approach to address these wicked societal challenges (Cowls et al., 2021; Dong & Götz, 2021; Gebken et al., 2021). Both scholars and practitioners increasingly acknowledge the transformative potential of digital technologies, highlighting their ability to significantly impact environmental, social, and economic sustainability (George et al., 2021; Hinsen et al., 2023; Melville, 2010). Within organizational contexts, digital technologies enable novel forms of collaboration, enhance resource efficiency, improve transparency, and facilitate scalable solutions previously unattainable (Guandalini, 2022; Onsongo, 2019; Seidel et al., 2017; Walsham, 2012). Despite this acknowledged

potential, research at the intersection of digitalization and sustainability often remains fragmented, addressing these domains independently rather than synergistically (Guandalini, 2022; Kotlarsky et al., 2023; Ologeanu-Taddei et al., 2025). Consequently, organizations have limited understanding of how to systematically utilize digital technologies for social value creation (Benbya et al., 2020; Lubberink et al., 2017).

Addressing societal challenges with digital technologies in organizational contexts involves two distinct yet complementary approaches: digital innovation and transformation for the good. Digital innovation concentrates on developing targeted initiatives that leverage digital technologies to create novel products, services, business models, or processes to address societal challenges (Nambisan et al., 2017). Conversely, digital transformation encompasses comprehensive, systemic organizational changes in processes, structures, and culture, fundamentally driven by digital technologies and intended for positive societal impact (Vial, 2019). Recognizing the interdependencies between these two approaches is essential, as targeted digital innovation often serves as a critical stepping stone, informing and accelerating comprehensive digital transformation efforts (Drechsler et al., 2020). Simultaneously, digital transformation provides a necessary foundation and environment conducive to fostering individual digital innovation initiatives (Appio et al., 2021). Therefore, tackling societal challenges requires organizations to integrate and leverage targeted digital innovation initiatives and holistic digital transformations through targeted interventions and strategic organizational reorientation toward sustainability.

Regarding leveraging digital innovation for the good, the concept of digital social innovation has increasingly gained scholarly and practical attention (Bonina et al., 2021; Buck, Krombacher, et al., 2023; Qureshi et al., 2021). Digital social innovation refers to the creation of new products, services, or processes leveraging digital technologies to address societal challenges (Bonina et al., 2021). The concept integrates insights from digital innovation, which involves utilizing digital technologies to create novel products, services, business models, or processes (Nambisan et al., 2017), and social innovation, which encompasses innovation activities addressing societal challenges by providing solutions that surpass traditional approaches in terms of efficiency, impact, sustainability, or fairness (Phills et al., 2008). Thus, digital social innovation represents an interdisciplinary convergence of technological advancement and social value creation.

Current research underscores the growing strategic relevance of digital social innovation for organizations aiming to achieve societal impact and competitive advantage (Mirvis et al., 2016;

Porter & Kramer, 2006). For instance, Bonina et al. (2021) analyze digital social innovation comprehensively, emphasizing its dual value orientation that balances collectivistic and utilitarian objectives. Meanwhile, Buck, Krombacher, et al. (2023) conceptualize the distinctive characteristics of digital social innovation specifically within incumbent firms. Rodrigo and Palacios (2021) explore the determinants influencing employee commitment to digital social innovation initiatives over time, highlighting the critical role of internal organizational dynamics. Suseno and Abbott (2021) explore digital social innovation from a women's entrepreneurship perspective, shedding light on the role of gender dynamics in digital innovation practices. Furthermore, specific empirical studies illustrate practical implementations of digital social innovation, such as designing digital solutions to support homeless people through donations (Gebken et al., 2021) or leveraging open-source software to support communities with limited economic resources (Dong & Götz, 2021).

Additionally, digital social innovation is gaining increasing relevance in practice, driving organizations to design solutions that advance sustainable development (Qureshi et al., 2021). Organizations with their extensive resources, global reach, and social embeddedness are particularly well-positioned to implement such innovations (Grant, 1991; Oberländer et al., 2021; D. Yu & Hang, 2010). At the same time, they face growing expectations to contribute positively to society beyond profit-making, as they are viewed as social actors with moral intentions and societal responsibilities (Bauman & Skitka, 2012). These expectations increasingly influence stakeholder perceptions, especially among employees, customers, and investors (Barakat et al., 2016; Bartikowski et al., 2011). Consequently, digital social innovation emerges as a strategic tool that enables organizations to create social value while strengthening their competitive advantage (Buck, Krombacher, et al., 2023; Chen, 2010; Gable, 2010; Kohli & Melville, 2019). A prominent example is Vodafone's M-Pesa initiative, developed in collaboration with Safaricom, which delivers financial solutions to people who previously had no access to banking. The use of digital technology enabled the solution to scale rapidly, significantly enhancing both social impact and the organization's revenue (Onsongo, 2019).

However, while there is consensus in research and practice that digital social innovation represents an important emerging phenomenon that fundamentally differs from digital and social innovation (Buck, Krombacher, et al., 2023), conceptual ambiguities remain. The existing literature faces conceptual ambiguities regarding the unique dynamics of digital social innovation and lacks systematic guidance for organizations seeking to design such initiatives

successfully (Buck, Krombacher, et al., 2023; Graf-Drasch et al., 2022; Tim et al., 2021). Thus, further evidence is necessary on how organizations can institutionalize digital social innovation as part of their core innovation strategies, rather than treating it as a peripheral activity. Therefore, addressing these research gaps by establishing a clear understanding and guidance for the design of digital social innovation is crucial to ensure organizations can effectively leverage digital technologies to develop impactful solutions, driving the progress of the 17 SDGs.

At the same time, institutionalizing digital social innovation within organizations encompasses broader change processes beyond merely adopting a new organizing logic for innovation (Drechsler et al., 2020; Yoo et al., 2010). These broader organizational change processes are captured in the nascent literature on digital transformation (Vial, 2019). Within this context, the concept of twin transformation, integrating digital and sustainability transformation, has emerged as a strategic paradigm for organizations (Breiter et al., 2024; Christmann et al., 2024; Zimmer & Järveläinen, 2022). Digital transformation encompasses comprehensive and systemic shifts in organizational processes, structures, and cultures driven by digital technologies, aiming to substantially improve efficiency, innovation capacity, and competitive positioning (Vial, 2019). Sustainability transformation, in turn, describes a profound, non-linear change process toward a more desirable state within a social-ecological system (Blythe et al., 2018; Dorninger et al., 2020; Hölscher et al., 2018). Building on this, twin transformation is defined as a "value-adding interplay between digital and sustainability transformation efforts that improve an organization by leveraging digital technologies for enabling sustainability and leveraging sustainability for guiding digital progress" (Christmann et al., 2024, p. 7).

A growing body of literature deals with the emerging topic of twin transformation. For example, Zimmer and Järveläinen (2022) introduce a typology of digital transformation for sustainability, distinguishing between 1) digital transformation, 2) green-digital transformation, 3) social-digital transformation, and 4) digital-sustainable co-transformation. The latter sees digital and sustainability transformation as one strategic imperative. Christmann et al. (2024) distinguish between primary and support capabilities needed to transform into a digital and sustainable organization and become twin transformers. As a result, they offer a holistic capability overview and present an Information Systems (IS) Capability Framework for twin transformation. Breiter et al. (2024) build a twin transformation maturity model, revealing pathways to becoming a twin transformer. Additionally, Ologeanu-Taddei et al. (2025) uncover issues and assumptions around the conceptualizations of digital transformation and

sustainability at the organizational level, and Auweiler et al. (2025) describe the value-adding outcomes that result from implementing the twin transformation strategies and mechanisms from an environmental, social, and governance perspective.

Additionally, twin transformation is gaining increasing relevance in practice (Balta et al., 2022; Hinsen et al., 2023; Ollagnier, 2021). Organizations are increasingly adopting integrated approaches to digital and sustainability transformation, aiming to leverage synergies between both domains to unlock value creation, risk mitigation, and future resilience (Böttcher et al., 2023; Christmann et al., 2024; Ologeanu-Taddei et al., 2025). By aiming for a co-equal, dual-headed organizational transformation that jointly harnesses the benefits of digital and sustainability transformation, organizations can simultaneously reduce costs, increase efficiency, and strengthen their reputation (Guandalini, 2022; Loeser, 2013; Zimmer & Järveläinen, 2022). For instance, Schneider Electric illustrates the practical implementation of twin transformation. By integrating IoT sensors, digital twins, and real-time analytics in its factory in Le Vaudreuil, the company reduced energy use and CO2 emissions by 25% and cut material waste by 17% (Kaplan, 2023). This demonstrates how aligning digital and sustainability goals can yield measurable efficiency gains and environmental impact. Such examples underscore how twin transformation is not only a strategic imperative in theory but also a proven pathway to measurable business and sustainability outcomes in practice, serving as a purposeful catalyst for digital social innovation (Hanseln et al., 2022; Peng et al., 2022; Zimmer & Järveläinen, 2022).

Given the expected potential of twin transformation and the growing societal and economic pressure, it is imperative for research and practice to gain a deeper understanding of how to align digital and sustainability transformation efforts to effectively manage and sustain twin transformation. Despite initial promising developments in research, the academic understanding of twin transformation remains limited. Current research lacks the understanding that holistically captures the interplay of digital and sustainability transformations within an organization. Additionally, organizations lack guidance in designing and implementing twin transformation (Christmann et al., 2024; Ollagnier, 2021). Existing methods provide limited guidance on effectively implementing twin transformation, as they do not consider digital and sustainability transformation in an integrated manner (Bharadwaj et al., 2013; Broman & Robèrt, 2017; Kopnina, 2017; Vial, 2019). Thus, evidence is necessary on how organizations can holistically transform to integrate digital and sustainability imperatives and build a solid foundation for developing digital innovation for the good.

Addressing these substantial gaps in digital innovation and transformation research can significantly enhance organizations' capabilities to systematically use digital technologies for the good. Clarifying their understanding and offering orientation for their design will empower organizations to better navigate the complexities of the digital-sustainability nexus, supporting effective implementation of innovative digital solutions to societal challenges and adequately transforming the whole organization.

I.2 Research Objectives

To address the identified research gaps, this dissertation contributes to digital innovation and digital transformation by pursuing two primary research objectives: (1) understanding and designing digital innovation for the good, and (2) understanding and designing digital transformation for the good. These two objectives are addressed through seven research papers, each contributing distinct but interrelated insights. The conceptual structure of the dissertation and the distribution of the research papers across the two research objectives are visualized in Figure 1.

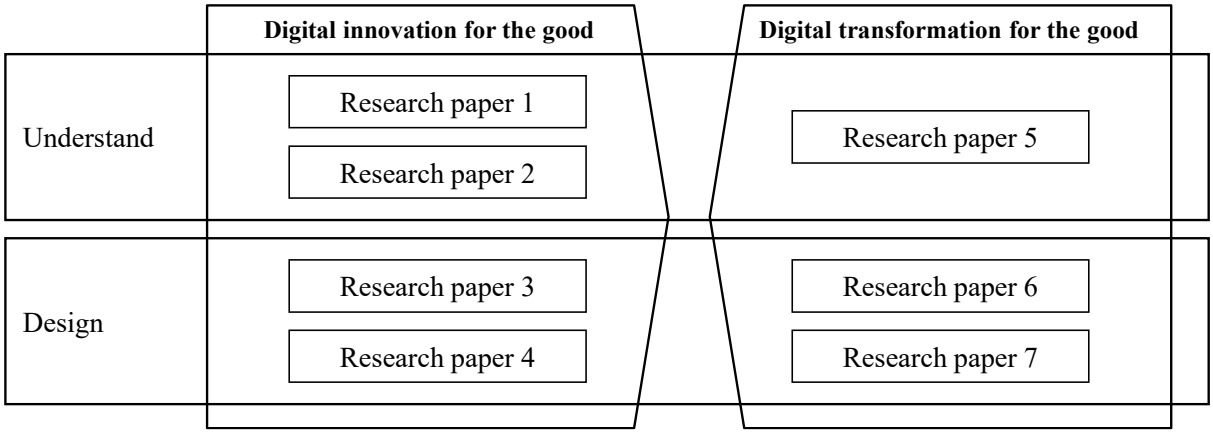

Figure 1. Assignment of the research papers to the research areas of the dissertation

The first four research papers are positioned within the research topic of digital innovation for the good, focusing on understanding and designing digital social innovation (Section II). The section begins with Research Paper 1, which lays a conceptual foundation for understanding digital social innovation through synthesizing specific success factors (Section II.1). To complement this perspective, Research Paper 2 provides an overview of the barriers to digital social innovation. This understanding provides a basis for further exploration of digital social innovation's successful design (Section II.2). Therefore, Research Paper 3 provides inspirational patterns of how incumbents can leverage their existing resource base to build digital social innovation. Additionally, Research Paper 4 offers an approach to understanding

digital social innovation's impact and, therefore, helps to shape its design to avoid unintended consequences. The remaining three papers form the foundation for the second research topic, digital transformation for the good, which explores the understanding and design of an integrated digital and sustainable transformation as a twin transformation (Section III). Research Paper 5 offers a holistic understanding of the synergistic interplay between digital and sustainability transformation across various organizational layers (Section III.1). This is complemented by Research Paper 6, which applies a resource orchestration perspective to examine how firms can effectively mobilize, structure, and align their internal resources to design twin transformation (Section III.2). Finally, Research Paper 7 builds on these insights by developing a strategic framework that guides practitioners in formulating and implementing coherent and actionable twin transformation strategies.

By linking these contributions, this dissertation advances the understanding and design of digital innovation and transformation for the good. The research objectives form the backbone of this cumulative dissertation and serve to integrate the individual papers into a coherent scholarly narrative. Providing novel insights into digital innovation and transformation for the good, this dissertation is relevant for researchers and practitioners.

I.3 Structure of the Dissertation and Embedding of the Research Papers

The dissertation comprises seven research papers, contributing to the abovementioned research objectives. Table 1 provides an overview of the dissertation structure and the embedded research papers.

The dissertation is structured as follows: Section I introduces the research gaps addressed in this dissertation and defines the research objectives. Section II explores the foundations of digital innovation for the good by presenting the concept of digital social innovation. The four associated research papers identify success factors, barriers, and patterns for digital social innovation and an analysis of how a specific digital technology affects the system of a societal challenge. Section III explores the foundations of digital transformation for the good by presenting the concept of twin transformation. The three associated research papers lay the foundation for twin transformation research by understanding the interplay of digital and sustainability transformation and the orchestration of resources to foster twin transformation, as well as presenting a framework for developing a twin transformation strategy. Section IV presents a summary of this dissertation's findings and limitations, while highlighting potential directions for future research. Finally, Section V lists the references, while the appendix in

Section VI includes an index of the research papers, a summary of the individual contributions, and the complete versions of the research papers.

I	**Introduction**
II	**Digital Innovation for the Good**
	Research Paper 1 Making the most of digital social innovation: An exploration into success factors Buck, C.; Heim, L.; Körner-Wyrtki, K.; Krombacher, A.; Röglinger, M.
	Research Paper 2 Barriers along the digital social innovation process: A structured literature review Buck, C.; Kempf, L.; Kneissel, K.; Krombacher, A.
	Research Paper 3 Know your worth: Resource-centric patterns for creating digital social innovation Buck, C.; Heim, L.; Krombacher, A.; Weissmann, H.
	Research Paper 4 AI in the web of trees: A systems thinking approach to understanding how artificial intelligence affects deforestation Krombacher, A.; Buck, C.; Heim, L.; Röglinger, M.
III	**Digital Transformation for the Good**
	Research Paper 5 Better Together: The interplay between digital transformation and sustainability transformation to realize twin transformation Lockl, A.; Heim, L.; Oberländer, A. M.
	Research Paper 6 Twin to win: A resource orchestration perspective on twin transformation Burghard, F.; Heim, L.; Kreuzer, T.; Wozar, J.
	Research Paper 7 Navigating twin transformation: A systematic approach for twin transformation strategy development Heim, L.; Buck, C.; Lockl, A.; Oberländer, A. M.
IV	**Conclusion**
V	**References**
VI	**Appendix**

Table 1. Overview of the dissertation and the associated research papers

II. Digital Innovation for the Good

As Section I outlines, digital innovation holds significant potential for social value creation. Specifically, this dissertation addresses digital social innovation and its pivotal role in enabling organizations to effectively tackle societal challenges. To this end, this dissertation first conceptualizes what constitutes successful digital social innovation and identifies success factors that organizations should consider for developing impactful digital social innovation (Section II.1, Research Paper 1). Additionally, it examines barriers hindering the development of digital social innovation (Section II.1, Research Paper 2). Building on this comprehensive understanding of success factors and barriers, this dissertation proposes resource-centric patterns, providing organizations with inspirational insights for designing digital social innovation. These patterns illustrate how organizations can effectively combine their existing resource base with various digital technology archetypes to address specific SDGs (Section II.2, Research Paper 3). After establishing a conceptual foundation for developing digital social innovations, this dissertation proceeds to explore their societal impact. Specifically, it introduces an analytical approach designed to unpack the systemic complexities involved when applying digital technologies, like artificial intelligence, to address wicked societal challenges, illustrated through the example of deforestation (Section II.2, Research Paper 4).

II.1 Understanding Digital Innovation for the Good

Research Paper 1: Making the Most of Digital Social Innovation: An Exploration into Success Factors

Digital social innovation leverages digital technologies to address societal challenges, offering organizations novel opportunities to develop innovative products, services, and business models, which can ultimately strengthen their competitive position (Porter & Kramer, 2006). By embracing digital social innovation, organizations can meet new regulatory requirements and the growing requirements from customers, employees, and investors for socially responsible solutions (Bonina et al., 2021; Eichler & Schwarz, 2019; Gössling & Vocht, 2007; Porter & Kramer, 2006). Despite these opportunities, organizations encounter significant challenges in developing digital social innovation, such as satisfying diverse stakeholders with conflicting priorities, achieving societal impact in a financially viable manner, and navigating inherent complexities and uncertainties (Buck, Kempf, et al., 2023; Hall & Vredenburg, 2003; Nambisan, 2017). Therefore, identifying success factors for digital social innovation development is essential to fully exploit digital social innovation's potential (Tim et al., 2021).

These success factors provide guidance for organizations, highlighting key performance areas to fully realize the potential of digital social innovation (Evanschitzky et al., 2012; Kuester et al., 2013). In response, Research Paper 1 investigates the following research question: *What are success factors for digital social innovation?*

To address the research question, Research Paper 1 applies a two-step methodological approach (Table 2). First, a systematic literature review was performed to build a preliminary success factor overview (Moher et al., 2015). The systematic literature review used the databases Business Source Premier, Web of Science Core Collection, Scopus, and Association for Information Systems Electronic Library Journals, focusing on success factors within digital innovation, social innovation, and digital social innovation. A title, abstract, and keyword search was conducted with the following search string: ("social innovation" OR "sustainab* innovation" OR "digital innovation" OR "ICT innovation" OR "information technolog* innovation" OR "information system* innovation") AND (success OR enabler OR determinant OR driver OR "critical factor*" OR "crucial factor*"). Coding the final pool of 83 papers yielded 14 preliminary digital social innovation success factors (Gioia et al., 2013). The success factors are categorized following the Human-Organization-Technology (Yusof et al., 2008) and Technology-Organizations-Environment (Tornatzky & Fleischer, 1990) frameworks into human, organization, and environment success factor categories. Second, these preliminary findings were contextualized and expanded through 21 semi-structured interviews with digital social innovation experts (Myers & Newman, 2007). The expert interviews validated and refined the preliminary success factors and identified four additional success factors, culminating in the Digital Social Innovation Success Factor Framework with 18 digital social innovation success factors.

#	Step	Method	Coding	Result
1	Conceptualization	83 relevant papers through a systematic literature review	- 315 open codes - 14 axial codes - 3 selective codes	Preliminary success factor overview: - 14 success factors - 3 success factor categories
2	Transfer	21 semi-structured interviews with digital social innovation experts	- 155 open codes - 18 axial codes - 3 selective codes	Digital social innovation success factor framework: - 18 success factors - 3 success factor categories

Table 2. Research approach

	Success factor	Resource *	Description	Illustrative statement	References from the literature review			Interviews
					Digital innovation	Social innovation	DSI**	
Human	Digital technology knowledge	C	The understanding of the digital world, programming skills, and deep comprehension of specific digital technologies to identify where digital technologies can add real social value and enable successful technical implementation.	"One major point that prevents digital social innovation success is that people start with solutions without any knowledge of the digital world and without someone in the team who has programming skills and truly understands the digital technology". (E17)	Carlan et al. (2017), Choi et al. (2021), Gierlich-Joas et al. (2020), Guinan et al. (2019), Hussain et al. (2024), Johansson et al. (2020), Kaewsaengon et al. (2023), Khin and Ho (2019), Kohli and Melville (2019), Müller, Påske, and Rodil (2019), Shah et al. (2024), van Riel et al. (2004), Wiesböck and Hess (2020)	Aksoy et al. (2019), de Arruda Torresa (2017), de Medeiros et al. (2022), Golgeci et al. (2022), Chuan Li and Bacete (2022), Lu et al. (2023), Sanzo-Perez et al. (2015), Taneja et al. (2023), Yun et al. (2019)	Schweitzer et al. (2015)	E1, E2, E4, E5, E6, E8, E10, E12, E14, E15, E17, E18, E19, E21
	Entrepreneurial resilience	C	The ability to withstand and overcome adversity, bounce back from negative experiences and persist in the face of scepticism and constraints to tackle legal, political, environmental, and technological restrictions in addressing wicked societal challenges.	"A hands-on and problem-solving nature is important to turn ideas for wicked societal challenges into action". (E17)	-	-	-	E2, E4, E7, E17, E18, E19, E20, E21
	Interdisciplinary collaboration	C	The close collaboration of different business units (e.g., IT, legal, R&D) and intensive knowledge and resource sharing to effectively address the complexity of digital social innovation.	"A single department can never develop a successful digital social innovation. Organisations always need IT, cross-sectional functions such as legal or data protection, and sometimes specialist departments. Thus, the collaboration between these departments is essential". (E11)	Gierlich-Joas et al. (2020), Guinan et al. (2019), Johansson et al. (2020), Kohli and Melville (2019), Müller, Obwegeser, et al. (2019), Müller, Påske, and Rodil (2019), van Riel et al. (2004), Wiesböck and Hess (2020)	Charalabidis et al. (2014), de Arruda Torresa (2017), de Medeiros et al. (2022), Dias et al. (2024), Halila and Rundquist (2011), Metszősy (2020), Meyer and Hartmann (2023), Neumeier (2017), Oliveira and Sbragia (2012), Petropoulou et al. (2022), Taneja et al. (2023), Urban and Gaffurini (2017)	-	E1, E2, E4, E5, E6, E7, E8, E10, E11, E12, E14, E15, E17, E18, E19, E20, E21
	Networking skills	C	The ability to connect with the surrounding network to build strategic partnerships with various stakeholders, foster collaboration, and stay updated on societal challenges and digital trends.	"Many different disciplines and stakeholders are involved in digital social innovation, which means that one cannot develop a successful digital social innovation independently. That is why networking is essential". (E10)	Müller, Påske, and Rodil (2019), Shojaei and Burgess (2022), Svahn et al. (2017)	Charalabidis et al. (2014), Halila and Rundquist (2011), Metszősy (2020), Oliveira and Sbragia (2012), Perrini et al. (2010), Petropoulou et al. (2022), Urban and Gaffurini (2017), Westley et al. (2014)	-	E2, E4, E5, E6, E7, E9, E10, E12, E14, E15, E17, E18, E19, E20, E21
	Social knowledge	C	Skills like empathy, humility, listening, and understanding the social domain (e.g., culture, beneficiaries) to genuinely help people and discern digital social innovation with the potential for societal change.	"In contrast to conventional innovation, digital social innovation requires the ability to empathise and understand different stakeholders even more. With digital social innovation, you do not only want to induce buying behaviour, but you want to help people. Furthermore, if you want to do so, you must be able to understand them". (E13)	Gierlich-Joas et al. (2020), van Riel et al. (2004)	Aksoy et al. (2019), Canestrino et al. (2019), de Medeiros et al. (2022), Deserti and Rizzo (2020), Golgeci et al. (2022), Martínez-Martínez et al. (2023), Metszősy (2020), Binti Mustapha and Bin Abu Seman (2023), Naranjo-Valencia et al. (2020), Taneja et al. (2023), Westley et al. (2014)	-	E6, E7, E8, E10, E11, E12, E13, E15, E16, E17, E18, E19, E20, E21
	Systemic thinking	C	The ability to deliberately and systematically gain deep insights into complex domains, considering potential rebound effects, and understanding the interdependencies between the conceptual, social, and technological levels to create social value while avoiding unintended negative consequences.	"If you make a mistake in the whole system logic, you may damage more in society or environment than you solve". (E12)	-	-	-	E1, E2, E9, E10, E12, E16, E17, E19

	Success factor	Resource *	Description	Illustrative statement	References from the literature review: Digital innovation	References from the literature review: Social innovation	References from the literature review: DSI**	Interviews
Organization	Continuous monitoring	A	The tracking of progress, re-evaluation of assumptions, and use of financial, social, and technological KPIs enable proactive risk management and organisations to maintain engagement by sharing the progress and successes achieved with stakeholders.	"Throughout the development, you need some impact analysis running in parallel to check if you are creating the desired social impact". (E16)	Guinan et al. (2019), Müller, Obwegeser, et al. (2019)	Pfitzer et al. (2013), Wirth et al. (2023)		E3, E4, E6, E8, E10, E12, E14, E15, E16, E18, E19, E20, E21
	Dual value creation	A	The creation of socially responsible and financially sustainable digital social innovation to enable long-term success by exploring innovative revenue models (e.g., beyond traditional data monetisation and advertising) and leveraging the affordability and accessibility of digital technologies to scale social value.	"There must be an economic perspective in social value creation because there must be some funding in the long-term. Otherwise, organisations build a digital social innovation that does not exist two years later because there is no more money". (E3)	Müller, Påske, and Rodil (2019)	Aksoy et al. (2019), Casale Mashiah et al. (2023), de Arruda Torresa (2017), Deserti and Rizzo (2020), Dopelt et al. (2023), Fellnhofer (2017), Metszősy (2020), Perrini et al. (2010), Pfitzer et al. (2013), Weppen and Cochrane (2012)	Bonina et al. (2021)	E1, E2, E3, E4, E5, E6, E7, E8, E9, E11, E12, E13, E14, E15, E17, E18, E19, E20, E21
	Openness for experimentation	C	The emphasis is on values such as accepting failure, embracing a learning mindset, and being receptive to change and new digital technologies to tackle the complex nature of digital social innovation, with its legal, political, social, and technological constraints.	"Due to the legal, political, environmental, and technological restriction and the complex systemic dependencies in digital social innovation, failure is probably even more likely than in conventional innovation and thus requiring risk tolerance". (E6)	Al Issa and Omar (2024), Choi et al. (2021), Del Giudice, Scuotto, et al. (2021), El-Haddadeh (2020), Gierlich-Joas et al. (2020), Goncalves et al. (2020), Guinan et al. (2019), Cai Li et al. (2022), Lyu et al. (2024), Meland et al. (2023), Müller, Obwegeser, et al. (2019), Müller, Påske, and Rodil (2019), Nylén and Holmström (2015)	Aksoy et al. (2019), Bright and Godwin (2010), Chalmers (2013), de Medeiros et al. (2022), Erdiaw-Kwasie and Abunyewah (2024), Fellnhofer (2017), Herrera (2015), Hsu et al. (2019), Lu et al. (2023), Najib et al. (2021), Urban and Gaffurini (2017)	-	E1, E2, E4, E5, E6, E8, E10, E11, E12, E13, E14, E15, E17, E18, E19, E20, E21
	Organizational identity	A	The shared norms and beliefs within the organisation to embrace the commitment to social value creation through digital technologies, as introducing digital options, are often met with resistance.	"When things get difficult, which is often the case with digital social innovation, the question is always: Why am I doing this? When motivation comes from within, organisations can handle complex situations more easily because the team wants to change the world positively". (E13)	Gierlich-Joas et al. (2020), Müller, Påske, and Rodil (2019), Wiesböck and Hess (2020)	Aksoy et al. (2019), Casale Mashiah et al. (2023), Dias et al. (2024), Divella and Sterlacchini (2021), Dopelt et al. (2023), Fellnhofer (2017), Herrera (2016), Ko et al. (2019), Metszősy (2020), Meyer and Hartmann (2023), Neumeier (2017), Oliveira and Sbragia (2012), Pearce and van Knippenberg (2023), Perrini et al. (2010), Petropoulou et al. (2022), Sanzo-Perez et al. (2015), Urban and Gaffurini (2017), Wirth et al. (2023)	Rodrigo and Palacios (2021)	E2, E4, E5, E6, E7, E10, E11, E13, E15, E18, E19, E20, E21
	Privacy and security	A	The careful consideration of data collection, acquisition, usage, storage, and sharing, with a strong emphasis on protecting personal and sensitive data to ensure compliance and prevent causing harm when addressing sensitive societal challenges.	"For example, if I offer a digital solution to support children experiencing domestic violence and make a mistake in data protection, I can quickly cause more harm than help. Since societal challenges are far more sensitive, organisations must put data protection and security first". (E12)	-	-	-	E1, E12
	Strategic alignment	A	The active promotion of digital social innovation as an integrated part of the business strategy, IT strategy, and corporate social responsibility to merge organisational processes, digital technologies, and social responsibility activities to prevent mission drift.	"It is enormously important to commit to digital social innovation strategically, take the social topic seriously, and not just let it run parallel to day-to-day business. If the strategic alignment to digital social innovation is missing, employees will be burdened with day-to-day business, and digital social innovation will not be actively fostered". (E10)	Johansson et al. (2020), Khin and Ho (2019), Khrais and Alghamdi (2022), Lyu et al. (2024), Shah et al. (2024), Shojaei and Burgess (2022), Svahn et al. (2017), Wiesböck and Hess (2020)	Alegre and Berbegal-Mirabent (2016), Battistella et al. (2021), Bright and Godwin (2010), Casale Mashiah et al. (2023), de Arruda Torresa (2017), de Medeiros et al. (2022), Deserti and Rizzo (2020), Fellnhofer (2017), Herrera (2015), Herrera (2016), Lu et al. (2023), Neumeier (2017), Pearce and van Knippenberg (2023), Perrini et al. (2010), Petropoulou et al. (2022), Pfitzer et al. (2013), Sigurdsson and Candi (2020)	-	E1, E2, E4, E5, E6, E7, E9, E10, E11, E12, E13, E14, E15, E17, E18, E19, E21

	Success factor	Resource *	Description	Illustrative statement	References from the literature review			Interviews
					Digital innovation	Social innovation	DSI**	
Environment	Structures and processes	A	The clearly defined structures and processes harness digital technologies' iterative and constantly evolving process while aiming for long-term behavioural and structural change.	"Unlike conventional innovation, where success is often achieved after a short period, digital social innovation often aims to change behaviours and local structures in the long-term. Accordingly, organisations require clear structures and processes designed for the long-term". (E21)	Del Giudice, Scuotto, et al. (2021), Guinan et al. (2019), Johansson et al. (2020), Khrais and Alghamdi (2022), Müller, Obwegeser, et al. (2019), Svahn et al. (2017), Wiesböck and Hess (2020)	Aksoy et al. (2019), Battistella et al. (2021), Battisti (2012), de Medeiros et al. (2022), Herrera (2015), Hillgren et al. (2011), Mair and Schoen (2007), Metszősy (2020), Meyer and Hartmann (2023), Neumeier (2017), Pfitzer et al. (2013), Taneja et al. (2023)	-	E2, E4, E6, E8, E10, E11, E12, E14, E15. E18, E19, E21
	Top management support	A	The leadership's commitment to become familiar with digital technologies, effectively communicate their potential for social value creation to employees, and inspire a digital and social culture shift that includes lower risk aversion, incentives, organisation decision-making, and talent development to support digital social innovation efforts.	"If an organisation decides to move more in the direction of social in its digital innovation department and the top management does not support this, it will not happen. At the same time, if top management is interested in it, it becomes much more exciting, which is also related to the empowerment of employees". (E17)	Al Issa and Omar (2024), Guinan et al. (2019), Johansson et al. (2020), Kohli and Melville (2019), Müller, Påske, and Rodil (2019), Shojaei and Burgess (2022), Wiesböck and Hess (2020)	Aksoy et al. (2019), Alegre and Berbegal-Mirabent (2016), de Medeiros et al. (2022), Deserti and Rizzo (2020), Erdiaw-Kwasie and Abunyewah (2024), Fellnhofer (2017), Golgeci et al. (2022), Halila and Rundquist (2011), Herrera (2016), Horte and Halila (2008), Hsu et al. (2019), Metszősy (2020), Najib et al. (2021), Neumeier (2017), Oliveira and Sbragia (2012), Pasricha and Rao (2018), Pearce and van Knippenberg (2023), Petropoulou et al. (2022), Westley et al. (2014)	-	E2, E5, E6, E7, E8, E10, E11, E13, E14, E15, E17, E18, E19, E21
	Beneficiary integration	A	The placement of beneficiaries at the centre of the development process, involving them in co-creation and feedback cycles, understanding their comfort levels with digital technologies, and designing digital social innovation that aligns with their specific context, culture, and needs to increase the adoption and generation of social value.	"You develop digital social innovation because you want to generate impact. Moreover, you can only impact if the digital social innovation is accepted and used in the market. Accordingly, you must put the beneficiary at the centre". (E19)	Johansson et al. (2020), Xie et al. (2024)	Battisti (2012), Canestrino et al. (2019), Chalmers (2013), de Arruda Torresa (2017), Herrera (2015), Hillgren et al. (2011), Maclean et al. (2013), Mair and Schoen (2007), Nordberg et al. (2020)	-	E2, E3, E4, E5, E6, E7, E9, E10, E11, E12, E14, E16, E17, E18, E19, E20, E21
	Opportunity sensing	C	The continual analysis of the digital environment, market conditions, and distant knowledge domains to exploit emerging digital opportunities.	"Especially in the field of digital solutions, things happen very quickly. You must stay up to date because otherwise, another organisation will be faster". (E20)	Carlan et al. (2017), El-Haddadeh (2020), Kohli and Melville (2019), Nylén and Holmström (2015), van Riel et al. (2004)	Aksoy et al. (2019), Alegre and Berbegal-Mirabent (2016), Chalmers (2013), de Medeiros et al. (2022), Dias et al. (2024), Dopelt et al. (2023), Halila and Rundquist (2011), Herrera (2015), Metszősy (2020), Pfitzer et al. (2013), Taneja et al. (2023), Weppen and Cochrane (2012)	-	E2, E4, E5, E6, E7, E8, E9, E10, E11, E17, E18, E20, E21
	Partner integration	A	The engagement of diverse experts from various disciplines, countries, and industries to address wicked societal challenges emphasises the need for multidisciplinary inter-organisational cooperation, formal governance, and mutual trust among stakeholders to effectively manage and share data, knowledge, and resources.	"Digital social innovation often addresses complex systemic challenges you cannot tackle on your own, as many different actors are involved" (E20)	Carlan et al. (2017), Johansson et al. (2020), Meland et al. (2023), Shojaei and Burgess (2022), Svahn et al. (2017)	Aksoy et al. (2019), Alegre and Berbegal-Mirabent (2016), Battistella et al. (2021), Battisti (2012), Divella and Sterlacchini (2021), Herrera (2015), Herrera (2016), Horte and Halila (2008), Mair and Schoen (2007), Meyer and Hartmann (2023), Neumeier (2017), Petropoulou et al. (2022), Pfitzer et al. (2013), Phillips et al. (2019), Rauter et al. (2019), Wirth et al. (2023)	-	E1, E2, E4, E6, E7, E8, E10, E11, E12, E13, E14, E16, E17, E18, E19, E20, E21
	Societal problem understanding	C	The deep understanding of wicked societal challenges is needed before evaluating the potential of digital technologies to address their root effectively and not only alleviate symptoms.	"These wicked societal challenges are deeply rooted in society and some benefit from these circumstances. That is why societal challenges are so difficult to solve. Thus, in digital social innovation development, organisations must be clear about the societal challenge they want to solve and understand why it is so wicked before talking about the possibilities of digital technologies". (E10)	-	-	-	E4, E8, E9, E10, E11, E13, E15, E16, E17, E19, E18, E21

*A = Asset, C = Capability ** DSI = Digital social innovation

Table 3. Digital social innovation success factor overview

Research Paper 1 presents two key results: the Digital Social Innovation Success Factor Overview (Table 3) and the Digital Social Innovation Success Factor Framework (Figure 2). The Digital Social Innovation Success Factor Overview consists of 18 success factors grouped into the three categories: human, organization, and environment. The category *human* includes six success factors, highlighting employees' knowledge and competencies (Orji et al., 2020; Yusof et al., 2008). The category *organization* comprises eight success factors, describing the characteristics of organizations facilitating digital social innovation development (Nilashi et al., 2016; Orji et al., 2020). The category *environment* comprises four success factors addressing externalities influencing digital social innovation development (Orji et al., 2020).

The Digital Social Innovation Success Factor Framework consists of digital social innovation success factors, moderating factors, and digital social innovation success. Thus, the Digital Social Innovation Success Factor Framework goes beyond the Digital Social Innovation Success Factor Overview by incorporating moderating factors, such as the addressed SDG, organizational type, and organizational purpose. These moderating factors affect the relationship between the identified digital social innovation success factors and digital social innovation success.

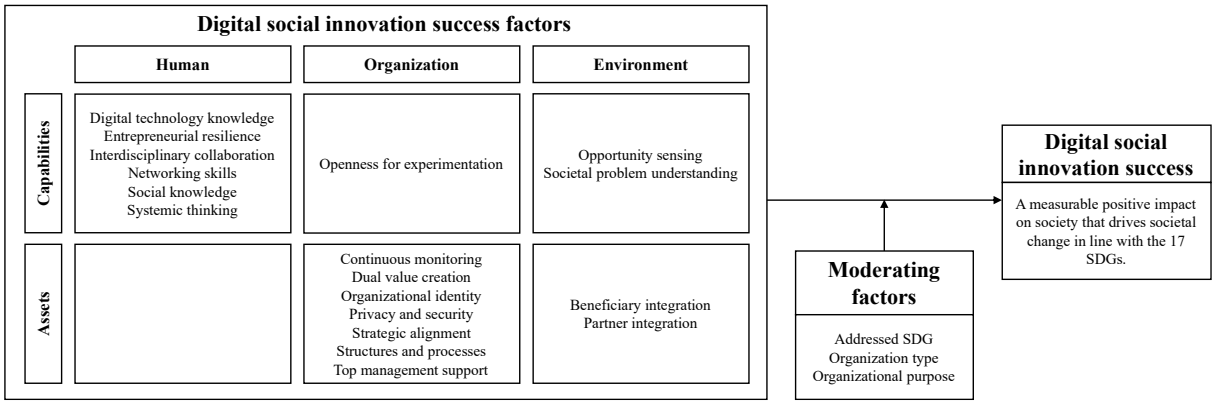

Figure 2. Digital social innovation success factor framework

In establishing a comprehensive understanding of success factors for digital social innovation, Research Paper 1 presents two theoretical implications. First, this research provides empirical groundwork for further theorizing digital social innovation by highlighting the need to refine and extend existing success factors from digital and social innovation literature. Through expert interviews, the study identifies the unique characteristics of digital social innovation and how these differ from digital and social innovation. Second, since the findings of Research Paper 1 represent a theory for analyzing, they serve as the foundation for higher-order theories such as theories for prediction, explanation, design, and action (Gregor, 2006). Additionally, Research

Paper 1 offers two practical implications. First, organizations should use the Digital Social Innovation Success Factor Framework for operational support in digital social innovation development. The success factor categories enable practitioners to structure and organize digital social innovation development. Additionally, the identified 18 success factors provide guidance through concrete measures for digital social innovation development. Second, the results underline the importance for organizations to integrate digital social innovation as part of their strategic agenda. As a result, these insights support practitioners in identifying critical resources and determining where further investment is needed to build additional resources.

Research Paper 2: Barriers Along the Digital Social Innovation Process: A Structured Literature Review

Digital social innovation represents a promising yet emerging phenomenon, enabling organizations to leverage digital technologies to address societal challenges. Despite its growing relevance, organizations encounter numerous barriers when attempting to develop and implement digital social innovation, resulting in many initiatives failing to realize their potential (Oeij et al., 2019). While Kohli and Melville's (2019) framework offers relevant insights by structuring the digital innovation process into actions, environment, and outcomes, it lacks a focus on how digital innovation contributes to addressing societal challenges. In light of the crucial need to grasp the barriers that hinder the effective development of digital social innovation (Lettice & Parekh, 2010; Neumeier, 2017), Research Paper 2 systematically investigates these barriers organizations encounter along the digital social innovation process. Hence, this paper addresses the research question: *What are the barriers along the digital social innovation process?*

To address this research question, a systematic literature review was conducted (Sharma & Bansal, 2023; Wolfswinkel et al., 2013). First, a comprehensive search protocol was defined using the search string: ("digital innovation*" OR "social innovation*") AND (barrier OR challenge OR risk) within Web of Science Core Collection. Following a multi-stage screening process, the search resulted in a total of 33 articles (Wolfswinkel et al., 2013). Using open, axial, and selective coding (Sharma & Bansal, 2023; Wolfswinkel et al., 2013) 28 barriers were identified and organized into 12 categories. The categories were aligned with an adapted version of Kohli and Melville's (2019) digital innovation framework, expanded by including the societal environment, thus creating the Digital Social Innovation Barrier Framework.

The Digital Social Innovation Barrier Framework comprises 28 barriers within twelve

categories and five main elements: the societal environment, the internal organizational environment, the external competitive environment, the digital social innovation actions, and the digital social innovation outcomes (Figure 3). The *societal environment* comprises the two barriers, poor digital literacy (Ramilo & Embi, 2014; Rosa, 2017) and triggering societal rethinking (Scott, 2005), going beyond the organization and its relevant stakeholders. The *internal organizational environment* (Kohli & Melville, 2019) encompasses eleven barriers within the categories strategy (e.g., dual identity), marketing and branding (e.g., lack of marketing and branding activities), culture (e.g., lack of role models), and resources (e.g., lack of digital infrastructure) (Battistella et al., 2021; Suseno & Abbott, 2021; Tim et al., 2021; Vicente et al., 2020). *External competitive environment* (Kohli & Melville, 2019) includes organization-external barriers that hinder the digital social innovation process and encompasses seven barriers in the categories public image (e.g., lack of credibility) and stakeholders (e.g., securing stakeholder support) (Roundy, 2017; Wood, 2012). *Digital social innovation actions* (Kohli & Melville, 2019) includes four categories with five barriers regarding the development process itself. Following Kohli and Melville (2019), the categories are called initiation (e.g., problem understanding), development (e.g., development of an appropriate solution), implementation (e.g., premature release), and exploit (e.g., finding an appropriate scaling strategy) (Kayser et al., 2018; Lettice & Parekh, 2010; Roundy & Bonnal, 2017; Tim et al., 2021). The last main element *digital social innovation outcomes* (Kohli & Melville, 2019) refers to the resulting service, process, or product (Bonina et al., 2021). The main element includes the three barriers intangibility (Brock et al., 2020), capturing social value (Battistella et al., 2021; Geobey et al., 2012), and failure to achieve societal change (Bonina et al., 2021; Lettice & Parekh, 2010; Westley et al., 2014).

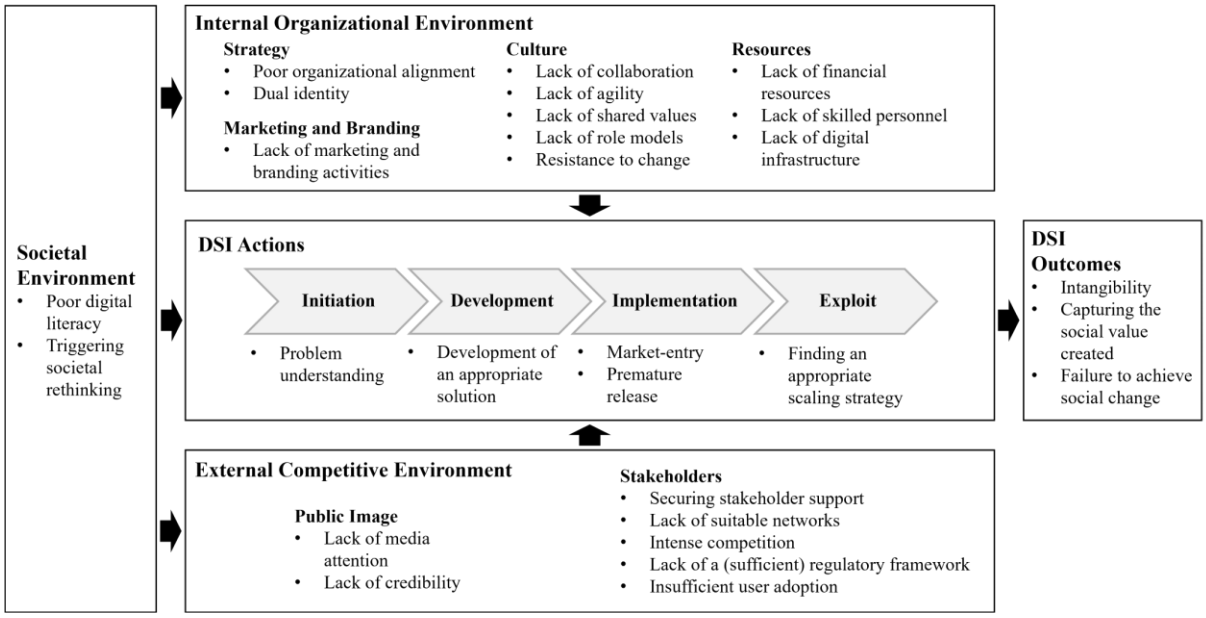

Figure 3. Digital social innovation barrier framework

Research Paper 2 provides two theoretical implications. First, Research Paper 2 contributes to understanding the factors influencing the digital social innovation process by uncovering 28 barriers. As a comprehensive overview, the Digital Social Innovation Barrier Framework provides descriptive knowledge and lays the groundwork for future research to generate descriptive, explanatory, and prescriptive knowledge (Gregor, 2006). Second, Research Paper 2 progresses the field of digital social innovation by building on Kohli and Melville (2019) to establish a foundational basis for further theorizing the digital social innovation process. Additionally, Research Paper 2 yields two practical implications. First, the Digital Social Innovation Barrier Framework offers a comprehensive overview of the barriers organizations face throughout the digital social innovation process, enhancing their awareness of such barriers. Second, the Digital Social Innovation Barrier Framework equips organizations with relevant insights into structuring the digital social innovation process.

II.2 Developing Digital Innovation for the Good

Research Paper 3: Know Your Worth: Resource-centric Patterns for Creating Digital Social Innovation

To create impactful solutions during digital social innovation development, incumbent firms can leverage their meaningful resource base (e.g., established networks, engaged employees, or financial strengths) (Grant, 1991; Oberländer et al., 2021; D. Yu & Hang, 2010). Incumbent firms can efficiently utilize their existing assets, as innovation frequently emerges through recombining available ideas and resources, significantly enhancing the impact of digital social

innovation (Beverungen et al., 2018; Gassmann et al., 2013; Mulgan et al., 2007). However, incumbent firms struggle to recognize the latent potential of their resource bases and lack guidance for leveraging these assets through digital technologies to simultaneously create social and economic value (Bonina et al., 2021; Lock & Seele, 2017). Consequently, there remains a gap in structured guidance for incumbent firms on systematically leveraging their rich resource base to establish impactful digital social innovation (D. Yu & Hang, 2010). In response, Research Paper 3 explores the following research question: *What are resource-centric patterns of digital social innovation initiatives?*

Research Paper 3 employs a three-step cluster analysis to answer this research question. First, a total of 618 real-world digital social innovation initiatives were extracted from the 2018/2019 and 2021/2022 corporate social responsibility and annual reports of the 30 largest incumbent firms in Germany and the United States. Second, the digital social innovation initiatives were categorized along the three dimensions: resources, purpose-related digital technology archetype, and SDG target. The first dimension *resources* draws on Barney (1991), distinguishing between physical, social, and human resources. Physical resources refer to physical capital resources, encompassing tangible assets such as financial capital, buildings, factories, equipment, access materials, or digital technologies (Beheshti & Beheshti, 2010; Bosler et al., 2021; Jain et al., 2020; Wernerfelt, 1984). Human resources comprise human capital regarding employees and their skills, judgment, experience, insights, and knowledge for creating digital social innovation (Dr et al., 2022; Kok & Uhlaner, 2001; Qian et al., 2017; Tarigan & Siagian, 2021). Social resources refer to organizational capital resources, including social capabilities, such as internal and external relations (Barney, 1991). Given the central role of digital technologies in digital social innovation, the second dimension *purpose-oriented digital technology archetypes* was treated independently as a separate dimension. The dimension follows Baier et al.'s (2023) categorization, distinguishing between nine digital technology archetypes: connectivity and computation, platform provision, personal mobile communication, sensor-based data collection, actor-based data execution, analytical insight generation, self-dependent material agency, augmented interaction, and natural interaction. The third dimension *SDG target* refers to the 17 SDGs, which are grouped into people, planet, peace, prosperity, and partnerships (Eichler & Schwarz, 2019; United Nations, 2015; Wu et al., 2018). Third, a cluster analysis was conducted after classifying the digital social innovation initiatives (Field, 2013; Hair et al., 2010), which led to the identification of eight resource-centric patterns of digital social innovation (Figure 4).

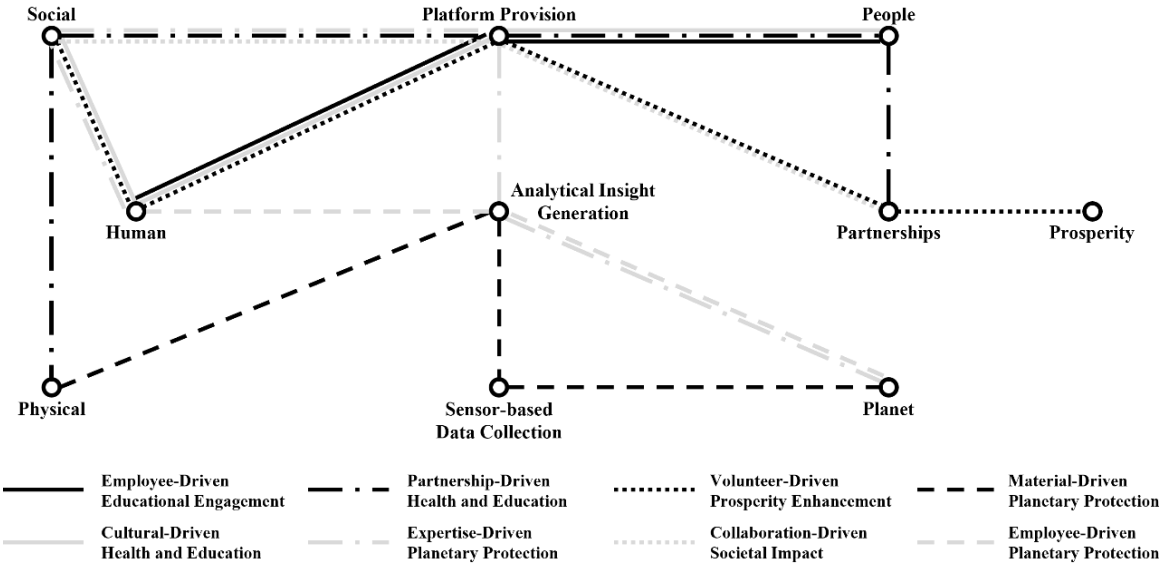

Figure 4. Digital social innovation pattern map

The pattern *Employee-Driven Educational Engagement* consists of 110 real-world digital social innovations. It describes how human resources can be leveraged through platform provision to address the SDG target dimension people. The pattern of *Cultural-Driven Health and Education* contains 151 real-world digital social innovations and focuses on how human and social resources can be mobilized with platform provision to address the SDG target dimension of people. The pattern *Partnership-Driven Health and Education* subsumes 61 digital social innovations and demonstrates how physical and social resources can be mobilized through platform provision to address people and partnerships. The pattern *Expertise-Driven Planetary Protection* contains 98 real-world digital social innovations and focuses on using social and human resources with platform provision and analytical insight generation to advance the target dimension planet. The pattern *Collaboration-Driven Societal Impact* contains 31 digital social innovations and utilizes social and human resources to leverage platform provision to address partnerships. The pattern *Collaboration-Driven Societal Impact* consists of 57 digital social innovations, focusing on leveraging social resources through platform provision to address partnerships. The *Material-Driven Planetary Protection* pattern includes 74 digital social innovations and describes exploiting physical resources through analytical insight generation and sensor-based data collection to address the SDG target dimension planet. The last pattern, *Employee-Driven Planetary Protection*, includes 36 digital social innovations and includes human resources that are leveraged by analytical insight generation to contribute to the target dimension planet.

Research Paper 3 provides two theoretical implications. First, Research Paper 3 significantly advances existing research on digital social innovation by offering an analysis from a resource-centric perspective. The findings make a valuable contribution to theory building within the emerging field of digital social innovation research and build the foundation for developing higher-order theories (Doty & Glick, 1994). Second, Research Paper 3 enhances the understanding of digital social innovation from a resource-centric perspective. The findings demonstrate how incumbent firms can deploy their existing resource base through digital technology to create impactful digital social innovation systematically (Sirmon et al., 2011). Additionally, Research Paper 3 presents two practical implications. First, it guides how incumbent firms can effectively harness their current resource base to develop digital social innovation. Second, incumbent firms can utilize the identified digital social innovation patterns as inspiration and guidance for designing new digital social innovation.

Research Paper 4: AI in the Web of Trees: A Systems Thinking Approach to Understanding How AI Affects Deforestation

Deforestation represents one of our most urgent societal challenges, significantly contributing to global CO2 emissions and thereby exacerbating climate change (Harris et al., 2021; UNEP, 2024). Digital technologies are pivotal for tackling such wicked societal challenges, particularly Artificial Intelligence (AI) presents a wide range of opportunities for generating positive societal impacts, including combating deforestation (Cowls et al., 2021). Recent literature discusses numerous AI applications aimed at mitigating deforestation, such as forest monitoring and fire detection (e.g., Alshehri et al., 2023; Ball et al., 2022; Moreira et al., 2024; Neptune & Mothe, 2023). However, despite these significant contributions, current research lacks a comprehensive understanding of how AI influences the entire deforestation system. While AI holds promise in addressing deforestation, its deployment can also lead to unintended negative effects, notably through substantial energy demands inherent in AI algorithms (Shankar & Reuther, 2022; Strubell et al., 2020). This heightened energy consumption potentially exacerbates deforestation indirectly by driving energy-related forest resource extraction (Geist & Lambin, 2002). Therefore, AI's positive impacts in localized contexts might unintentionally exacerbate deforestation elsewhere. To effectively harness AI's potential in combating deforestation, it is critical to understand AI's impact within the system of deforestation. Accordingly, Research Paper 4 investigates the overarching question: *How can AI impact the system of deforestation?*

In response to the research question, Research Paper 4 adopts a systems thinking perspective

through the methodological application of causal loop diagrams (CLDs) (Coletta et al., 2021; Haraldsson, 2004; Senge, 1990). A systems thinking perspective offers a holistic approach to analyze how components within complex environments are interrelated and interact (Haraldsson, 2004). Thereby, CLDs serve to visualize and analyze systemic behavior. CLDs illustrate variables, relationships, and polarity (Coletta et al., 2021; Haraldsson, 2004). A polarity can be either positive, indicating that both variables move in the same direction (i.e., the more of variable A, the more of variable B or the less of variable A, the less of variable B), or negative, meaning the variables move in an inverse direction (i.e., the more of variable A, the less of variable B or the less of variable A, the more of variable B) (Sterman, 2000).

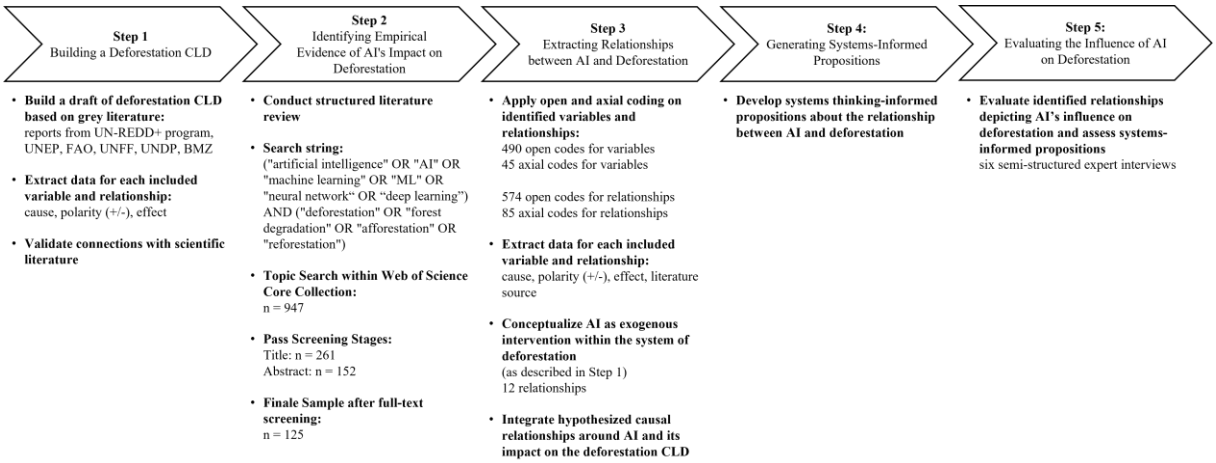

Figure 5. Research design of Research Paper 4

The methodological approach applied in Research Paper 4 consists of five steps (Alvarado et al., 2023; Jalali & Beaulieu, 2023) (Figure 5). First, the deforestation system was delineated using grey literature, i.e., reports and websites from the UN Reducing Emissions from Deforestation and Forest Degradation program, the UN Environmental Program, the UN Development Program, the Federal Ministry for Economic Cooperation and Development, the Food and Agriculture Organization of the UN, and the UN Forum on Forests. Second, a systematic literature review was conducted to assess the role of AI within the deforestation system (Boell & Cecez-Kecmanovic, 2015). The search was conducted within Web of Science Core Collection with the search string: (“artificial intelligence” OR “AI” or “machine learning” OR “ML” or “neural network” OR “deep learning”) AND (“deforestation” OR “forest degradation” OR “afforestation” OR “reforestation”). Third, the resulting sample of 125 articles was analyzed following Wolfswinkel et al. (2013). The analysis resulted in the identification of 45 distinct variables and 85 relationships, with 84 moving in the same direction and one moving in the inverse direction. Additionally, twelve relationships link AI to the deforestation system

(Table 4). The fourth step focused on deriving five system-informed propositions based on the overall CLD, offering overarching findings on how AI impacts deforestation. To verify the twelve identified relationships between AI and deforestation and the five derived propositions, six semi-structured interviews with experts were conducted (Myers & Newman, 2007).

Cause (AI part)	Polarity	Effect (deforestation system)
Alert to Legal Authorities	-	Forest Fires
Alert to Legal Authorities	-	Illegal Logging
Preventive Measures Against Forest Fires	-	Forest Fires
Preventive Measures Against Forest Disease	-	Forest Disease
Information on Afforestation Suitability	+	Resilience of Forest
Energy Demand	+	Demand for Biomass Energy
Targeted Conservation Plans	-	Deforestation
Targeted Conservation Plans	+	Terrestrial Biodiversity
Mitigation Benefits (e.g., REDD+)	+	Local Economy
Strategies Against Landslides	-	Landslides
Impact of Landslides on Infrastructure	+	Infrastructure Development
Informed Decision-Making Regarding Climate Change and Sustainable Development	-	Climate Change

Table 4. Cause-and-effect relationships between AI and deforestation

Research Paper 4 presents an extensive CLD incorporating 84 variables and 172 relationships, characterized by 142 positive and 30 inverse relationships. The CLD is accessible via the following link: https://embed.kumu.io/9c6e5946ad33b92cf2cfbc9d71c0938e. Three scenarios emerged from the analysis: the more AI, the better, the more AI, the worse, and the more AI, the greater the backfire.

The first scenario, *the more AI, the better,* highlights AI's balancing feedback loops, indicating a stabilizing impact on deforestation. An illustrative example is the balancing loop "Informed Decision-Making Regarding Current Deforestation" (Figure 6), in which AI monitors current forest conditions (variable: Information on Forest Structure) (e.g., Carter et al., 2024; Guhan & Revathy, 2024; Morford et al., 2024). This monitoring facilitates the collection of data on historical and ongoing deforestation (variable: Information on Past and Current Deforestation) (Carter et al., 2024; Wahab et al., 2021). The gathered information helps identify key drivers behind deforestation (variable: Information on Drivers of Deforestation) (Noor et al., 2024; Zulfiqar et al., 2021), thereby enabling policymakers to implement strategies aimed at deforestation prevention (variable: Informed Decision-Making Regarding Prevention of Deforestation) (Ball et al., 2022; Noor et al., 2024; Zulfiqar et al., 2021). Consequently, targeted conservation measures are developed (variable: Targeted Conservation Plan) (Moreira et al., 2024), effectively reducing deforestation (variable: Deforestation) (Expert 1-6). The cycle

continues as deforestation data are reintegrated into AI systems, reinitiating the described feedback loop (e.g., Ramadan et al., 2024; Singh et al., 2022; Slagter et al., 2024).

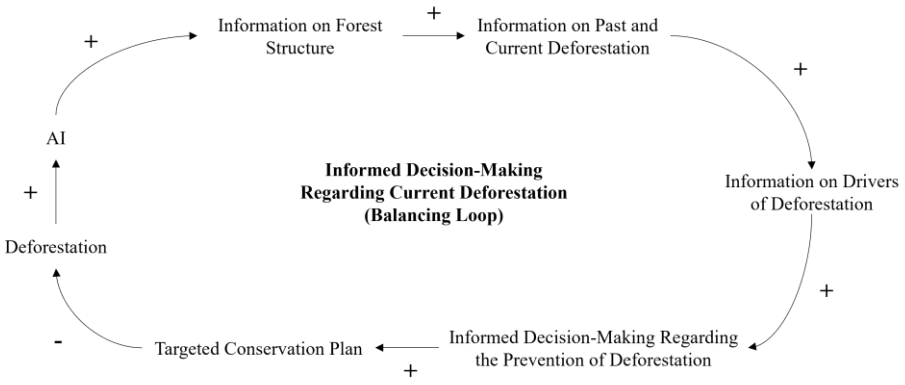

Figure 6. Balancing loop "Informed Decision-Making Regarding Current Deforestation"

The second scenario, *the more AI, the worse,* highlights AI's immediate negative impact on deforestation. An example is the reinforcing loop termed "Heightened Demand for Energy" (Figure 7). The loop describes that AI (variable: AI) requires energy (variable: Energy Demand) (Shankar & Reuther, 2022; Strubell et al., 2020), escalating the demand for energy resources derived from forests (variable: Demand for Energy Resources) (Expert 1-6). Consequently, this leads to further deforestation (variable: Deforestation) (W. Liu et al., 2017; Tran et al., 2023). Updated data regarding deforestation is fed back into AI (variable: AI) (e.g., Ramadan et al., 2024; Slagter et al., 2024), perpetuating the reinforcing loop.

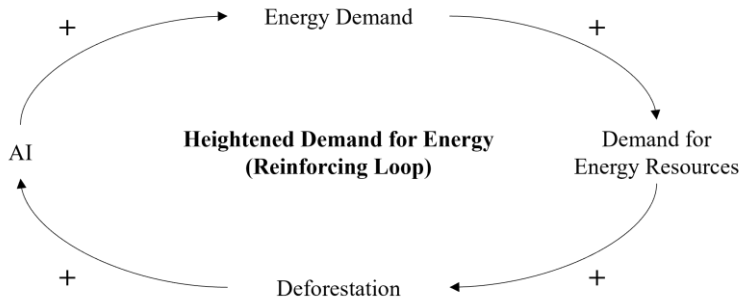

Figure 7. Reinforcing loop "Heightened Demand for Energy"

The third scenario, *the more AI, the greater the backfire,* demonstrates a positive influence of AI on deforestation. However, this initial benefit conceals underlying structural dynamics over time, resulting in unexpected adverse consequences. An example is the reinforcing loop "From Mitigation Success to Ecological Overshoot" (Figure 8). Thereby, AI (variable: AI) contributes to precise carbon accounting (variable: Accurate Carbon Accounting) (Mascaro et al., 2014; Sanderman et al., 2018), enhancing the evaluation of mitigation benefits (variable: Mitigation

Benefits (e.g., REDD+)) (Angelsen, 2008; Hussin & Gilani, 2011). Mitigation benefits can improve local economic conditions (variable: Local Economy) (Expert 1-6), thereby improving community livelihoods (variable: Livelihood of Local Community) (Cen & Yan, 2022). Improved livelihoods lead to better human health (variable: Human Health) (Cen & Yan, 2022; Ullah & Bavorova, 2024), fostering increased global population growth (variable: Global Population Growth) (Bongaarts, 2009). This population growth accelerates infrastructure expansion (variable: Infrastructure Development) (Mahtta et al., 2022; UNEP et al., 2009), further intensifying deforestation (variable: Deforestation) (e.g., Duke et al., 2014; Haq et al., 2024). Subsequent deforestation data are integrated back into AI systems (variable: AI) (e.g., Mascaro et al., 2014; Sanderman et al., 2018), thus maintaining the reinforcing loop.

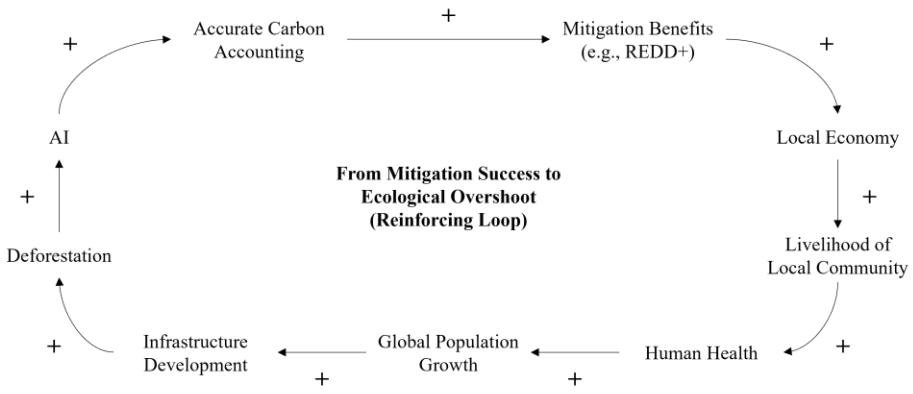

Figure 8. Reinforcing loop “From Mitigation Success to Ecological Overshoot”

Based on the CLD, five system-informed propositions are formulated. Proposition 1, *AI solutions mainly address the symptoms of deforestation rather than its root causes*, emphasizes that existing AI solutions tend to operate independently, targeting only the symptoms of deforestation. It argues that addressing the deeper, underlying causes is complex yet critical for unlocking AI’s full potential in combating deforestation. Proposition 2, *AI solutions assist in informed decision-making regarding combatting deforestation*, highlights that current AI primarily provides decision-makers with essential information to develop conservation strategies. This implies that greater benefits may arise when AI moves beyond simply informing and begins to generate policy recommendations and offer actionable, real-time guidance. Proposition 3, *AI can only unfold its potential in addressing deforestation when data quality is ensured*, underscores the necessity of accurate data to prevent biased or incorrect AI-driven decisions. The proposition argues that the full potential of AI can only be achieved when AI relies on reliable, unbiased data and is integrated into systems that consistently observe and address unintended consequences. Proposition 4, *AI can have negative consequences in*

combating deforestation, raises awareness about the potential downsides, particularly emphasizing the energy-intensive nature of AI training processes. The proposition stresses the importance of carefully weighing the trade-offs between continued AI training and accepting current algorithmic performance levels to conserve resources. Proposition 5, *AI can optimize locally and centered on specific needs, which might not lead to a destined outcome within the overall system*, points out that AI solutions typically aim for outcomes beneficial on a local scale, potentially not aligning with the whole system of deforestation. This proposition advocates for more integrative, system-wide AI solutions to prevent unintended negative outcomes and to better support overall systemic sustainability.

Research Paper 4 identifies two theoretical implications. First, the presented CLD acts as a theory for explaining (Gregor, 2006), forming the basis for future system dynamics models (Binder et al., 2004). The insights into AI's role in the system of deforestation outlined through the CLD provide the groundwork for dynamic scenario development within a comprehensive system dynamics model. Second, the research approach serves as a blueprint for examining the systemic impacts of digital technologies on various societal challenges. Future studies could use these insights to investigate, for example, AI's influence on marine plastic pollution or assess remote sensing technology's role in biodiversity loss. Additionally, Research Paper 4 provides three practical implications. First, the findings can support organizations in developing AI-based interventions to mitigate deforestation. Second, organizations may apply the findings to evaluate the impact of their existing AI applications. Third, policymakers can use these results to design incentive structures encouraging the implementation of AI solutions to reduce deforestation.

III. Digital Transformation for the Good

As Section II outlines, digital innovation can create social value and drive holistic organizational transformation towards enhanced digitalization and sustainability. Consequently, in the context of integrated digital and sustainability transformation called twin transformation, this dissertation investigates how the combined effects of multiple digital social innovation impact organizational actors, structures, practices, values, and beliefs, potentially altering, challenging, replacing, or complementing existing organizational norms and routines. Thus, this section expands the focus from analyzing individual digital social innovation initiatives discussed in Section II to comprehensive, large-scale transformation processes within organizations. First, the section conceptualizes the interplay between digitalization and sustainability transformation across various organizational layers (Section III.1, Research Paper 5). Building on this detailed understanding of their interplay, the dissertation employs a resource orchestration perspective to explore how organizations can effectively structure, bundle, and leverage resources to achieve twin transformation (Section III.2, Research Paper 6). Complementing this perspective, the dissertation proposes a structured framework and methodological guidance to design an effective twin transformation strategy (Section III.2, Research Paper 7).

III.1 Understanding Digital Transformation for the Good

Research Paper 5: Better Together: The Interplay Between Digital Transformation and Sustainability Transformation to Realize Twin Transformation

Given the rising societal challenges and the promising potential of digital technologies, organizations are increasingly confronted with the dual imperative of driving digital and sustainability transformation (Dao et al., 2011; Vial, 2019; Wessel et al., 2021). While both transformations have been widely researched independently, their integration into a cohesive approach, referred to as the twin transformation, remains underexplored (Breiter et al., 2024; Christmann et al., 2024). Driven by the growing demands of digitalization and sustainability, organizations must think about both transformations together to leverage synergies, save resources, and act effectively (Gimpel et al., 2021; Guandalini, 2022; Veit & Thatcher, 2023). However, the convergence of both transformations remains poorly understood, and an integrated perspective that focuses on the two transformations' detailed interplay is required (Guandalini, 2022). Accordingly, Research Paper 5 addresses this research gap by investigating

the research question: *How do digital transformation and sustainability transformation interact within twin transformation?*

To answer this research question, Research Paper 5 employs a multi-method approach (Mingers, 2001), combining a structured literature review with 32 semi-structured expert interviews. First, following vom Brocke et al. (2015) and Wolfswinkel et al. (2013), a systematic literature review was conducted within Web of Science and all A and B-ranked conferences in the VHB Publication Media Rating 2024 (VHB, 2024). The search string ((“digital transformation”) AND (social OR environmental OR green OR sustainable)) yielded 69 articles describing the interplay of digital and sustainability transformation. Complementary 32 semi-structured expert interviews were conducted to integrate insights from practice (Myers & Newman, 2007; Schultze & Avital, 2011).

Building on these insights, the Twin Transformation Model (Figure 9) is presented, providing a comprehensive understanding of the detailed interplay between digital and sustainability transformation within twin transformation in an organizational context. Thereby, the two transformations are considered equally entitled transformations, with digital transformation creating an opportunity space that enables sustainability transformation, while sustainability transformation effectively navigates and shapes this space, providing essential guidance to digital transformation. The interplay underscores a relationship of mutual dependence, where each transformation uniquely contributes to achieving the twin transformation. The Twin Transformation Model offers a structured analysis of the interplay between digital and sustainability transformation through 44 twin transformation interactions (i.e., first-order concepts), 22 central digital and sustainability transformation themes (i.e., second-order themes), as well as organizational layers (i.e., aggregate dimensions). Following Alter’s (2013) work system framework, the Twin Transformation Model encompasses eight organizational layers (e.g., processes and activities). Central digital (e.g., smart production systems) and sustainability (e.g., circularity) transformation themes are presented for each layer, influencing and complementing each other. Additionally, twin transformation interactions demonstrate how digital transformation themes can enable sustainability transformation themes and how sustainability transformation themes can guide digital transformation themes to converge both transformations. Table 5 summarizes the key findings of Research Paper 5 and describes each twin transformation interaction, including two exemplary references for each interaction: one from the systematic literature review and one from the interview study. The table is read from both sides as follows (using the example of processes and activities): “Smart production

systems enable circularity by connecting production areas to enable efficient information sharing and precise manufacturing" (from left to right). "Circularity guides smart production systems by applying the principles of repair, refurbish, remanufacture, and recycle to smart production processes" (from right to left).

Starting within the organizational core, we distinguish between the organizational layers processes and activities, participants, and information (Alter, 2013). The interplay between business process automation and green business process management is highlighted in the *processes and activities* layer, with automation enhancing green practices through improved workflow efficiency and accurate environmental reporting (Ching et al., 2022; Kneissel et al., 2023). Conversely, green business process management informs automation efforts by embedding sustainability into process design (Y. Yu et al., 2021; Zhu et al., 2023). Additionally, the interplay of smart production systems and circularity is described, highlighting connectivity, digital twins, systems thinking, and principles of circularity (Ching et al., 2022; Ghobakhloo et al., 2021; Ozkan-Ozen et al., 2020; Y. Yu et al., 2021). The *participants* layer examines interactions between chief digital officers and chief sustainability officers, as well as between new digital work and workplace mindfulness. Thereby, chief digital officers track digital trends and provide technological expertise (Mendez-Picazo et al., 2024; K. Wang et al., 2024), while chief sustainability officers ensure that digital initiatives align with sustainability objectives (ElMassah & Mohieldin, 2020; Feroz et al., 2023). Moreover, new digital work enhances workplace mindfulness by offering flexibility and automating routine tasks (Beier et al., 2020; Ghobakhloo, 2020), whereas workplace mindfulness influences digital work by fostering self-awareness as well as employee empowerment and training (Ghobakhloo, 2020; Weritz et al., 2022). Within the *information* layer, smart data enables fair data through strategic decision-making support and transparent information practices (Dionisio et al., 2023; Guandalini, 2022), while fair data ensures ethical principles guiding the use of smart data (Clausen et al., 2022; Dörr & Lautermann, 2024). Additionally, integrated databases support sustainable data centers by centralizing and optimizing data use (Guo et al., 2020; Nayal et al., 2022), whereas sustainable data centers influence database integration through renewable energy use and sustainable infrastructure design (Del Giudice, Chierici, et al., 2021; Nguyen et al., 2023).

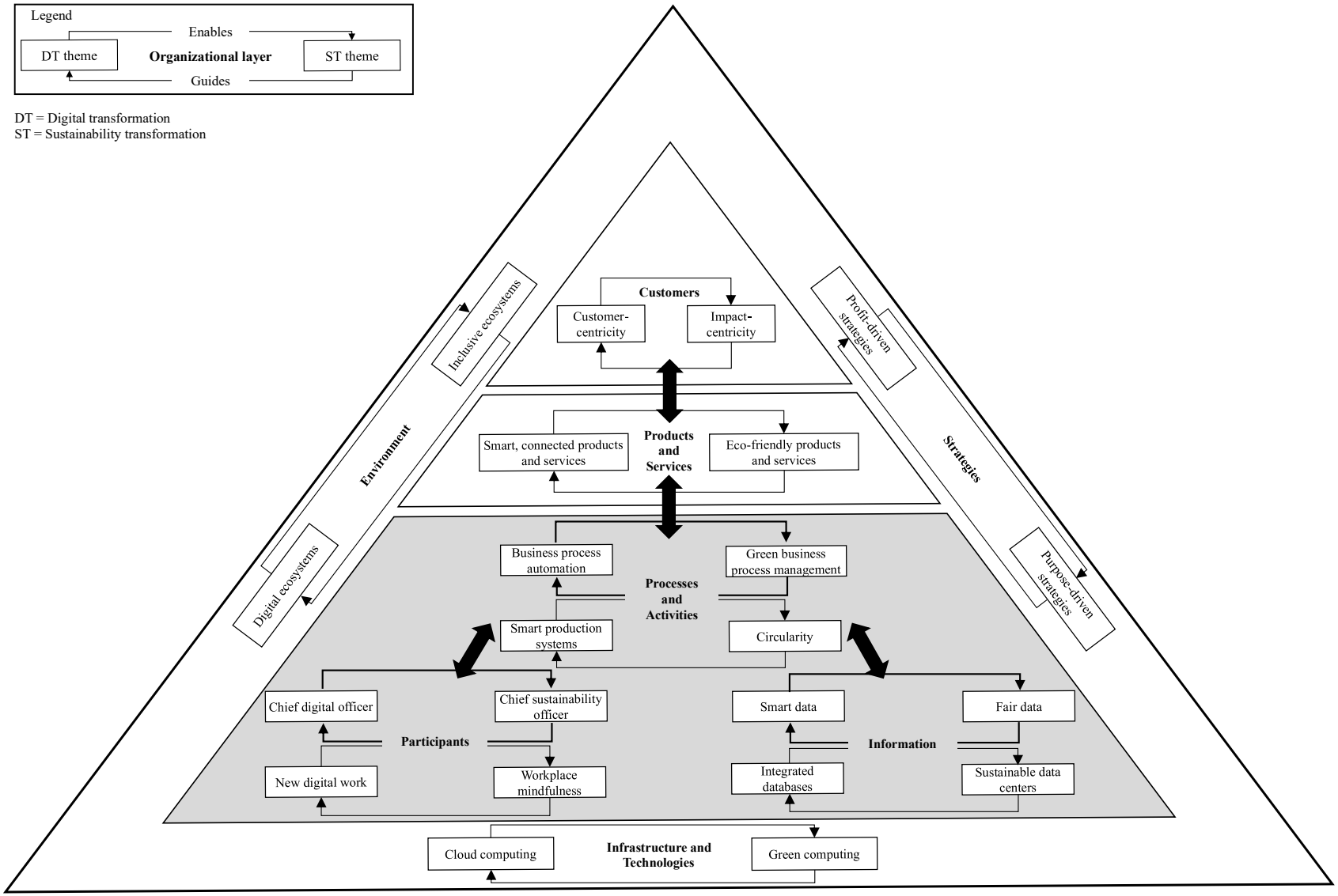

Figure 9. Twin transformation model

	DT	DT enables ST by …	Exemplary references	Twin Transformation	ST guides DT by …	Exemplary references	ST
Processes & activities	Business process automation	… increasing administrative processes efficiency to minimize resource consumption.	Kneissel et al. (2023); E10		…ensuring that energy-efficient practices and technologies are incorporated in business process automation.	Zhu et al. (2023); E31	Green business process management
		… enabling accurate measurement and reporting to monitor and control process performance.	Ching et al. (2022); E31		… appreciating social and environmental responsibilities in business processes to overcome only profit-oriented process designs.	Y. Yu et al. (2021); E25	
	Smart production systems	… connecting production areas to enable efficient information sharing and precise manufacturing.	Y. Yu et al. (2021); E11		… applying the principles of repair, refurbish, remanufacture, and recycle to smart production processes.	Ozkan-Ozen et al. (2020); E29	Circularity
		… creating digital twins to simulate, test, and sustainably optimize systems and processes prior to commissioning.	Ghobakhloo et al. (2021); E29		... establishing systems thinking in Industry 4.0 to identify and address root causes of sustainability problems.	Ching et al. (2022); E5	
Participants	Chief digital officer	… monitoring the market for technology trends that improve sustainability.	K. Wang et al. (2024); E8		… overseeing digital initiatives to achieve sustainability goals.	ElMassah and Mohieldin (2020); E6	Chief sustainability officer
		… providing technological expertise and education on using digital technologies for sustainability.	Mendez-Picazo et al. (2024); E29		... increasing visibility and alignment of sustainability themes to make them a core of the digital agenda.	Feroz et al. (2023); E12	
	New digital work	… creating a digital work environment that allows employees to access and collaborate from anywhere, at any time.	Beier et al. (2020); E17		… giving employees permission and space for self-awareness in an "always-on" culture.	Weritz et al. (2022); E21	Workplace mindfulness
		… automating workflows to take over monotonous work, lead to safer working conditions, and create new job opportunities.	Ghobakhloo (2020); E11		… empowering and training employees for new job opportunities through digital transformation.	Ghobakhloo et al. (2021); E12	
Information	Smart data	… analyzing large and diverse data to foster strategic and conscious decision-making.	Dionisio et al. (2023); E5		… implementing fair data principles (i.e., findable, accessible, interoperable, and reusable) to optimize data (re)use.	Dörr and Lautermann (2024); E21	Fair data
		… enhancing information transparency to ensure compliance with legal and ethical requirements.	Guandalini (2022); E19		… ensuring ethical data usage through greater transparency of what data is collected and possible data biases.	Clausen et al. (2022); E20	
	Integrated databases	… streamlining heterogeneous and redundant data sources to reduce server workload and energy consumption.	Guo et al. (2020); E7		… using renewable energy sources to reduce data management's overall ecological and economic footprint.	Nguyen et al. (2023); E29	Sustainable data centers
		... providing a central place of storage to gather information on sustainability.	*Nayal et al. (2022); E4*		*... optimizing data center location and design to maximize efficiency and server longevity.*	Del Giudice, Scuotto, et al. (2021); E25	
Customers	Customer-centricity	*... analyzing customer data to understand sustainability needs and expectations.*	*E10*		*... ensuring the preservation of natural resources in serving customer demands to save future generations' well-being.*	Q. Liu et al. (2022); E31	Impact-centricity
		... educating customers about environmentally responsible behavior to influence their purchasing decisions.	*Nguyen et al. (2023); E18*		*... expanding the customer focus to environmental and social aspects (e.g., child labor, carbon emissions).*	Pappas et al. (2023); E8	
Products & services	Smart, connected products and services	… promoting predictive and prescriptive maintenance to expand product life cycles.	Q. Liu et al. (2022); E16		… using sensor data to encourage consumers to rethink their behavior and act more environmentally and socially responsible.	Renland Haugjord and Kempton (2022); E11	Eco-friendly products and services
		… leveraging the layered modular architecture to achieve rapid adaptations, shorter production time, and waste reduction.	Y. Yu et al. (2021); E18		… respecting the principles of the sustainable web manifesto to build high-performing, low-carbon digital value propositions.	Chotia et al. (2024); E16	
Environment	Digital ecosystems	… dissolving organizational boundaries to connect a growing number and variety of actors for societal impact.	E17		… accounting for inclusiveness to ensure equity for all stakeholders in digital ecosystems	Crivellari et al. (2024); E21	Inclusive ecosystems
		… enabling unlimited data sharing and recombination to effectively manage the utilization of resources and foster innovation.	Del Giudice, Scuotto, et al. (2021)		… addressing sustainability goals through networking effects on cross-sectoral collaboration platforms.	E17	
Infrastructure & technology	Cloud computing	… migrating applications to the cloud to shut down local infrastructure.	Schmermbeck et al. (2020); E26		… optimizing algorithms, data processing methods and software solutions to maximize performance while reducing energy consumption.	Nguyen et al. (2023); E14	Green computing
		… using cloud-powered technologies to accelerate decarbonization initiatives.	Feroz et al. (2023); E5		… optimizing the use of physical devices (such as machinery and facilities) to reduce waste and lower overall energy consumption.	Dou and Gao (2023); E5	
Strategies	Profit-driven strategies	… incorporating cost- and efficiency-driven KPIs to ensure economic stability and finance sustainability investments.	J. Wang et al. (2023); E24		… incorporating environmental and social metrics to ensure dual value creation through intertwining economic and sustainable goals.	Ukko et al. (2019); E6	Purpose-driven strategies
		… ensuring resilience to financial threats and thus securing employment for the long-term.	Narula et al. (2024); E4		… considering the interests of the employees as a part of the organizational interests to ensure their well-being and commitment.	Weritz et al. (2022); E4	

Aggregate Dimensions = Organisational Layers | Second-order Themes = TT Themes | First-order Concepts = TT Interactions

Table 5. Detailed twin transformation interplay

Extending the core of the organization, the layers of customers as well as products and services span an organization's boundaries (Alter, 2013). The *customer* layer captures customer-centricity, focusing on understanding sustainability needs and environmentally responsible behavior (Nguyen et al., 2023). Conversely, impact-centricity impacts customer-centricity by integrating broader environmental and social considerations into customer interactions (Q. Liu et al., 2022; Pappas et al., 2023). The *products and services* layer explores the relationship between smart, connected and eco-friendly products and services. Smart, connected products and services facilitate eco-friendly solutions by utilizing adaptable modular designs and predictive maintenance (Q. Liu et al., 2022; Y. Yu et al., 2021), while eco-friendly principles guide digital product evolution towards sustainability (Chotia et al., 2024; Renland Haugjord & Kempton, 2022).

Lastly, the organizational layers environment, infrastructure and technologies, as well as strategies, are mainly external to the organization, with a direct impact on all other layers (Alter, 2013). The *environment* layer showcases how digital ecosystems foster inclusive ecosystems by enabling collaboration and innovation through data sharing (Del Giudice, Chierici, et al., 2021). Inclusive ecosystems, in return, embed diversity and equity into digital ecosystems (Crivellari et al., 2024). The *infrastructure and technology* layer examines how cloud computing enables green computing by reducing local infrastructure and environmental impact (Feroz et al., 2023; Schmermbeck et al., 2020), while green computing designs cloud computing by enhancing efficiency and advocating for responsible technology use (Nguyen et al., 2023). The *strategies* layer describes interactions between profit-driven strategies, ensuring economic stability (Narula et al., 2024; J. Wang et al., 2023), and purpose-driven strategies, which integrate environmental and social goals into organizational decision-making (Ukko et al., 2019; Weritz et al., 2022).

To illustrate the Twin Transformation Model, Research Paper 5 also highlights 16 exemplary twin transformation initiatives drawn from real-world organizations, showing how twin transformation unfolds in practice. For example, for the organizational layer information, the twin transformation initiative Digital Clean Up Day encourages employees to integrate sustainable thinking into their work routines. These examples provide actionable insights into how twin transformation can be implemented across industries and organizational levels.

Research Paper 5 offers three theoretical implications. First, Research Paper 5 provides an approach for looking at different organizational transformation types synergistically, to leverage their mutual strength rather than looking at them in isolation. Second, Research Paper

5 complements existing research at the interface between digital and sustainability transformation (Breiter et al., 2024; Christmann et al., 2024). The research advances the discourse on digital and sustainability transformation by integrating sustainability perspectives into traditional digital transformation processes, highlighting the necessity of aligning digital transformation with broader societal goals beyond economic gains (Soluk & Kammerlander, 2021; Vial, 2019). Third, the developed Twin Transformation Model contributes explanatory knowledge detailing the mutually reinforcing relationship of digital and sustainability transformation across organizational layers, offering a foundation for future theories of prediction as well as design and action (Gregor, 2006). Additionally, Research Paper 5 presents two practical implications. First, the Twin Transformation Model supports managers in comprehending and effectively communicating the interactions between digital and sustainability transformation, facilitating strategic planning and structured implementation. Furthermore, the outlined twin transformation initiatives serve as actionable guidelines, enabling organizations to simultaneously achieve digital innovation and sustainability objectives, enhancing long-term competitive advantage.

III.2 Designing Digital Transformation for the Good

Research Paper 6: Twin to Win: A Resource Orchestration Perspective on Twin Transformation

Twin transformation, the integration of digital and sustainability transformation, allows organizations to leverage synergies and optimize resource utilization. Thereby, twin transformation requires the effective use of existing resources, i.e., tangible and intangible assets, such as sensor technology to measure emissions in production plants (Graf-Drasch et al., 2023), and the creation of new dynamic capabilities, such as the ability to synthesize diverse data pools to reduce emissions (Breiter et al., 2024; Christmann et al., 2024). These capabilities are critical to realizing the benefits of twin transformation and support organizations in sensing and seizing innovative opportunities at the intersection of digitalization and sustainability, e.g., digital ecosystems that enable circular economy-based business models (Christmann et al., 2024; Zimmer & Järveläinen, 2022). While previous research has identified novel resources necessary for twin transformation, such as dynamic capabilities (Breiter et al., 2024), little is known about how organizations can effectively create and exploit them to successfully design twin transformation. Thus, Research Paper 6 addresses this gap by adopting a resource orchestration perspective and investigating the question: *How can organizations structure, bundle, and leverage resources to drive twin transformation?*

To address this research question, Research Paper 6 conducted 20 semi-structured interviews with experts from organizations experienced in twin transformation across various industries, including automotive, software development, or consulting. The interviews were guided by the methodological recommendations of Myers and Newman (2007). An iterative inductive–deductive approach was employed for data analysis, incorporating coding procedures described by Gioia et al. (2013) and Skjott Linneberg and Korsgaard (2019). By integrating relevant literature, the study aimed to understand how organizations structure, bundle, and leverage resources to design twin transformation from a resource orchestration perspective. The findings were synthesized into the Twin Transformation Resource Orchestration Pyramid (Figure 10), which comprises three interconnected layers: 1) twin transformation structuring dimensions, 2) twin transformation bundling clusters, and 3) twin transformation leveraging purposes.

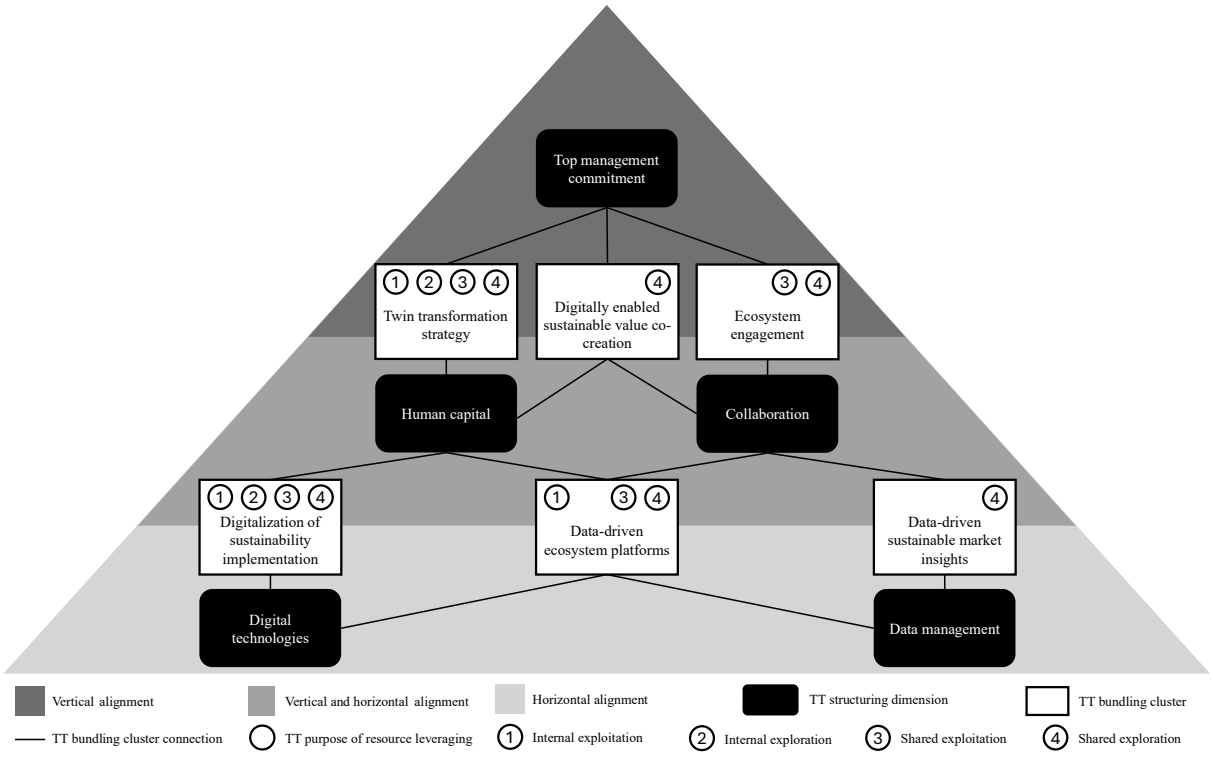

Figure 10. Twin transformation resource orchestration pyramid

The pyramid incorporates five *twin transformation structuring dimensions* (Table 6). Along these dimensions, organizations structure their twin transformation relevant resources in vertical, horizontal, or vertical and horizontal alignment and span the sub-processes of acquiring, accumulating, and divesting resources (Sirmon et al., 2007). Top management commitment is key to vertical alignment, requiring a long-term twin transformation vision, a mindset shift, and clear communication to embed twin transformation throughout the organization. Human capital and collaboration support vertical and horizontal alignment by

fostering skilled personnel, internal cooperation, and external partnerships. Digital technologies and data management drive horizontal alignment by enabling cross-departmental communication and supporting twin transformation through data-based decision-making.

Alignment areas	**Twin transformation structuring dimension**	**Sub-processes**
Vertical alignment of twin transformation resources	Top management commitment	- Develop a long-term vision and strategy for the organization to drive twin transformation. *[Acquire]* - Show genuine top management commitment to twin transformation and support its implementation. *[Accumulate]* - Discard goals that conflict with the twin transformation vision. *[Divest]*
Vertical and horizontal alignment of twin transformation resources	Human capital	- Recruit personnel with twin transformation-specific skills. *[Acquire]* - Identify employees who are willing to push twin transformation forward. *[Accumulate]* - Overcome resistance towards twin transformation among employees. *[Divest]*
	Collaboration	- Know the core business and form external partnerships that provide complementary twin transformation competencies. *[Acquire]* - Foster internal cooperation among departments and along hierarchies. *[Accumulate]*
Horizontal alignment of twin transformation resources	Digital technologies	- Introduce new working methods with digital technologies to support sustainability. *[Acquire]* - Consider digital technologies as a means to achieve sustainability. *[Accumulate]*
	Data management	- Identify and collect twin transformation-relevant data within the ecosystem. *[Acquire]* - Use data to identify opportunities for more sustainable processes, products, services, and business models. *[Accumulate]* - Remove redundant data and avoid the collection of unnecessary data for twin transformation. *[Divest]*

Table 6. Overview of the twin transformation structuring dimensions

Resources from the twin transformation structuring dimensions are combined within six *twin transformation bundling clusters* to acquire more complex capabilities (Table 7). These clusters are aligned with the sub-processes of stabilize, enrich, and pioneer (Sirmon et al., 2007). The bundling cluster twin transformation strategy focuses on aligning top management and employees by clearly communicating twin transformation goals, engaging staff, and providing training in sustainability (e.g., carbon monitoring) and digital skills (e.g., programming). Closely linked is the ecosystem cluster, which emphasizes that sustainability challenges require collaboration across organizational boundaries and top management commitment. Digitally enabled sustainable value co-creation emphasizes innovation through collaboration across stakeholders, using digital tools (e.g., platforms for product reuse) to enable knowledge sharing and value creation. The twin transformation bundling cluster digitalization of sustainability implementation emphasizes the role of digital technologies in achieving sustainability goals and requires employees to develop processual thinking and digital skills. Next, data-driven sustainable market insights stress the role of data transparency along supply chains to enable informed customer decisions and new sustainable innovations. Finally, the cluster data-driven ecosystem platforms is essential for promoting transparency and collaboration among

ecosystem partners by enabling data sharing across organizations, supporting joint innovation, improving process efficiency, and accelerating twin transformation progress through shared knowledge and digital infrastructures.

Twin transformation bundling cluster	**Resource dimensions**	**Sub-processes**
Twin transformation strategy	- Top management commitment - Human capital	- Develop a long-term twin transformation strategy to complement top management's vision and promote a culture of employee engagement for twin transformation. *[Stabilize]* - Train employees constantly regarding sustainability, its regulations, new digital technologies, and their potential applications. *[Enrich]*
Ecosystem engagement	- Top management commitment - Collaboration	- Anchor sustainability as a common goal beyond your organization throughout the network, supported by digital technologies. *[Stabilize]* - Enable collaboration in the ecosystem where the parties support each other and work on joint innovations. *[Pioneer]*
Digitally enabled sustainable value co-creation	- Top management commitment - Human capital - Collaboration	- Build an atmosphere that fosters co-creation and collaboration to create twin transformation value. *[Enrich]* - Find partners that complement your strengths to create new collaborative twin transformation opportunities. *[Pioneer]*
Digitalization of sustainability implementation	- Human capital - Digital technologies	- Establish sustainability as the goal and digital technologies as a means to the twin transformation aim. *[Stabilize]* - Train employees in processual thinking and utilizing digital technologies for sustainability. *[Enrich]*
Data-driven sustainable market insights	- Collaboration - Data management	- Collect sustainability data and share it along the supply chain. *[Stabilize]* - Utilize market data to create more sustainable product and service innovations. *[Pioneer]*
Data-driven ecosystem platforms	- Collaboration - Digital technologies - Data management	- Establish a digital infrastructure that fosters data transparency and promotes open communication among stakeholders within the ecosystem. *[Stabilize]* - Share knowledge, data, and best practices to create a more efficient ecosystem with your partners. *[Enrich]*

Table 7. Overview of the twin transformation bundling clusters

Last, the twin transformation bundling clusters support four *twin transformation purposes of resource leveraging*, i.e., internal exploitation, internal exploration, shared exploitation, and shared exploration (Oberländer et al., 2021). To pursue these purposes, firms must first mobilize twin transformation bundling clusters and then coordinate and deploy them through targeted processes (Sirmon et al., 2007). Internal exploitation focuses on enhancing efficiency and optimizing the effective use of internal resources, e.g., through an internal data pool. Internal exploration, by contrast, seeks to discover new business opportunities by fostering innovation and leveraging internal capabilities for digital and sustainable development. Shared exploitation aims to improve existing value propositions by deepening collaboration with external partners and jointly addressing common societal challenges. Finally, shared exploration involves the development of entirely new products, services, or business models by engaging with partners and ecosystems, using shared data and insights to drive innovation. These four purposes are systematically linked to relevant twin transformation bundling clusters and operationalized through coordination and deployment processes, as summarized in Table 8.

Twin transformation purpose of resource leveraging	Sub-processes	
	Twin transformation bundling clusters *[Mobilize]*	**Description**
Internal exploitation	- Twin transformation strategy - Digitalization of sustainability implementation - Data-driven digital ecosystems	- Establish an internal data pool that supports twin transformation. *[Coordinate*] - Identify and optimize inefficiencies in organizational processes to enhance sustainability. *[Deploy]*
Internal exploration	- Twin transformation strategy - Digitalization of sustainability implementation	- Establish an innovation culture with skilled employees to enhance twin transformation. *[Coordinate]* - Foster innovation to discover new business opportunities that are both digital and sustainable. *[Deploy]*
Shared exploitation	- Twin transformation strategy - Digitalization of sustainability implementation - Ecosystem engagement - Data-driven digital ecosystems	- Use a shared data ecosystem to enable twin transformation. *[Coordinate]* - Foster strong collaborations with industry partners and stakeholders along the supply chain to identify and address critical bottlenecks. *[Deploy]*
Shared exploration	- Twin transformation strategy - Digitalization of sustainability implementation - Ecosystem engagement - Data-driven sustainable market insights - Digitally enabled sustainable value co-creation - Data-driven ecosystem platforms	- Enhance digital, sustainable, and collaborative innovation for twin transformation. *[Coordinate]* - Utilize complementary partnerships and market insights to create novel products and services. *[Deploy]*

Table 8. Overview of the twin transformation purposes of resource leveraging

Research Paper 6 offers theoretical implications by advancing the understanding of twin transformation from a resource orchestration perspective. Research Paper 6 illustrates how structuring, bundling, and leveraging resources unfold specifically in the context of twin transformation, thereby supporting the development of twin transformation-specific capabilities (Breiter et al., 2024; Christmann et al., 2024). The study also extends resource orchestration theory by embedding it in the complex and dynamic setting of twin transformation, which involves broader and more diverse resource pools than digital or sustainability transformation alone (Christmann et al., 2024; Oberländer et al., 2021; Piccoli et al., 2024). Furthermore, Research Paper 6 highlights that there is no one-size-fits-all approach to twin transformation, emphasizing the importance of examining contextual factors influencing how organizations orchestrate resources to achieve successful transformation (Soh et al., 2023; Wessel et al., 2021). As a practical implication, the Twin Transformation Resource Orchestration Pyramid provides a concrete tool for organizations to assess their twin transformation resource base, identify gaps, and strategically bundle and leverage resources to generate value. Thus, Research Paper 6 helps practitioners to manage the complexity of twin transformation more effectively and design twin transformation efforts in a structured and goal-oriented manner.

Research Paper 7: Navigating Twin Transformation: A Systematic Approach for Twin Transformation Strategy Development

The growing urgency of digital transformation and the increasing relevance of sustainability require organizations to rethink their strategies in an integrated manner. Twin transformation, the simultaneous pursuit of digital and sustainable transformation, has become a key priority for building long-term competitiveness. However, organizations lack a structured approach for developing and aligning twin transformation into their business strategy (Breiter et al., 2024; Christmann et al., 2024). Successfully aligning a twin transformation strategy to an organization's overarching business strategy ensures long-term resilience and competitiveness (Ollagnier, 2021). However, existing methods offer limited guidance for effectively managing and implementing twin transformation, as they typically address digital and sustainability transformations in isolation (Bharadwaj et al., 2013; Broman & Robèrt, 2017; Kopnina, 2017; Vial, 2019). As a result, there is a lack of methodological support for designing a twin transformation strategy that provides a structured, step-by-step approach, ensuring alignment with the overarching business strategy (Guandalini, 2022). To address this gap, Research Paper 7 investigates the following research question: *How can organizations develop and integrate a twin transformation strategy into their overarching business strategy?*

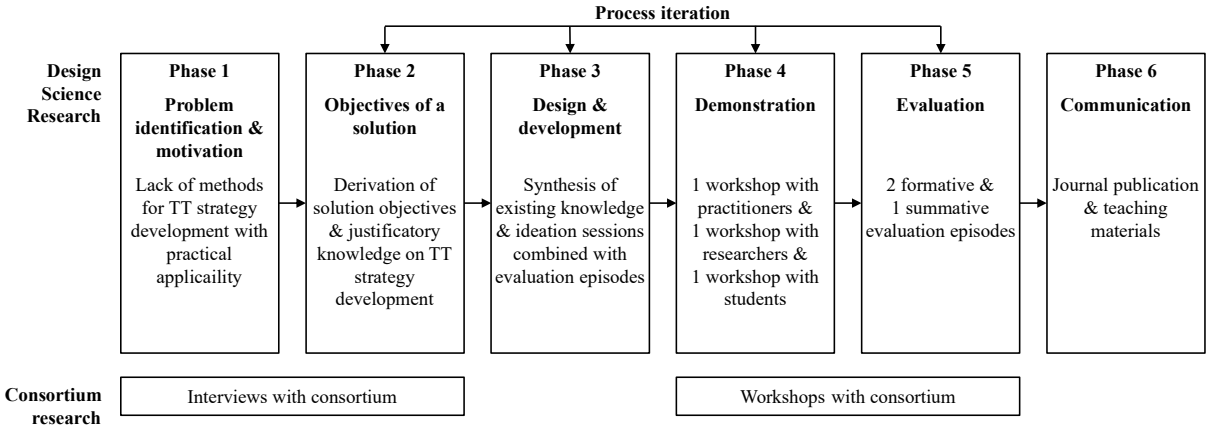

Figure 11. Research design following Peffers et al. (2007)

Research Paper 7 develops a Twin Transformation Strategy Framework to answer this research question, which provides a structured representation of an organization's twin transformation strategy. Complementing the Twin Transformation Strategy Framework, Research Paper 7 also proposes a step-by-step methodology that conceptualizes five sequential activities for developing the twin transformation strategy. To ensure the development of a problem-solving artifact that is both practically relevant and scientifically rigorous, we adopt the Design Science

Research approach as outlined by Peffers et al. (2007) (Figure 11). To ensure practical relevance, we conducted 22 interviews with domain experts during Phases 1 and 2 (Hevner, 2007; March & Smith, 1995). Thus, during Phase 1, the key challenges, strategic misalignment, implementation difficulties, ineffective leadership, and regulatory as well as financial constraints, were identified. During Phase 2, six design objectives were derived from the interviews to define the intended outcome of the artifact in Phase 3 (Gregor & Hevner, 2013). Table 9 provides an overview of the design objectives.

Design objective	Description
1	To empower organizations in developing a twin transformation strategy, the method needs to bridge the gap between digital and sustainability transformation, making both central and equal components of the strategy.
2	To empower organizations in twin transformation strategy development, the method must promote strategic alignment by ensuring coherence between the twin transformation strategy and the overarching business strategy.
3	To empower organizations in developing a twin transformation strategy, the method needs to foster mutual understanding and willingness for sustainability experts to learn about digital transformation and vice versa.
4	To empower organizations to develop a twin transformation strategy, the method needs to divide the process into manageable, understandable steps.
5	To empower organizations in twin transformation strategy development, the method must incorporate top-down and bottom-up approaches.
6	To empower organizations to develop an individual twin transformation strategy, the method must be generalizable and adapt to diverse industries, organizational structures, and cultures.

Table 9. Overview of the design objectives

The Twin Transformation Strategy Framework and its step-by-step methodology were built on the theoretical and practical insights gained during Phase 3. The theoretical insights primarily stem from reviewing existing twin transformation strategy development methods, serving as guiding orientations. Three workshops were conducted to demonstrate (Phase 4) and evaluate (Phase 5) the findings. This included two formative artificial evaluations, one with six students and one with ten research assistants, and one summative naturalistic evaluation with four participants of a manufacturing organization. The evaluation aimed to assess theoretical soundness and practical applicability, using criteria such as ease of use, operationality, efficiency, and generality. Figure 12 shows the final version of the Twin Transformation Strategy Framework and its accompanying methodology (Phase 6). The completed Twin Transformation Strategy Framework represents the twin transformation strategy itself as the tangible outcome of the strategy development process. By placing the identified twin transformation action fields at its core and embedding them within the broader context of digital and sustainability transformations, as well as the overarching business strategy, the framework offers a holistic perspective of an organization’s twin transformation strategy. The

accompanying methodology consists of five consecutive activities that guide users through developing a twin transformation strategy.

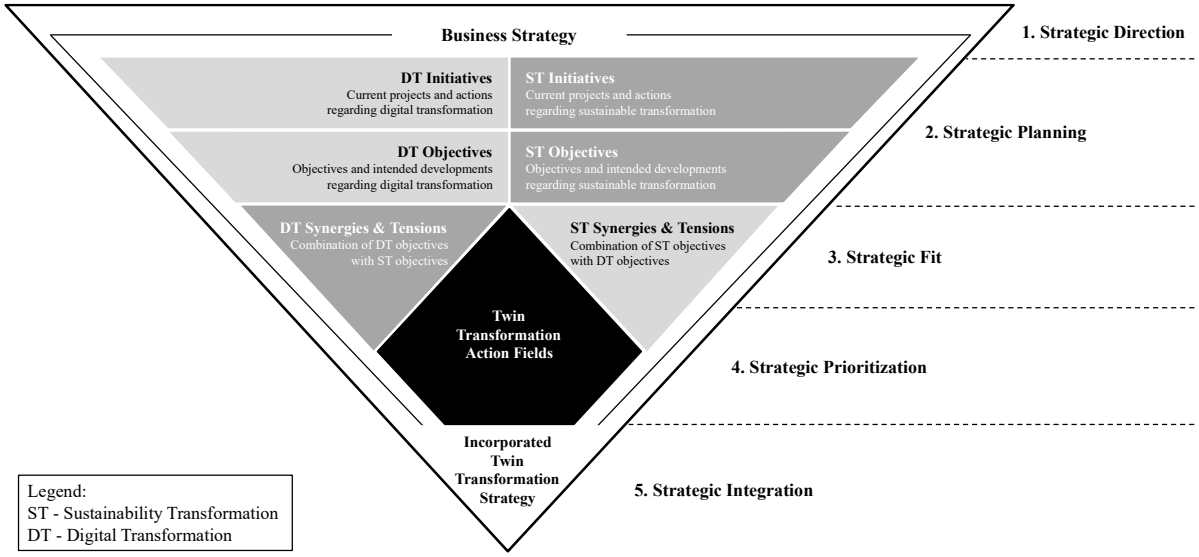

Figure 12. Twin transformation strategy framework

Activity 1 *strategic direction* lays the foundation for the following activities by establishing guardrails for the twin transformation strategy based on the overarching business strategy. This ensures alignment with the business strategy from the beginning. The workshop team analyzes the organization's vision and long-term objectives within this activity, fostering a shared understanding of the strategic context. Building a common understanding helps maintain consistency and coherence throughout the development of the twin transformation strategy. The outcome is a concise list of two to five long-term strategic objectives guiding the strategy forward. The process gains direction by clearly defining these objectives early on, enabling more focused discussion in subsequent activities.

Activity 2 *strategic planning* captures the organization's status quo in digital and sustainability transformation. The activity is carried out separately for the digital and sustainability transformation domains, with experts identifying existing initiatives bottom-up and prioritizing three to six objectives for each domain. In the following, both expert groups present their insights to one another to establish a shared understanding across all participants. This bottom-up approach complements the top-down direction set in Activity 1, establishing a solid foundation for twin transformation strategy development.

Activity 3 *strategic fit* encourages collaboration between digitalization and sustainability experts by assessing each other's objectives for potential synergies and tensions. Building on the prioritized objectives in Activity 2, participants use color-coded sticky notes to differentiate

synergies from tensions visually. Each team then reviews the objectives of the other team and discusses how, from their perspectives, these objectives can be meaningfully complemented by actions from their perspective. Thus, the key outcomes of this activity are the color-coded notes that visualize potential synergies and tensions between digital and sustainability transformation. In addition, the process promotes mutual understanding and contributes to developing innovative ideas for achieving twin transformation objectives.

Activity 4 *strategic prioritization* builds upon the previously identified synergies and tensions for the initial twin transformation action fields. All participants come together and collaboratively examine the synergies and tensions in more detail. The identified potential for exploiting synergies and reducing tensions are the twin transformation action fields, which are assessed using an impact/effort matrix to determine their value and implementation feasibility. The focus is on selecting valuable quick wins and major initiatives while deprioritizing actions with low-impact and high-effort. The expected outcome of Activity 4 is the identification of at least three quick wins and one major twin transformation action field. Clear responsibilities and next steps are assigned to each prioritized twin transformation action field to ensure accountability and execution. This activity results in a preliminary roadmap for twin transformation implementation.

Activity 5 *strategic integration* ensures that the prioritized twin transformation action fields are integrated into the organization's overarching business strategy. The participants systematically examine how the twin transformation action fields influence key strategic elements of the business strategy (e.g., organizational culture, knowledge, finances, product and services). Based on this, necessary refinements of the business strategy are identified and documented to align the twin transformation strategy with long-term business objectives. The process reinforces that the twin transformation strategy is not a standalone project but a key enabler of long-term strategic transformation and value creation across the organization.

Research Paper 7 offers theoretical implications by providing a structured approach for managing multiple transformation logics. The Twin Transformation Strategy Framework and its step-by-step methodology show how organizations can navigate and operationalize such plural transformation logics through a structured, stepwise approach that aligns digital and sustainability ambitions with overarching business goals. Therefore, Research Paper 7 expands the concept of strategic alignment toward a triadic view, incorporating additional strategic dimensions. Additionally, Research Paper 7 offers two practical implications. First, the Twin Transformation Strategy Framework serves as a visual representation of an organization's twin

transformation strategy once completed, enhancing transparency, promoting strategic clarity, and empowering organizations to maintain direction, focus on high-impact initiatives, and drive long-term competitiveness. Second, the step-by-step methodology provides practical guidance for collaboratively developing the twin transformation strategy. The methodology operationalizes the framework by breaking the twin transformation strategy development process into manageable, actionable steps. For each activity, managers are given a clear objective, a description of the process, illustrative examples, and guiding questions to facilitate application.

IV. Conclusion

IV.1 Summary

Digital technologies have emerged as powerful tools to address today's pressing societal challenges, offering organizations new pathways for enabling positive societal change (Buck, Krombacher, et al., 2023; Cowls et al., 2021; Dong & Götz, 2021). To successfully leverage these potentials, organizations combine targeted digital innovation and holistic digital transformation for the good, as both are interdependent, with innovation catalyzing transformation and transformative efforts fostering a conducive environment for ongoing innovation (Appio et al., 2021; Drechsler et al., 2020). Although the relevance of digital technologies and sustainability is growing in practice, research is still at a relatively early stage. As a result, research misses a holistic understanding and successful design of digital social innovation and twin transformation.

To address these shortcomings, the dissertation contributes to the topic of digital for the good with two primary research objectives: (1) understanding and designing digital innovation for the good, and (2) understanding and designing digital transformation for the good.

First, this dissertation touches upon the research topic of *digital innovation for the good*, focusing on understanding and designing digital social innovation with four research papers in Section II.

Regarding *understanding digital social innovation*, Research Paper 1 contributes a Digital Social Innovation Success Factor Overview and the Digital Social Innovation Success Factor Framework. The Digital Social Innovation Success Factor Overview includes 18 success factors, categorized into human, organization, and environment, and specifies key action fields necessary to understand for successful digital social innovation development. The Digital Social Innovation Success Factor Framework consists of the digital social innovation success factors, moderating factors, and digital social innovation success. Thus, the Digital Social Innovation Success Factor Framework provides a holistic understanding of factors relevant to digital social innovation and includes specific contexts influencing these success factors. To complement this perspective, Research Paper 2 contributes the Digital Social Innovation Barrier Framework, which identifies 28 barriers organized into twelve categories across five main elements. Thereby, Research Paper 2 extends Kohli and Melville's (2019) digital innovation framework to a digital social innovation framework by integrating the societal environment as a fifth core element. With the Digital Social Innovation Barrier Framework,

Research Paper 2 contributes a holistic understanding of the digital social innovation process and its barriers.

Regarding the *design of digital social innovation*, Research Paper 3 contributes eight resource-centric patterns of digital social innovation that offer inspirational guidance on the design of digital social innovation through leveraging an incumbent firm's resource base. Thus, Research Paper 3 advances current research by analyzing digital social innovation using a resource-centric lens. This work contributes to the design of digital social innovation by illustrating how incumbent firms can utilize their existing resource base through purpose-related digital technology archetypes to address various SDGs systematically. Additionally, Research Paper 4 contributes an approach capturing digital social innovation's impact on a specific societal challenge and, therefore, helps to shape its design to avoid unintended consequences. To demonstrate this approach, Research Paper 4 explores the role of AI within the system of deforestation by applying systems thinking. Research Paper 4 presents a detailed CLD composed of 84 variables and 172 causal relationships, capturing causal mechanisms on how AI interacts with the broader deforestation system. In addition, the results include five system-informed propositions shedding light on AI's overarching influence on deforestation. Together, these findings serve as a blueprint for exploring digital technologies' impact on wicked societal challenges when designing digital social innovation.

Second, this dissertation touches upon the research topic of *digital transformation for the good*, focusing on understanding and designing twin transformation with three research papers in Section III.

Regarding the *understanding of twin transformation*, Research Paper 5 contributes the Twin Transformation Model that reflects the interplay between digital and sustainability transformation across an organization. The Twin Transformation Model includes 44 twin transformation interactions and 22 digital and sustainability transformation themes structured along eight organizational layers (Alter, 2013). The interactions and themes describe in detail how digital transformation can enable sustainability transformation and how sustainability transformation can guide the design of digital transformation across the various organizational layers. Thus, Research Paper 5 contributes a holistic understanding of the interplay between digital and sustainability transformation.

Regarding the *design of twin transformation*, Research Paper 6 contributes the Twin Transformation Resource Orchestration pyramid. The pyramid includes five twin

transformation structuring dimensions, along which necessary twin transformation resources are structured, and six twin transformation bundling clusters, in which the twin transformation structuring dimensions are bundled to develop advanced capabilities. Finally, the twin transformation bundling clusters are aligned with the four twin transformation purposes of resource leveraging (Oberländer et al., 2021). Thus, Research Paper 6 examines how organizations can effectively structure, bundle, and leverage their resources to design twin transformation. Finally, Research Paper 7 contributes the Twin Transformation Strategy Framework, which provides a structured representation of an organization's twin transformation strategy. The Twin Transformation Strategy Framework provides a structured, visual overview that captures all key elements of the twin transformation strategy in one place. Complementing this framework, Research Paper 7 provides a step-by-step methodology that systematically guides the design process. The methodology conceptualizes five sequential activities for developing a twin transformation strategy, from defining the strategic direction to embedding twin transformation into the business strategy.

Overall, this dissertation significantly contributes to the existing literature by providing descriptive and design knowledge on using digital for the good. On the one hand, descriptive knowledge lays the groundwork for a theory for analysis (type I theory according to Gregor, 2006) by enhancing the understanding of success factors and barriers to digital social innovation and conceptualizing the twin transformation interplay at an organizational level. On the other hand, this dissertation provides design knowledge, which forms the basis for a theory for design and action (theory type V according to Gregor, 2006) by providing inspirational digital social innovation patterns, a blueprint for understanding digital technologies' impact on societal challenges, guidance on orchestrating resources for twin transformation, and a step-by-step methodology for twin transformation strategy development. The presented results provide insights for research and practice, guiding future researchers in investigating and shaping digital social innovation and twin transformation (see Section IV.3) as well as practitioners in advancing integrated sustainability and digital actions in organizations. In doing so, the contributions of this dissertation not only enhance the theoretical understanding of digital for the good but also offer tangible benefits for organizations to reach an integrated digital and sustainable future.

IV.2 Limitations

The research findings presented in this dissertation should be interpreted with consideration of their overall limitations, which are summarized below. These extend beyond the specific limitations of each research paper, which are detailed in the respective research paper (see Sections VI.3 – VI.9). Instead, this section identifies broader constraints of this dissertation.

First, and perhaps most importantly from a conceptual standpoint, the dissertation treats digital innovation for the good and digital transformation for the good as two distinct streams of inquiry. While this differentiation proved analytically helpful in structuring the research objectives and organizing the dissertation's contributions, it also highlights a significant gap in the current literature, as the interplay between digital innovation for the good (i.e., digital social innovation) and digital transformation for the good (i.e., twin transformation) remains largely unexplored. This separation risks overlooking important synergies and tensions between individual innovation initiatives and organization-wide transformation. Digital social innovation initiatives may act as catalysts or relevant building blocks for broader twin transformation efforts, while twin transformation can establish the infrastructure, capabilities, or cultural conditions necessary to enable digital social innovation. Investigating this mutual influence is essential for developing a more integrated theoretical understanding and for informing organizations on how to align and sequence digital innovation and transformation efforts to maximize their positive societal impact.

Second, the methodological orientation of the dissertation leans heavily toward conceptual development and qualitative research designs. This was chosen, as it is particularly well suited for investigating novel, complex, and under-theorized phenomena such as digital social innovation and twin transformation. Thus, the qualitative research designs enabled a deep exploration of the emerging practices, various stakeholder perspectives, and context-specific dynamics that would be difficult to capture through standardized instruments at this early stage of the research phenomenon. However, this methodological orientation also introduces limitations. The absence of quantitative research restricts the ability to generalize the findings statistically or to validate the proposed results. Incorporating quantitative methods or large-scale empirical validation would help verify the stability and applicability of the proposed models and frameworks across different sectors or organizational types.

Third, this dissertation primarily emphasizes the enabling potential of digital technologies for a positive societal impact. While this perspective is consistent with the overarching research

objectives, exploring digital innovation and transformation for the good results in an underrepresentation of the risks, unintended consequences, and ambivalences often accompanying digital innovation and transformation. Issues like digital exclusion, insufficient data privacy and security, or increased energy consumption are acknowledged but not addressed in depth. This predominantly optimistic framing may obscure digitalization's critical ethical, ecological, and societal tensions. Although Research Paper 4 takes an initial step toward recognizing negative side effects, the boarder dissertation offers limited engagement with the potential downsides of digital social innovation and twin transformation. As a result, the current research provides an incomplete picture of the double-edged nature of digital technologies in societal contexts.

IV.3 Future Research

This dissertation's contributions and limitations highlight potential starting points for future research.

First, future research should systematically investigate the interplay between digital social innovation and twin transformation. This dissertation deliberately analyzed these phenomena in isolation to provide conceptual clarity. However, the practical reality suggests that digital social innovation and twin transformation are strongly intertwined, potentially forming mutually reinforcing dynamics (Appio et al., 2021; Drechsler et al., 2020). For instance, digital social innovation initiatives can act as catalysts for broader twin transformation efforts, while twin transformation can provide the structural and cultural foundations, such as digital infrastructures, resource configurations, and sustainability-oriented mindsets, that are necessary for institutionalizing digital social innovation (Buck et al., 2025; Seidel et al., 2017). Future research could explore this intersection more explicitly by conducting longitudinal case studies to examine how initial digital social innovation initiatives evolve into strategic twin transformation programs over time. For example, researchers could use in-depth case studies or comparative project histories to trace how digital social innovation initiatives gain traction, face resistance, or become institutionalized across different phases of twin transformation. These approaches can help trace development over time, uncover decision pathways and contextual enablers, and identify key events or turning points that shape the trajectory of digital and sustainable integration. Overall, connecting digital social innovation and twin transformation in a theoretically and empirically grounded manner would advance a more integrated understanding of how organizations can align digital innovation and transformation efforts for the good.

Second, future research should expand the methodological diversity to enhance generalizability and the robustness of findings. While this dissertation primarily employed conceptual frameworks, structured literature reviews, and qualitative case-based insights to explore emerging and complex phenomena, advancing the field requires triangulation with quantitative approaches. For example, building on Research Paper 1 or Research Paper 6, researchers could develop and validate measurement instruments using survey-based studies and structural equation modeling, thereby quantifying the influence of specific success factors or orchestration strategies on performance indicators (e.g., societal impact, economic impact). Additionally, these studies could test the causal influence of various contextual or managerial decisions on digital sustainability outcomes. In doing so, future research can generate more precise, evidence-based insights that support the stability and applicability of the proposed models and frameworks across different sectors or organizational types for further theory building and practical decision-making in digital innovation and transformation for the good.

Third, while this dissertation emphasizes the positive potential of digital technologies for societal impact, future research should adopt a more critical perspective by systematically examining the societal risks and unintended consequences of digital innovation and transformation. Digital technologies are not inherently sustainable, as they can lead to negative side effects such as digital exclusion, ethical concerns around AI, privacy concerns, and environmental harms like e-waste or the carbon footprint of digital infrastructures. Future research could further investigate systemic rebound effects in the context of digital innovation. For instance, while AI can support forest protection through monitoring and early fire detection (as shown in Research Paper 4), training large-scale models may exacerbate climate impact (Cowls et al., 2021; Strubell et al., 2020). Building on causal loop diagrams, researchers could conduct participatory workshops to identify leverage points and co-develop strategies to mitigate negative outcomes. Additionally, scenario-based simulations could be run in the next step to explore the long-term implications of different digital interventions and identify potential rebound effects early on. Regarding digital transformation, research should identify and classify how negative sustainability impacts emerge across different phases of the organizational transformation process, from strategy development to implementation. These may include increased energy use, exclusion due to unequal digital access, or shifts in employment and skill demands. Case studies can help uncover how organizations identify, assess, and manage such trade-offs, including the role of leadership, governance structures, and

stakeholder involvement. Exploring these downsides more thoroughly could enhance the maturity and reflexivity of digital sustainability research.

In conclusion, this dissertation aims to provide valuable insights and practical guidance for researchers and practitioners, facilitating the design of digital for the good. By promoting the understanding and development of digital innovation and transformation for the good, this dissertation aims to help develop a sustainable and digital future that ensures the world remains a viable and thriving environment for future generations.

V. References

Aksoy, L., Alkire, L., Choi, S., Kim, P. B., & Zhang, L. (2019). Social Innovation in Service: A Conceptual Framework and Research Agenda. *Journal of Service Management*, *30*(3), 429–448. https://doi.org/10.1108/JOSM-11-2018-0376

Al Issa, H.-E., & Omar, M. M. S. (2024). Digital Innovation Drivers in Retail Banking: The Role of Leadership, Culture, and Technostress Inhibitors. *International Journal of Organizational Analysis*, *32*(11), 19–43. https://doi.org/10.1108/IJOA-08-2023-3905

Alegre, I., & Berbegal-Mirabent, J. (2016). Social Innovation Success Factors: Hospitality and Tourism Social Enterprises. *International Journal of Contemporary Hospitality Management*, *28*(6), 1155–1176. https://doi.org/10.1108/IJCHM-05-2014-0231

Alshehri, M., Ouadou, A., & Scott, G. (2023). Deforestation Detection in the Brazilian Amazon Using Transformer-based Networks. In *2023 IEEE Conference on Artificial Intelligence (CAI)*.

Alter, S. (2013). Work System Theory: Overview of Core Concepts, Extensions, and Challenges for the Future. *Journal of the Association for Information Systems*, 72–121. https://doi.org/10.17705/1jais.00323

Alvarado, M., Lovell, R., Guell, C., Taylor, T., Fullam, J., Garside, R., Zandersen, M., & Wheeler, B. (2023). Street Trees and Mental Health: Developing Systems Thinking-informed Hypotheses Using Causal Loop Diagraming. *Ecology and Society*, *28*(2). https://doi.org/10.5751/ES-14013-280201

Angelsen, A. (Ed.). (2008). *Moving Ahead with REDD: Issues, Options and Implications*. Center of International Forestry Research.

Appio, F. P., Frattini, F., Petruzzelli, A. M., & Neirotti, P. (2021). Digital Transformation and Innovation Management: A Synthesis of Existing Research and an Agenda for Future Studies. *Journal of Product Innovation Management*, *38*(1), 4–20. https://doi.org/10.1111/jpim.12562

Auweiler, S., Crome, C., Kneissel, K., Kreuzer, T., & Müller, M. (2025). From Synergy to Value - An ESG Perspective on Twin Transformation. *ECIS 2025 Proceedings*. https://aisel.aisnet.org/ecis2025/isresilience/isresilience/2

Baier, M.-S., Berger, S., Kreuzer, T., Oberländer, A. M., & Röglinger, M. (2023). What Makes Digital Technology? A Categorization Based on Purpose. *Communications of the Association for Information Systems*, *52*(1), 556–609. https://doi.org/10.17705/1CAIS.05215

Ball, J. G. C., Petrova, K., Coomes, D. A., & Flaxman, S. (2022). Using Deep Convolutional Neural Networks to Forecast Spatial Patterns of Amazonian Deforestation. *Methods in Ecology and Evolution*, *13*(11), 2622–2634. https://doi.org/10.1111/2041-210X.13953

Balta, W., Chawla, M., Dencik, J., & Lin, S. (2022). *Sustainability as a Transformation Catalyst*. https://www.ibm.com/downloads/documents/us-en/10a99803fb2fdc03

Barakat, S. R., Isabella, G., Boaventura, J. M. G., & Mazzon, J. A. (2016). The Influence of Corporate Social Responsibility on Employee Satisfaction. *Management Decision*, *54*(9), 2325–2339. https://doi.org/10.1108/MD-05-2016-0308

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Bartikowski, B., Walsh, G., & Beatty, S. E. (2011). Culture and Age as Moderators in the Corporate Reputation and Loyalty Relationship. *Journal of Business Research*, *64*(9), 966–972. https://doi.org/10.1016/j.jbusres.2010.11.019

Battistella, C., Dangelico, R. M., Nonino, F., & Pessot, E. (2021). How Social Start-ups Avoid Being Falling Stars When Developing Social Innovation. *Creativity and Innovation Management*, *30*(2), 320–335. https://doi.org/10.1111/caim.12431

Battisti, S. (2012). Social Innovation: The Process Development of Knowledge-Intensive Companies. *International Journal of Services Technology and Management*, *18*(3/4), Article 52860, 224–244. https://doi.org/10.1504/IJSTM.2012.052860

Bauman, C. W., & Skitka, L. J. (2012). Corporate Social Responsibility as a Source of Employee Satisfaction. *Research in Organizational Behavior*, *32*, 63–86. https://doi.org/10.1016/j.riob.2012.11.002

Beheshti, H. M., & Beheshti, C. M. (2010). Improving Productivity and Firm Performance with Enterprise Resource Planning. *Enterprise Information Systems*, *4*(4), 445–472. https://doi.org/10.1080/17517575.2010.511276

Beier, G., Ullrich, A., Niehoff, S., Reißig, M., & Habich, M. (2020). Industry 4.0: How It is Defined From a Sociotechnical Perspective and How Much Sustainability It Includes – A

Literature Review. *Journal of Cleaner Production*, *259*, 120856. https://doi.org/10.1016/j.jclepro.2020.120856

Benbya, H., Nan, N., Tanriverdi, H., & Yoo, Y. (2020). Complexity and information systems research in the emerging digital world. *MIS Quarterly*, *44*(1), 1–17. https://doi.org/10.25300/MISQ/2020/13304

Beverungen, D., Lüttenberg, H., & Wolf, V. (2018). Recombinant Service Systems Engineering. *Business & Information Systems Engineering*, *60*(5), 377–391. https://doi.org/10.1007/s12599-018-0526-4

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. https://doi.org/10.25300/misq/2013/37:2.3

Binder, T., Vox, A., Belyazid, S., Haraldsson, H., & Svensson, M. (2004). Developing System Dynamics Models From Causal Loop Diagrams. In *Proceedings of the 22nd International Conference of the System Dynamic Society*.

Binti Mustapha, N. D., & Bin Abu Seman, S. (2023). Knowledge Creation as Influence The Achievement of Organisational Social Innovation. *European Public & Social Innovation Review*, *8*(2), 54–64. https://doi.org/10.31637/epsir-2023-245

Blythe, J., Silver, J., Evans, L., Armitage, D., Bennett, N. J., Moore, M.-L., Morrison, T. H., & Brown, K. (2018). The Dark Side of Transformation: Latent Risks in Contemporary Sustainability Discourse. *Antipode*, *50*(5), 1206–1223. https://doi.org/10.1111/anti.12405

Boell, S. K., & Cecez-Kecmanovic, D. (2015). On Being 'Systematic' In Literature Reviews in IS. *Journal of Information Technology*, *30*(2), 161–173. https://doi.org/10.1057/jit.2014.26

Bongaarts, J. (2009). Human population growth and the demographic transition. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *364*(1532), 2985–2990. https://doi.org/10.1098/rstb.2009.0137

Bonina, C., López-Berzosa, D., & Scarlata, M. (2021). Social, Commercial, or Both? An Exploratory Study of the Identity Orientation of Digital Social Innovations. *Information Systems Journal*, *31*(5), 695–716. https://doi.org/10.1111/isj.12290

Bosler, M., Burr, W., & Ihring, L. (2021). Digital Innovation in Incumbent Firms: An Exploratory Analysis of Value Creation. *International Journal of Innovation and Technology Management*, *18*(02), 2040003. https://doi.org/10.1142/S0219877020400039

Böttcher, T. P., Empelmann, S., Weking, J., Hein, A., & Krcmar, H. (2023). Digital sustainable business models: Using digital technology to integrate ecological sustainability into the core of business models. *Information Systems Journal*, Article isj.12436. Advance online publication. https://doi.org/10.1111/isj.12436

Breiter, K., Crome, C., Oberländer, A. M., & Schnaak, F. (2024). Dynamic Capabilities for the Twin Transformation Climb: A Capability Maturity Model. *Information Systems Frontiers.* Advance online publication. https://doi.org/10.1007/s10796-024-10520-y

Bright, D. S., & Godwin, L. N. (2010). Encouraging Social Innovation in Global Organizations: Integrating Planned and Emergent Approaches. *Journal of Asia-Pacific Business*, *11*(3), 179–196. https://doi.org/10.1080/10599231.2010.500572

Brock, K., Ouden, E. den, Langerak, F., & Podoynitsyna, K. (2020). Front End Transfers of Digital Innovations in a Hybrid Agile-Stage-Gate Setting. *Journal of Product Innovation Management*, *37*(6), 506–527. https://doi.org/10.1111/jpim.12556

Broman, G. I., & Robèrt, K.-H. (2017). A Framework for Strategic Sustainable Development. *Journal of Cleaner Production*, *140*, 17–31. https://doi.org/10.1016/j.jclepro.2015.10.121

Buck, C., Heim, L., Körner-Wyrtki, K., Krombacher, A., & Röglinger, M. (2025). Making the Most of Digital Social Innovation: An Exploration Into Success Factors. *Journal of Business Research*, *190*, 115215. https://doi.org/10.1016/j.jbusres.2025.115215

Buck, C., Kempf, L., Kneissel, K., & Krombacher, A. (2023). Barriers Along the Digital Social Innovation Process: A Structured Literature Review. *Proceedings of the 18th International Conference on Wirtschaftsinformatik*, *60*. https://aisel.aisnet.org/wi2023/60

Buck, C., Krombacher, A., Röglinger, M., & Körner-Wyrtki, K. (2023). Doing Good by Going Digital: A Taxonomy of Digital Social Innovation in the Context of Incumbents. *The Journal of Strategic Information Systems*, *32*(4), 101806. https://doi.org/10.1016/j.jsis.2023.101806

Canestrino, R., Ćwiklicki, M., Di Nauta, P., & Magliocca, P. (2019). Creating Social Value Through Entrepreneurship: The Social Business Model of La Paranza. *Kybernetes*, *48*(10), 2190–2216. https://doi.org/10.1108/K-03-2018-0135

Carlan, V., Sys, C., Vanelslander, T., & Roumboutsos, A. (2017). Digital Innovation in the Port Sector. *Competition and Regulation in Network Industries*, *18*(1-2), 71–93. https://doi.org/10.1177/1783591717734793

Carter, G., Wagner, F. H., Dalagnol, R., Roberts, S., Ritz, A. L., & Saatchi, S. (2024). Detection of Forest Disturbance Across California Using Deep-learning on PlanetScope Imagery. *Frontiers in Remote Sensing*, *5*, Article 1409400. https://doi.org/10.3389/frsen.2024.1409400

Casale Mashiah, D., Beeri, I., Vigoda-Gadot, E., & Hartman, A. (2023). Responsible Research and Innovation in Europe: Empirical Evidence From Regional Planning Initiatives in Austria, Norway, and Spain. *European Planning Studies*, *31*(9), 1949–1974. https://doi.org/10.1080/09654313.2023.2170215

Cen, S.-T., & Yan, W.-H. (2022). Economic Growth, People's Livelihood Preferences of Local Governments and Residents' Health. *Frontiers in Public Health*, *10*, 844015. https://doi.org/10.3389/fpubh.2022.844015

Chalmers, D. (2013). Social Innovation: An Exploration of the Barriers Faced by Innovating Organizations in the Social Economy. *Local Economy: The Journal of the Local Economy Policy Unit*, *28*(1), 17–34. https://doi.org/10.1177/0269094212463677

Charalabidis, Y., Loukis, E., & Androutsopoulou, A. (2014). Fostering Social Innovation Through Multiple Social Media Combinations. *Information Systems Management*, *31*(3), 225–239. https://doi.org/10.1080/10580530.2014.923267

Chen, Y.-C. (2010). Citizen-Centric E-Government Services: Understanding Integrated Citizen Service Information Systems. *Social Science Computer Review*, *28*(4), 427–442. https://doi.org/10.1177/0894439309359050

Ching, N. T., Ghobakhloo, M., Iranmanesh, M., Maroufkhani, P., & Asadi, S. (2022). Industry 4.0 Applications for Sustainable Manufacturing: A Systematic Literature Review And a Roadmap to Sustainable Development. *Journal of Cleaner Production*, *334*, 130133. https://doi.org/10.1016/j.jclepro.2021.130133

Choi, I., Chung, S., Han, K., & Pinsonneault, A. (2021). CEO Risk-taking Incentives and IT Innovation: The Moderating Role of a CEO's IT-related Human Capital. *Management Information Systems Quarterly*, *45*(4), 2175–2192. https://aisel.aisnet.org/misq/vol45/iss4/21

Chotia, V., Cheng, Y., Agarwal, R., & Vishnoi, S. K. (2024). AI-enabled Green Business Strategy: Path to Carbon Neutrality via Environmental Performance and Green Process

Innovation. *Technological Forecasting and Social Change*, *202*, 123315. https://doi.org/10.1016/j.techfore.2024.123315

Christmann, A.-S., Crome, C., Graf-Drasch, V., Oberländer, A. M., & Schmidt, L. (2024). The Twin Transformation Butterfly. *Business & Information Systems Engineering*, *66*(4), 489–505. https://doi.org/10.1007/s12599-023-00847-2

Clausen, S., Brünker, F., Jung, A.-K., & Stieglitz, S. (2022). The Impact of Signaling Commitment to Ethical AI on Organizational Attractiveness. *Proceedings of the 17th International Conference on Wirtschaftsinformatik*. https://aisel.aisnet.org/wi2022/digital_business_models/digital_business_models/10

Coletta, V. R., Pagano, A., Pluchinotta, I., Fratino, U., Scrieciu, A., Nanu, F., & Giordano, R. (2021). Causal Loop Diagrams for Supporting Nature Based Solutions Participatory Design and Performance Assessment. *Research in Organizational Behavior*, *280*, 111668. https://doi.org/10.1016/j.jenvman.2020.111668

Cowls, J., Tsamados, A., Taddeo, M., & Floridi, L. (2021). A Definition, Benchmark and Database of AI for Social Good Initiatives. *Nature Machine Intelligence*, *3*(2), 111–115. https://doi.org/10.1038/s42256-021-00296-0

Crivellari, I., Grøder, C. H., Parmiggiani, E., Moltubakk, S. T., & Bertheussen, L. E. (2024). Socially Sustainable Digital Transformation in the Public Sector: A Systematic Literature Review. *Proceedings of the 57th Hawaii International Conference on System Sciences*. https://scholarspace.manoa.hawaii.edu/items/88e406ef-afc0-4481-9eaf-f79d011c8437

Dao, V., Langella, I., & Carbo, J. (2011). From Green to Sustainability: Information Technology and an Integrated Sustainability Framework. *The Journal of Strategic Information Systems*, *20*(1), 63–79. https://doi.org/10.1016/j.jsis.2011.01.002

de Arruda Torresa, P. M. (2017). Design for Socio-technical Innovation: A Proposed Model to Design the Change. *The Design Journal*, *20*, S3035-S3046. https://doi.org/10.1080/14606925.2017.1352811

de Medeiros, J. F., Bisognin Garlet, T., Duarte Ribeiro, J. L., & Nogueira Cortimiglia, M. (2022). Success Factors for Environmentally Sustainable Product Innovation: An Updated Review. *Journal of Cleaner Production*, *345*, 131039. https://doi.org/10.1016/j.jclepro.2022.131039

Del Giudice, M., Chierici, R., Mazzucchelli, A., & Fiano, F. (2021). Supply chain management in the era of circular economy: The moderating effect of big data. *The International Journal of Logistics Management*, *32*(2), 337–356. https://doi.org/10.1108/IJLM-03-2020-0119

Del Giudice, M., Scuotto, V., Papa, A., Tarba, S. Y., Bresciani, S., & Warkentin, M. (2021). A Self-tuning Model for Smart Manufacturing SMEs: Effects on Digital Innovation. *Journal of Product Innovation Management*, *38*(1), 68–89. https://doi.org/10.1111/jpim.12560

Deserti, A., & Rizzo, F. (2020). Context Dependency of Social Innovation: In Search of New Sustainability Models. *European Planning Studies*, *28*(5), 864–880. https://doi.org/10.1080/09654313.2019.1634005

Dias, Á., Hallak, R., & Patuleia, M. (2024). Entrepreneurial Passion: A Key Driver of Social Innovations for Tourism Firms. *Entrepreneurship Research Journal.* Advance online publication. https://doi.org/10.1515/erj-2023-0455

Dionisio, M., Souza Junior, S. J., Paula, F., & Pellanda, P. C. (2023). The Role of Digital Social Innovations to Address SDGs: A Systematic Review. *Environment, Development and Sustainability*, 1–26. https://doi.org/10.1007/s10668-023-03038-x

Divella, M., & Sterlacchini, A. (2021). Determinants of Sustainable & Responsible Innovations: A Firm-level Analysis for Italy. *Structural Change and Economic Dynamics*, *59*, 360–374. https://doi.org/10.1016/j.strueco.2021.09.011

Dong, J. Q., & Götz, S. J. (2021). Project Leaders as Boundary Spanners in Open Source Software Development: A Resource Dependence Perspective. *Information Systems Journal*, *31*(5), 672–694. https://doi.org/10.1111/isj.12313

Dopelt, K., Mordehay, N., Goren, S., Cohen, A., & Barach, P. (2023). "I Believe More in the Ability of the Small Person to Make Big Changes": Innovation and Social Entrepreneurship to Promote Public Health in Israel. *European Journal of Investigation in Health, Psychology and Education*, *13*(9), 1787–1800. https://doi.org/10.3390/ejihpe13090130

Dorninger, C., Abson, D. J., Apetrei, C. I., Derwort, P., Ives, C. D., Klaniecki, K., Lam, D. P., Langsenlehner, M., Riechers, M., Spittler, N., & Wehrden, H. (2020). Leverage points for sustainability transformation: a review on interventions in food and energy systems. *Ecological Economics*, *171*, 106570. https://doi.org/10.1016/j.ecolecon.2019.106570

Dörr, S., & Lautermann, C. (2024). Beyond Direct Stakeholders: The Extensive Scope of Societal Corporate Digital Responsibility. *Organizational Dynamics*, *53*(2), 101057. https://doi.org/10.1016/j.orgdyn.2024.101057

Doty, D. H., & Glick, W. H. (1994). Typologies as a Unique Form of Theory Building: Toward Improved Understanding and Modeling. *The Academy of Management Review*, *19*(2), 230–251. https://doi.org/10.2307/258704

Dou, Q., & Gao, X. (2023). How Does the Digital Transformation of Corporates Affect Green Technology Innovation? An Empirical Study From the Perspective of Asymmetric Effects and Structural Breakpoints. *Journal of Cleaner Production*, *428*, 139245. https://doi.org/10.1016/j.jclepro.2023.139245

Dr, J., Oh, H., Kim, M., & Jung, S. (2022). Unusual Insider Behavior Detection Framework on Enterprise Resource Planning Systems Using Adversarial Recurrent Autoencoder. *IEEE Transactions on Industrial Informatics*, *18*(3), 1541–1551. https://doi.org/10.1109/TII.2021.3090362

Drechsler, K., Gregory, R., Wagner, H.-T., & Tumbas, S. (2020). At the Crossroads between Digital Innovation and Digital Transformation. *Communications of the Association for Information Systems*, *47*, 521–538. https://doi.org/10.17705/1CAIS.04723

Duke, N., Nagelkerken, I., & Agardy, T. (2014). *The Importance of Mangroves to People: A Call to Action*. https://www.unep.org/resources/report/importance-mangroves-people-call-action

Eichler, G., & Schwarz, E. (2019). What Sustainable Development Goals do Social Innovations Address? A Systematic Review and Content Analysis of Social Innovation Literature. *Sustainability*, *11*(2), Article 522. https://doi.org/10.3390/su11020522

El-Haddadeh, R. (2020). Digital Innovation Dynamics Influence On Organisational Adoption: The Case of Cloud Computing Services. *Information Systems Frontiers*, *22*(4), 985–999. https://doi.org/10.1007/s10796-019-09912-2

ElMassah, S., & Mohieldin, M. (2020). Digital Transformation and Localizing the Sustainable Development Goals. *Ecological Economics*, *169*, 106490. https://doi.org/10.1016/j.ecolecon.2019.106490

Erdiaw-Kwasie, M. O., & Abunyewah, M. (2024). Determinants of Social Innovation in Hybrid Organisations: The Moderating Role of Technology Readiness. *Business Strategy and the Environment*, *33*(2), 1099–1112. https://doi.org/10.1002/bse.3536

Evanschitzky, H., Eisend, M., Calantone, R. J., & Jiang, Y. (2012). Success Factors of Product Innovation: An Updated Meta-Analysis. *Journal of Product Innovation Management*, *29*, 21–37. https://doi.org/10.1111/j.1540-5885.2012.00964.x

FAO, IFAD, UNICEF, WFP, & WHO. (2024). *The State of Food Security and Nutrition in the World 2024*. https://openknowledge.fao.org/items/ebe19244-9611-443c-a2a6-25cec697b361 https://doi.org/10.4060/cd1254en

Fellnhofer, K. (2017). Drivers of Innovation Success in Sustainable Businesses. *Journal of Cleaner Production*, *167*, 1534–1545. https://doi.org/10.1016/j.jclepro.2017.08.197

Feroz, A. K., Zo, H., Eom, J., & Chiravuri, A. (2023). Identifying Organizations' Dynamic Capabilities for Sustainable Digital Transformation: A Mixed Methods Study. *Technology in Society*, *73*, 102257. https://doi.org/10.1016/j.techsoc.2023.102257

Field, A. P. (2013). *Discovering Statistics Using IBM SPSS Statistics* (4th edition). Sage.

Gable, G. (2010). Strategic Information Systems Research: An Archival Analysis. *Journal of Strategic Information Systems*, *19*(1), 3–16. https://doi.org/10.1016/j.jsis.2010.02.003

Gassmann, O., Frankenberger, K., & Csik, M. (2013). *Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. Galler Business Model Navigator*. Hanser.

Gebken, L., Drews, P., & Schirmer, I. (2021). Stakeholder and Value Orientation in Digital Social Innovation: Designing a Digital Donation Concept to Support Homeless Neighbors. *Proceedings of the 54th Hawaii International Conference on System Sciences.* Advance online publication. https://doi.org/10.24251/HICSS.2021.772

Geist, H. J., & Lambin, E. F. (2002). Proximate causes and underlying driving forces of tropical deforestation. *BioScience*, *52*(2), 143. https://doi.org/10.1641/0006-3568(2002)052[0143:PCAUDF]2.0.CO;2

Geobey, S., Westley, F. R., & Weber, O. (2012). Enabling Social Innovation Through Developmental Social Finance. *Journal of Social Entrepreneurship*, *3*(2), 151–165. https://doi.org/10.1080/19420676.2012.726006

George, G., Merrill, R. K., & Schillebeeckx, S. J. D. (2021). Digital Sustainability and Entrepreneurship: How Digital Innovations Are Helping Tackle Climate Change and Sustainable Development. *Entrepreneurship Theory and Practice*, *45*(5), 999–1027. https://doi.org/10.1177/1042258719899425

Ghobakhloo, M. (2020). Industry 4.0, Digitization, and Opportunities for Sustainability. *Journal of Cleaner Production*, *252*, 119869. https://doi.org/10.1016/j.jclepro.2019.119869

Ghobakhloo, M., Iranmanesh, M., Grybauskas, A., Vilkas, M., & Petraitė, M. (2021). Industry 4.0, Innovation, and Sustainable Development: A Systematic Review and a Roadmap to Sustainable Innovation. *Business Strategy and the Environment*, *30*(8), 4237–4257. https://doi.org/10.1002/bse.2867

Gholami, R., Watson, R., Hasan, H., Molla, A., & Bjorn-Andersen, N. (2016). Information Systems Solutions for Environmental Sustainability: How Can We Do More? *Journal of the Association for Information Systems*, *17*(8), 521–536. https://doi.org/10.17705/1jais.00435

Gierlich-Joas, M., Hess, T., & Neuburger, R. (2020). More Self-organization, More Control - Or Even Both? Inverse Transparency as a Digital Leadership Concept. *Business Research*, *13*(4), 1–27. https://doi.org/10.1007/s40685-020-00130-0

Gimpel, H., Graf-Drasch, V., Hawlitschek, F., & Neumeier, K. (2021). Designing Smart and Sustainable Irrigation: A Case Study. *Journal of Cleaner Production*, *315*, 128048. https://doi.org/10.1016/j.jclepro.2021.128048

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking Qualitative Rigor in Inductive Research. *Organizational Research Methods*, *16*(1), 15–31. https://doi.org/10.1177/1094428112452151

Golgeci, I., Ali, I., Bozkurt, S., Gligor, D. M., & Arslan, A. (2022). The Impact of Corporate Support Programs on Environmental and Social Innovation: Empirical Insights from the Food and Beverage Industry. *International Journal of Operations & Production Management*, *42*(7), 898–929. https://doi.org/10.1108/IJOPM-10-2021-0640

Goncalves, D., Bergquist, M., Bunk, R., & Alänge, S. (2020). Cultural Aspects of Organizational Agility Affecting Digital Innovation. *Journal of Entrepreneurship, Management and Innovation*, *16*(4), 13–46. https://doi.org/10.7341/20201641

Gössling, T., & Vocht, C. (2007). Social Role Conceptions and CSR Policy Success. *Journal of Business Ethics*, *74*(4), 363–372. https://doi.org/10.1007/s10551-007-9512-3

Graf-Drasch, V., Kauffeld, L., Kempf, L., Oberländer, A. M., & Teuchert, A. (2023). Driving Twin Transformation-the Interplay of Digital Transformation and Sustainability Transformation. *Proceedings of the 31st European Conference on Information Systems*, *255*. https://aisel.aisnet.org/ecis2023_rp/255/

Graf-Drasch, V., Krombacher, A., Lindenthal, A., Oberländer, A. M., & Schäfer, R. (2022). Digitally Social: Review, Synthesis, and Future Directions for Digital Social Innovation. *ECIS 2022 Research Papers*. https://aisel.aisnet.org/ecis2022_rp/39

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, *33*(3), 114–135. https://doi.org/10.2307/41166664

Gregor, S. (2006). The Nature of Theory in Information Systems. *MIS Quarterly*, *30*(3), 611. https://doi.org/10.2307/25148742

Gregor, S., & Hevner, A. R. (2013). Positioning and Presenting Design Science Research for Maximum Impact. *MIS Quarterly*, *37*(2), 337–355. https://doi.org/10.25300/MISQ/2013/37.2.01

Guandalini, I. (2022). Sustainability Through Digital Transformation: A Systematic Literature Review for Research Guidance. *Journal of Business Research*, *148*, 456–471. https://doi.org/10.1016/j.jbusres.2022.05.003

Guhan, T., & Revathy, N. (2024). EMLARDE Tree: Ensemble Machine Learning Based Random De-correlated Extra Decision Tree for the Forest Cover Type Prediction. *Signal, Image and Video Processing*, *18*(12), 8525–8536. https://doi.org/10.1007/s11760-024-03470-0

Guinan, P. J., Parise, S., & Langowitz, N. (2019). Creating an Innovative Digital Project Team: Levers to Enable Digital Transformation. *Business Horizons*, *62*(6), 717–727. https://doi.org/10.1016/j.bushor.2019.07.005

Guo, H [Huadong], Nativi, S., Liang, D., Craglia, M., Wang, L., Schade, S., Corban, C., He, G., Pesaresi, M., Li, J., Shirazi, Z., Liu, J., & Annoni, A. (2020). Big Earth Data Science: An Information Framework for a Sustainable Planet. *International Journal of Digital Earth*, *13*(7), 743–767. https://doi.org/10.1080/17538947.2020.1743785

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th ed.). Prentice-Hall.

Halila, F., & Rundquist, J. (2011). The Development and Market Success of Eco-innovations. *European Journal of Innovation Management*, *14*(3), 278–302. https://doi.org/10.1108/14601061111148807

Hall, J., & Vredenburg, H. (2003). The Challenges of Innovating for Sustainable Development. *MIT Sloan Management Review*, *45*(1), 61–71.

Hanseln, E. G., Wicki, S., & Schaltegger, S. (2022). Sustainability-oriented Technology Exploration: Managerial Values, Ambidectrous Design, and, AND Separation Drift. *International Journal of Innovation Management*, *26*(05), 1–27. https://EconPapers.repec.org/RePEc:wsi:ijimxx:v:26:y:2022:i:05:n:s1363919622400047

Haq, B., Ali Jamshed, M., Ali, K., Kasi, B., Arshad, S., Khan Kasi, M., Ali, I., Shabbir, A., Abbasi, Q. H., & Ur-Rehman, M. (2024). Tech-driven Forest Conservation: Combating Deforestation with Internet of Things, Artificial Intelligence, and Remote Sensing. *IEEE Internet of Things Journal*, *11*(14), 24551–24568. https://doi.org/10.1109/JIOT.2024.3378671

Haraldsson, H. V. (2004). *Introduction to System Thinking and Causal Loop Diagrams*. Department of Chemical Engineering.

Harris, N. L., Gibbs, D. A., Baccini, A., Birdsey, R. A., Bruin, S. de, Farina, M., Fatoyinbo, L., Hansen, M. C., Herold, M., Houghton, R. A., Potapov, P. V., Suarez, D. R., Roman-Cuesta, R. M., Saatchi, S. S., Slay, C. M., Turubanova, S. A., & Tyukavina, A. (2021). Global Maps of Twenty-first Century Forest Carbon Fluxes. *Nature Climate Change*, *11*(3), 234–240. https://doi.org/10.1038/s41558-020-00976-6

Herrera, M. E. B. (2015). Creating competitive advantage by institutionalizing corporate social innovation. *Journal of Business Research*, *68*(7), 1468–1474. https://doi.org/10.1016/j.jbusres.2015.01.036

Herrera, M. E. B. (2016). Innovation For Impact: Business Innovation for Inclusive Growth. *Journal of Business Research*, *69*(5), 1725–1730. https://doi.org/10.1016/j.jbusres.2015.10.045

Hillgren, P.-A., Seravalli, A., & Emilson, A. (2011). Prototyping and Infrastructuring in Design for Social Innovation. *CoDesign*, *7*(3-4), 169–183. https://doi.org/10.1080/15710882.2011.630474

Hinsen, S., Huber, F., Pantzer, J., Schleich, E., Wilkens, H., Oberländer, A. M., Graf-Drasch, V., Crome, C., Meyer-Hollatz, T., & Bitzer, M. (2023). *Building a Digital and Sustainable Future – Twin Transformation Study*. https://www.ey.com/de_de/functional/forms/download/building-a-digital-and-sustainable-future-twin-transformation-study-volume-2

Hölscher, K., Wittmayer, J. M., & Loorbach, D. (2018). Transition Versus Transformation: What's the Difference? *Environmental Innovation and Societal Transitions*, *27*, 1–3. https://doi.org/10.1016/j.eist.2017.10.007

Horte, S. A., & Halila, F. (2008). Success Factors for Eco-innovations and Other Innovations. *International Journal of Innovation and Sustainable Development*, *3*(3/4), Article 22231, 301. https://doi.org/10.1504/IJISD.2008.022231

Hsu, H.-Y., Liu, F.-H., Tsou, H.-T., & Chen, L.-J. (2019). Openness of Technology Adoption, Top Management Support and Service Innovation: A Social Innovation Perspective. *Journal of Business & Industrial Marketing*, *34*(3), 575–590. https://doi.org/10.1108/JBIM-03-2017-0068

Hussain, H., Jun, W., & Radulescu, M. (2024). Innovation Performance in the Digital Divide Context: Nexus of Digital Infrastructure, Digital Innovation, and E-knowledge. *Journal of the Knowledge Economy.* Advance online publication. https://doi.org/10.1007/s13132-024-02058-w

Hussin, Y. A., & Gilani, H. (2011). Mapping Carbon Stocks in Community Forests of Nepal Using High Spatial Resolution Satellite Images. *Sustainable Mountain Development*, *60*, 22–24.

Jain, P. K., Hazenberg, R., Seddon, F., & Denny, S. (2020). Social Value as a Mechanism for Linking Public Administrators with Society: Identifying the Meaning, Forms and Process of Social Value Creation. *International Journal of Public Administration*, *43*(10), 876–889. https://doi.org/10.1080/01900692.2019.1660992

Jalali, M. S., & Beaulieu, E. (2023). Strengthening a Weak Link: Transparency of Causal Loop Diagrams, Current State and Recommendation. *System Dynamics Review*, *40*(4). https://doi.org/10.1002/sdr.1753

Johansson, S., Kullström, M., Björk, J., Karlsson, A., & Nilsson, S. (2020). Digital Production Innovation Projects – The Applicability of Managerial Controls Under High Levels of Complexity and Uncertainty. *Journal of Manufacturing Technology Management*, *32*(3), 772–794. https://doi.org/10.1108/JMTM-04-2019-0145

Kaewsaengon, R., Kittichotwattana, O., Tongsri, P., Namee, K., & Hamid, M. (2023). Digital Media and Business Performance: Interactive Effects of Digital Innovation and Business Network Resilience. *Pakistan Journal of Life and Social Sciences, 21*, 775–792. https://doi.org/10.57239/PJLSS-2023-21.2.018.

Kayser, V., Nehrke, B., & Zubovic, D. (2018). Data Science as an Innovation Challenge: From Big Data to Value Proposition. *Technology Innovation Management Review*, *8*(3), 16–25. https://doi.org/10.22215/timreview/1143

Khin, S., & Ho, T. C. F. (2019). Digital Technology, Digital Capability and Organizational Performance. *International Journal of Innovation Science*, *11*(2), 177–195. https://doi.org/10.1108/IJIS-08-2018-0083

Khrais, L. T., & Alghamdi, A. M. (2022). Factors That Affect Digital Innovation Sustainability Among SMEs in the Middle East Region. *Sustainability*, *14*(14), 8585. https://doi.org/10.3390/su14148585

Kneissel, K., Oberländer, A., Pedraza-Copete, M., & Schäfer, R. (2023). Effects of Digital Transformation on Social Sustainability – An Effect Path Perspective. *Proceedings of the 31st European Conference on Information Systems*. https://aisel.aisnet.org/ecis2023_rp/235

Ko, W. W., Liu, G., Wan Yusoff, W. T., & Che Mat, C. R. (2019). Social Entrepreneurial Passion and Social Innovation Performance. *Nonprofit and Voluntary Sector Quarterly*, *48*(4), 759–783. https://doi.org/10.1177/0899764019830243

Kohli, R., & Melville, N. P. (2019). Digital Innovation: A Review and Synthesis. *Information Systems Journal*, *29*(1), 200–223. https://doi.org/10.1111/isj.12193

Kok, J. de, & Uhlaner, L. M. (2001). Organization Context and Human Resource Management in the Small Firm. *Small Business Economics*, *17*(4), 273–291. https://doi.org/10.1023/A:1012238224409

Kopnina, H. (2017). Sustainability: New Strategic Thinking for Business. *Environment, Development and Sustainability*, *19*(1), 27–43. https://doi.org/10.1007/s10668-015-9723-1

Kotlarsky, J., Oshri, I., & Sekulic, N. (2023). Digital Sustainability in Information Systems Research: Conceptual Foundations and Future Directions. *Journal of the Association for Information Systems*, *24*(4), 936–952. https://doi.org/10.17705/1jais.00825

Kuester, S., Schuhmacher, M. C., Gast, B., & Worgul, A. (2013). Sectoral Heterogeneity in New Service Development: An Exploratory Study of Service Types and Success Factors. *Journal of Product Innovation Management*, *30*(3), 533–544. https://doi.org/10.1111/jpim.12005

Lettice, F., & Parekh, M. (2010). The Social Innovation Process: Themes, Challenges and Implications for Practice. *International Journal of Technology Management*, *51*(1), Article 33133, 139–158. https://doi.org/10.1504/IJTM.2010.033133

Li, C [Cai], Khan, A., Ahmad, H., & Shahzad, M [Mohsin] (2022). Business Analytics Competencies in Stabilizing Firms' Agility and Digital Innovation amid COVID-19. *Journal of Innovation & Knowledge*, *7*(4), 100246. https://doi.org/10.1016/j.jik.2022.100246

Li, C [Chuan], & Bacete, G. (2022). Mapping the Technology Footprint in Design for Social Innovation. *International Journal of Innovation Studies*, *6*(3), 216–227. https://doi.org/10.1016/j.ijis.2022.07.003

Liu, Q., Trevisan, A. H., Yang, M., & Mascarenhas, J. (2022). A Framework of Digital Technologies for the Circular Economy: Digital Functions and Mechanisms. *Business Strategy and the Environment*, *31*(5), 2171–2192. https://doi.org/10.1002/bse.3015

Liu, W [Weiguo], Zhang, Z., Xie, X., Yu, Z., Gadow, K. von, Xu, J., Zhao, S., & Yang, Y. (2017). Analysis of the Global Warming Potential of Biogenic CO2 Emission in Life Cycle Assessments. *Scientific Reports*, *7*, 39857. https://doi.org/10.1038/srep39857

Lock, I., & Seele, P. (2017). Theorizing Stakeholders of Sustainability in the Digital Age. *Sustainability Science*, *12*(2), 235–245. https://doi.org/10.1007/s11625-016-0404-2

Loeser, F. (2013). Green IT and Green IS: Definition of Constructs and Overview of Current Practices. *Proceedings of the 19th Americas Conference on Information Systems*. https://aisel.aisnet.org/amcis2013/GreenIS/GeneralPresentations/4

Lu, H. T., Li, X., & Yuen, K. F. (2023). Digital Transformation as an Enabler of Sustainability Innovation and Performance – Information Processing and Innovation Ambidexterity Perspectives. *Technological Forecasting and Social Change*, *196*, 122860. https://doi.org/10.1016/j.techfore.2023.122860

Lubberink, R., Blok, V., van Ophem, J., & Omta, O. (2017). Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices. *Sustainability*, *9*(5), Article 721. https://doi.org/10.3390/su9050721

Lyu, C., Peng, C., Yang, X., & Liu, F. (2024). Is Ambidextrous Learning a Driver for SMEs' Sustainable Competitive Advantage in the Digital Era? An Empirical Study of SMEs in Nanjing, China. *Corporate Social Responsibility and Environmental Management*, *31*(2), 1052–1062. https://doi.org/10.1002/csr.2622

Maclean, M., Harvey, C., & Gordon, J. (2013). Social Innovation, Social Entrepreneurship and the Practice of Contemporary Entrepreneurial Philanthropy. *International Small Business Journal: Researching Entrepreneurship*, *31*(7), 747–763. https://doi.org/10.1177/0266242612443376

Mahtta, R., Fragkias, M., Güneralp, B., Mahendra, A., Reba, M., Wentz, E. A., & Seto, K. C. (2022). Urban Land Expansion: The Role of Population and Economic Growth for 300+ Cities. *Npj Urban Sustainability*, *2*(1). https://doi.org/10.1038/s42949-022-00048-y

Mair, J., & Schoen, O. (2007). Successful Social Entrepreneurial Business Models in the Context of Developing Economies. *International Journal of Emerging Markets*, *2*(1), 54–68. https://doi.org/10.1108/17468800710718895

Martínez-Martínez, A., Cegarra-Navarro, J.-G., Garcia-Perez, A., & Valon, T. de (2023). Active Listening to Customers: Eco-innovation Through Value Co-creation in the Textile Industry. *Journal of Knowledge Management*, *27*(7), 1810–1829. https://doi.org/10.1108/JKM-04-2022-0309

Mascaro, J., Asner, G. P., Knapp, D. E., Kennedy-Bowdoin, T., Martin, R. E., Anderson, C., Higgins, M., & Chadwick, K. D. (2014). A Tale of Two "Forests": Random Forest

Machine Learning AIDS Tropical Forest Carbon Mapping. *PLOS ONE*, *9*(1), e85993. https://doi.org/10.1371/journal.pone.0085993

Meland, K. V., Fitjar, R. D., Solheim, M. C. W., & Iakoleva, T. A. (2023). Digital Product Innovations: The Impact of Inter-firm Collaboration and Manager's Attitudes. *International Journal of Innovation Management*, *27*(0102), Article 2350012. https://doi.org/10.1142/S1363919623500123

Melville (2010). Information Systems Innovation for Environmental Sustainability. *MIS Quarterly*, *34*(1), 1. https://doi.org/10.2307/20721412

Mendez-Picazo, M.-T., Galindo-Martin, M.-A., & Perez-Pujol, R.-S. (2024). Direct and Indirect Effects of Digital Transformation on Sustainable Development in Pre- and Post-Pandemic Periods. *Technological Forecasting and Social Change*, *200*, 123139. https://doi.org/10.1016/j.techfore.2023.123139

Metszősy, G. (2020). Evaluating Social Innovation Tools: Process-oriented Approach. *Theory, Methodology, Practice*, *16*(1), 19–29. https://doi.org/10.18096/TMP.2020.01.03

Meyer, H., & Hartmann, T. (2023). The FLOODLABEL as a Social Innovation in Flood Risk Management to Increase Homeowners' Resilience. *Journal of Flood Risk Management*, Article e12962. Advance online publication. https://doi.org/10.1111/jfr3.12962

Mingers, J. (2001). Combining IS Research Methods: Towards a Pluralist Methodology. *Information Systems Research*, *12*(3), 240–259. https://doi.org/10.1287/isre.12.3.240.9709

Mirvis, P., Herrera, M. E. B., Googins, B., & Albareda, L. (2016). Corporate Social Innovation: How Firms Learn to Innovate for the Greater Good. *Journal of Business Research*, *69*(11), 5014–5021. https://doi.org/10.1016/j.jbusres.2016.04.073

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2015). Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P). *Systematic Reviews*, *4*(1), 1. https://doi.org/10.1186/2046-4053-4-1

Moreira, R. M., Lana, M., Sieber, S., & Malheiros, T. F. (2024). A Landscape Ecology Approach: Modeling Forest Fragmentation with Artificial Neural Networks and Cellular-automata Markov-chain for Improved Environmental Policy in the Southwestern Brazilian Amazon. *Land Degradation & Development*, *35*(2), 687–704. https://doi.org/10.1002/ldr.4945

Morford, S. L., Allred, B. W., Jensen, E. R., Maestas, J. D., Mueller, K. R., Pacholski, C. L., Smith, J. T., Tack, J. D., Tackett, K. N., & Naugle, D. E. (2024). Mapping Tree Cover Expansion in Montana, U.S.A. Rangelands Using High-resolution Historical Aerial imagery. *Remote Sensing in Ecology and Conservation*, *10*(1), 91–105. https://doi.org/10.1002/rse2.357

Mulgan, G., Tucker, S., Ali, R., & Sanders, B. (2007). Social Innovation: What It Is, Why It Matters and How It Can Be Accelerated. In https://www.semanticscholar.org/paper/Social-Innovation%3A-What-it-is%2C-why-it-matters-and-Mulgan-Tucker/5b16863e55d8a892bf92e7a4532eca4f56ca0103

Müller, S., Obwegeser, N., Glud, J., & Johildarson, G. (2019). Digital Innovation and Organizational Culture: The Case of a Danish Media Company. *Scandinavian Journal of Information Systems*, *31*(2), 3–34. https://aisel.aisnet.org/sjis/vol31/iss2/1

Müller, S., Påske, N., & Rodil, L. (2019). Managing Ambidexterity in Startups Pursuing Digital Innovation. *Communications of the Association for Information Systems*, *44*(1), 273–298. https://doi.org/10.17705/1CAIS.04418

Myers, M. D., & Newman, M. (2007). The Qualitative Interview in IS research: Examining the Craft. *Information and Organization*, *17*(1), 2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001

Najib, M., Abdul Rahman, A. A., Abror, A., Rachmawati, R., Simanjuntak, M., Prasetya, P., Suhartanto, D., & Fahma, F. (2021). Leaders' Support of Sustainable Innovation and Business Sustainability in Developing Countries: Evidence From Small And Medium Food Processing Enterprises. *Sustainability*, *13*(23), 13091. https://doi.org/10.3390/su132313091

Nambisan, S. (2017). Digital Entrepreneurship: Toward a Digital Technology Perspective of Entrepreneurship. *Entrepreneurship: Theory and Practice*, *41*(6), 1029–1055. https://doi.org/10.1111/etap.12254

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing Innovation Management Research in a Digital World. *MIS Quarterly*, *41*(1), 223–238. https://www.jstor.org/stable/26629644

Naranjo-Valencia, J. C., Ocampo-Wilches, A. C., & Trujillo-Henao, L. F. (2020). From Social Entrepreneurship to Social Innovation: The Role of Social Capital. Study Case in

Colombian Rural Communities Victim of Armed Conflict. *Journal of Social Entrepreneurship*, *13*(2), 1–34. https://doi.org/10.1080/19420676.2020.1770317

Narula, S., Tamvada, J. P., Kumar, A., Puppala, H., & Gupta, N. (2024). Putting Digital Technologies at the Forefront of Industry 5.0 for the Implementation of a Circular Economy in Manufacturing Industries. *IEEE Transactions on Engineering Management*, *71*, 3363–3374. https://doi.org/10.1109/TEM.2023.3344373

Nayal, K., Raut, R. D., Yadav, V. S., Priyadarshinee, P., & Narkhede, B. E. (2022). Retracted: The Impact of Sustainable Development Strategy on Sustainable Supply Chain Firm Performance in the Digital Transformation Era. *Business Strategy and the Environment*, *31*(3), 845–859. https://doi.org/10.1002/bse.2921

Neptune, N., & Mothe, J. (2023). Annotating Satellite Images of Forests With Keywords From a Specialized Corpus in the Context of Change Detection. In *CBMI '23, Proceedings of the 20th International Conference on Content-Based Multimedia Indexing* (pp. 14–20). Association for Computing Machinery. https://doi.org/10.1145/3617233.3617242

Neumeier, S. (2017). Social Innovation in Rural Development: Identifying the Key Factors of Success. *The Geographical Journal*, *183*(1), 34–46. https://doi.org/10.1111/geoj.12180

Nguyen, L., Lane, M., Nallaperuma, K., & Deniz, E. (2023). A Socio-Ecological-Technical Perspective: How has Information Systems Contributed to Solving the Sustainability Problem. *Proceedings of the 31st European Conference on Information Systems*. https://aisel.aisnet.org/ecis2023_rp/304

Nilashi, M., Ahmadi, H., Ahani, A., Ravangard, R., & Ibrahim, O. (2016). Determining the Importance of Hospital Information System Adoption Factors Using Fuzzy Analytic Network Process. *Technological Forecasting and Social Change*, *111*, 244–264. https://doi.org/10.1016/j.techfore.2016.07.008

Noor, S., Mumtaz, R., & Khan, M. A. (2024). Temporal Assessment of Forest Cover Dynamics in Response to Forest Fires and Other Environmental Impacts Using AI. *Environmental Monitoring and Assessment*, *196*(10), 893. https://doi.org/10.1007/s10661-024-12992-6

Nordberg, K., Mariussen, Å., & Virkkala, S. (2020). Community-driven Social Innovation and Quadruple Helix Coordination in Rural Development. Case study on LEADER Group Aktion Österbotten. *Journal of Rural Studies*, *79*, 157–168. https://doi.org/10.1016/j.jrurstud.2020.08.001

Nylén, D., & Holmström, J. (2015). Digital Innovation Strategy: A Framework for Diagnosing and Improving Digital Product and Service Innovation. *Business Horizons*, *58*(1), 57–67. https://doi.org/10.1016/j.bushor.2014.09.001

Oberländer, A. M., Röglinger, M., & Rosemann, M. (2021). Digital Opportunities for Incumbents - A Resource-centric Perspective. *The Journal of Strategic Information Systems*, *30*(3), 101670. https://doi.org/10.1016/j.jsis.2021.101670

Oeij, P. R., van der Torre, W., Vaas, F., & Dhondt, S. (2019). Understanding Social Innovation as an Innovation Process: Applying the Innovation Journey Model. *Journal of Business Research*, *101*, 243–254. https://doi.org/10.1016/j.jbusres.2019.04.028

Oliveira, S. R. M., & Sbragia, R. (2012). Knowledge Build-up High Complexity Environment: Towards on the Innovation Value Chain Performance in the Product Development Process Under Uncertainty and Restraint. *International Journal of Enterprise Network Management*, *5*, 97-125. https://doi.org/10.1504/IJENM.2012.047615

Ollagnier, J.-M. (2021). The European Double Up: A Twin Strategy That Will Strengthen Competitiveness. https://www.accenture.com/content/dam/accenture/final/a-com-migration/r3-3/pdf/pdf-144/accenture-the-european-double-up.pdf#zoom=50

Ologeanu-Taddei, R., Hönigsberg, S., Weritz, P., Wache, H., Mittermeier, F., Tana, S., Dang, D., Hautala-Kankaanpää, T., & Pekkola, S. (2025). The Relationship of Digital Transformation and Corporate Sustainability: Synergies and Tensions. *Technological Forecasting and Social Change*, *210*, 123809. https://doi.org/10.1016/j.techfore.2024.123809

Onsongo, E. (2019). Institutional Entrepreneurship and Social Innovation at the Base of the Pyramid: The Case of M-Pesa in Kenya. *Industry and Innovation*, *26*(4), 369–390. https://doi.org/10.1080/13662716.2017.1409104

Orji, I. J., Kusi-Sarpong, S., & Gupta, H. (2020). The Critical Success Factors of Using Social Media for Supply Chain Social Sustainability in the Freight Logistics Industry. *International Journal of Production Research*, *58*(5), 1522–1539. https://doi.org/10.1080/00207543.2019.1660829

Ozkan-Ozen, Y. D., Kazancoglu, Y., & Kumar Mangla, S. (2020). Synchronized Barriers for Circular Supply Chains in Industry 3.5/Industry 4.0 Transition for Sustainable Resource

Management. *Resources, Conservation and Recycling*, *161*, 104986. https://doi.org/10.1016/j.resconrec.2020.104986

Pappas, I. O., Mikalef, P., Dwivedi, Y. K., Jaccheri, L., & Krogstie, J. (2023). Responsible Digital Transformation for a Sustainable Society. *Information Systems Frontiers*, *25*(3), 945–953. https://doi.org/10.1007/s10796-023-10406-5

Pasricha, P., & Rao, M. K. (2018). The Effect of Ethical Leadership on Employee Social Innovation Tendency in Social Enterprises: Mediating Role of Perceived Social Capital. *Creativity and Innovation Management*, *27*(3), 270–280. https://doi.org/10.1111/caim.12287

Pearce, C. L., & van Knippenberg, D. (2023). Social Innovation is a Team Sport: Combining Top-Down and Shared Leadership for Social Innovation. *Business & Society, 63*, 1067-1072. https://doi.org/10.1177/00076503231190835

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. *Journal of Management Information Systems*, *24*(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302

Peng, X., Kurnia, S., Samson, D., & Cui, T. (2022). Exploring IT-Enabled Sustainability-Oriented Innovation: A Case Study. *Proceedings of the 26th Pacific Asia Conference on Information Systems*. https://aisel.aisnet.org/pacis2022/228

Perrini, F., Vurro, C., & Costanzo, L. A. (2010). A Process-based View of Social Entrepreneurship: From Opportunity Identification to Scaling-up Social Change in the Case of San Patrignano. *Entrepreneurship & Regional Development*, *22*(6), 515–534. https://doi.org/10.1080/08985626.2010.488402

Petropoulou, E., Benos, T., Theodorakopoulou, I., Iliopoulos, C., Castellini, A., Xhakollari, V., Canavari, M., Antonelli, A., & Petruzzella, D. (2022). Understanding Social Innovation in Short Food Supply Chains: An Exploratory Analysis. *International Journal of Food Studies*, *11*(2), SI182-SI195. https://doi.org/10.7455/ijfs/11.SI.2022.a5

Pfitzer, M., Bockstette, V., & Stamp, M. (2013). Innovating for Shared Value: Companies That Deliver Both Social Benefit and Business Value Rely on Five Mutually Reinforcing Elements. *Harvard Business Review*, *91*(9), 100–107. https://hbr.org/2013/09/innovating-for-shared-value

Phillips, W., Alexander, E. A., & Lee, H [Hazel] (2019). Going It Alone Won't Work! The Relational Imperative for Social Innovation in Social Enterprises. *Journal of Business Ethics*, *156*(2), 315–331. https://doi.org/10.1007/s10551-017-3608-1

Phills, J. A., Deiglmeier, K., & Miller, D. T. (2008). Rediscovering Social Innovation. *Stanford Social Innovation Review*, *6*(4), 34–43. https://doi.org/10.48558/GBJY-GJ47

Piccoli, G., Grover, V., & Rodriguez, J. (2024). Digital Transformation Requires Digital Resource Primacy: Clarification and Future Research Directions. *The Journal of Strategic Information Systems*, *33*(2), 101835. https://doi.org/10.1016/j.jsis.2024.101835

Porter, M. E., & Kramer, M. R. (2006). The Link Between Competitive Advantage and Corporate Social Reermsponsibility. *Harvard Business Review*, *84*(12), 78–92. https://www.academia.edu/2203469/The_link_between_competitive_advantage_and_corporate_social_responsibility

Qian, Y., Zhou, L., & Liu, X. (Eds.) (2017). Analysis of Enterprise Human Resource Management and the Firm Performance. in: *Proceedings of the 2017 3rd International Conference on Economics, Social Science, Arts, Education and Management Engineering (ESSAEME 2017)*, Huhhot, China

Qureshi, I., Pan, S. L., & Zheng, Y. (2021). Digital Social Innovation: An Overview and Research Framework. *Information Systems Journal*, *31*(5), 647–671. https://doi.org/10.1111/isj.12362

Ramadan, M. N., Ali, M. A., Khoo, S. Y., & Alkhedher, M. (2024). AI-powered IoT and UAV Systems for Real-time Detection and Prevention of Illegal Logging. *Results in Engineering*, *24*, 103277. https://doi.org/10.1016/j.rineng.2024.103277

Rauter, R., Globocnik, D., Perl-Vorbach, E., & Baumgartner, R. J. (2019). Open Innovation and Its Effects on Economic and Sustainability Innovation Performance. *Journal of Innovation & Knowledge*, *4*(4), 226–233. https://doi.org/10.1016/j.jik.2018.03.004

Renland Haugjord, B., & Kempton, A. (2022). Achieving Data Innovation for Sustainable Energy Solutions. *Proceedings of the 30th European Conference on Information Systems*. https://aisel.aisnet.org/ecis2022_rp/87

Rodrigo, L., & Palacios, M. (2021). What Antecedent Attitudes Motivate Actors to Commit to the Ecosystem of Digital Social Innovation? *Technological Forecasting & Social Change*, *162*, Article 120394. https://doi.org/10.1016/j.techfore.2020.120394

Roundy, P. T. (2017). “Doing good” While Serving Customers: Charting the Social Entrepreneurship and Marketing Interface. *Journal of Research in Marketing and Entrepreneurship*, *19*(2), 105–124. https://doi.org/10.1108/JRME-03-2017-0009

Roundy, P. T., & Bonnal, M. (2017). The Singularity of Social Entrepreneurship: Untangling Its Uniqueness and Market Function. *The Journal of Entrepreneurship*, *26*(2), 137–162. https://doi.org/10.1177/0971355717708068

Sanderman, J., Hengl, T., Fiske, G., Solvik, K., Adame, M. F., Benson, L., Bukoski, J. J., Carnell, P., Cifuentes-Jara, M., Donato, D., Duncan, C., Eid, E. M., Ermgassen, P. zu, Lewis, C. J. E., Macreadie, P. I., Glass, L., Gress, S., Jardine, S. L., Jones, T. G., . . . Landis, E. (2018). A Global Map of Mangrove Forest Soil Carbon at 30 m Spatial Resolution. *Environmental Research Letters*, *13*(5), 55002. https://doi.org/10.1088/1748-9326/aabe1c

Sanzo-Perez, M. J., Álvarez-González, L. I., & Rey-García, M. (2015). How to Encourage Social Innovations: A Resource-based Approach. *The Service Industries Journal*, *35*(7-8), 430–447. https://doi.org/10.1080/02642069.2015.1015517

Schmermbeck, H., Thünnesen, J., Voss, N., & Ahlemann, F. (2020). Green IS Does Not Just Save Energy – Insights from a Survey on Organizations’ Uses of Sustainable Technologies. *Proceedings of the 53rd Hawaii International Conference on System Sciences*. https://aisel.aisnet.org/hicss-53/da/analytics_for_green_is/2

Schultze, U., & Avital, M. (2011). Designing Interviews to Generate Rich Data for Information Systems Research. *Information and Organization*, *21*(1), 1–16. https://doi.org/10.1016/j.infoandorg.2010.11.001

Schweitzer, F., Rau, C., Gassmann, O., & van den Hende, E. (2015). Technologically Reflective Individuals as Enablers of Social Innovation. *Journal of Product Innovation Management*, *32*(6), 847–860. https://doi.org/10.1111/jpim.12269

Seidel, S., Bharati, P., Fridgen, G., Watson, R. T., Albizri, A., Boudreau, M.-C., Butler, T., Chandra Kruse, L., Guzman, I., Karsten, H., Lee, H [Habin], Melville, N., Rush, D., Toland, J., & Watts, S. (2017). The Sustainability Imperative in Information Systems Research. *Communications of the Association for Information Systems*, *40*(1), 40–52. https://doi.org/10.17705/1CAIS.04003

Senge, P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. Doubleday Currence.

Shah, N., Zehri, A. W., Saraih, U. N., Abdelwahed, N. A. A., & Soomro, B. A. (2024). The Role of Digital Technology and Digital Innovation Towards Firm Performance in a Digital Economy. *Kybernetes*, *53*(2), 620–644. https://doi.org/10.1108/K-01-2023-0124

Shankar, S., & Reuther, A. (2022). Trends in Energy Estimates for Computing in AI/Machine Learning Accelerators, Supercomputers, and Compute-Intensive Applications. In *2022 IEEE High Performance Extreme Computing Conference (HPEC)*.

Sharma, G., & Bansal, P. (2023). Partnering Up: Including Managers as Research Partners in Systematic Reviews. *Organizational Research Methods*, *26*(2), 262–291. https://doi.org/10.1177/1094428120965706

Shojaei, R. S., & Burgess, G. (2022). Non-technical Inhibitors: Exploring the Adoption of Digital Innovation in the UK Construction Industry. *Technological Forecasting and Social Change*, *185*, 122036. https://doi.org/10.1016/j.techfore.2022.122036

Sigurdsson, K., & Candi, M. (2020). Saying and Doing: Social Responsibility Declared and Applied. *Creativity and Innovation Management*, *29*(1), 128–140. https://doi.org/10.1111/caim.12340

Singh, C., Karan, S. K., Sardar, P., & Samadder, S. R. (2022). Remote Sensing-based Biomass Estimation of Dry Deciduous Tropical Forest Using Machine Learning and Ensemble Analysis. *Research in Organizational Behavior*, *308*, 114639. https://doi.org/10.1016/j.jenvman.2022.114639

Sirmon, D. G., Hitt, M. A., & Ireland, R. D. (2007). Managing Firm Resources in Dynamic Environments to Create Value: Looking Inside the Black Box. *Academy of Management Review*, *32*(1), 273–292. https://doi.org/10.5465/amr.2007.23466005

Sirmon, D. G., Hitt, M. A., Ireland, R. D., Gilbert, B. A., Barney, J. B., Ketchen, D. J., & Wright, M. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management*, *37*(5), 1390–1412. https://doi.org/10.1177/0149206310385695

Skjott Linneberg, M., & Korsgaard, S. (2019). Coding Qualitative Data: A Synthesis Guiding the Novice. *Qualitative Research Journal*, *19*(3), 259–270. https://doi.org/10.1108/QRJ-12-2018-0012

Slagter, B., Fesenmyer, K., Hethcoat, M., Belair, E., Ellis, P., Kleinschroth, F., Peña-Claros, M., Herold, M., & Reiche, J. (2024). Monitoring Road Development in Congo Basin Forests with Multi-sensor Satellite Imagery and Deep Learning. *Remote Sensing of Environment*, *315*, 114380. https://doi.org/10.1016/j.rse.2024.114380

Soh, C., Yeow, A., & Goh, Q. W. (2023). Shaping Digital Transformation Pathways: Dynamics of Paradoxical Tensions and Responses. *Journal of the Association for Information Systems*, *24*(6), 1594–1617. https://doi.org/10.17705/1jais.00852

Soluk, J., & Kammerlander, N. (2021). Digital Transformation in Family-owned Mittelstand Firms: A Dynamic Capabilities Perspective. *European Journal of Information Systems*, *30*(6), 676–711. https://doi.org/10.1080/0960085X.2020.1857666

Sterman, J. (2000). *Business Dynamics: System Thinking and Modeling for a Complex World*. Irwin McGraw-Hill.

Strubell, E., Ganesh, A., & McCallum, A. (2020). Energy and Policy Considerations for Modern Deep Learning Research. *Proceedings of the AAAI Conference on Artificial Intelligence*, *34*(9), 13693–13696. https://doi.org/10.1609/aaai.v34i09.7123

Suseno, Y., & Abbott, L. (2021). Women Entrepreneurs' Digital Social Innovation: Linking Gender, Entrepreneurship, Social Innovation and Information Systems. *Information Systems Journal*, *31*(5), 717–744. https://doi.org/10.1111/isj.12327

Svahn, F., Mathiassen, L., & Lindgren, R. (2017). Embracing digital innovation in incumbent firms: How volvo cars managed competing concerns. *Management Information Systems Quarterly*, *41*(1), 239–253. https://doi.org/10.25300/MISQ/2017/41.1.12

Taneja, A., Goyal, V., & Malik, K. (2023). Sustainability-oriented Innovations – Enhancing Factors and Consequences. *Corporate Social Responsibility and Environmental Management*, *30*(6), 2747–2765. https://doi.org/10.1002/csr.2513

Tarigan, Z. J. H., & Siagian, H. (2021). The Effects of Strategic Planning, Purchasing Strategy and Strategic Partnership on Operational Performance. *Uncertain Supply Chain Management*, *9*(2), 363–372. https://doi.org/10.5267/j.uscm.2021.2.006

Tim, Y., Cui, L., & Sheng, Z. (2021). Digital Resilience: How Rural Communities Leapfrogged Into Sustainable Development. *Information Systems Journal*, *31*(2), 323–345. https://doi.org/10.1111/isj.12312

Tornatzky, L., & Fleischer, M. (1990). *The Process of Technology Innovation*. Lexington Books.

Tran, H., Juno, E., & Arunachalam, S. (2023). Emissions of Wood Pelletization and Bioenergy Use in the United States. *Renewable Energy*, *219*, 119536. https://doi.org/10.1016/j.renene.2023.119536

Ukko, J., Nasiri, M., Saunila, M., & Rantala, T. (2019). Sustainability Strategy as a Moderator in the Relationship Between Digital Business Strategy and Financial Performance. *Journal of Cleaner Production*, *236*, 117626. https://doi.org/10.1016/j.jclepro.2019.117626

Ullah, A., & Bavorova, M. (2024). Livelihood Impacts of Community-based Forest Landscape Restoration in the Hindu Kush Himalaya, Pakistan. *European Journal of Forest Research*, *143*(6), 1773–1786. https://doi.org/10.1007/s10342-024-01726-5

UNEP. (2024). *Raising Ambition, Accelerating Action: Towards Enhanced Nationally Determined Contributions for Forests*. https://www.un-redd.org/sites/default/files/2024-06/%5BV6%5D_ENG_NDC%20Report%202024.pdf

UNEP, FAO, & UNFF. (2009). *Vital Forest Graphics*. https://www.unep.org/resources/report/vital-forest-graphics

United Nations. (2015). *Transforming Our World: The 2030 Agenda for Sustainable Development*. https://sustainabledevelopment.un.org/content/documents/21252030 Agenda for Sustainable Development web.pdf

United Nations. (2024). *Progress Towards the Sustainable Development Goals*. https://unstats.un.org/sdgs/files/report/2024/SG-SDG-Progress-Report-2024-advanced-unedited-version.pdf

Urban, B., & Gaffurini, E. (2017). Organisational Learning Capabilities as Determinants of Social Innovation: An Empirical Study in South Africa. *SA Journal of Human Resource Management*, *15,* a857. https://doi.org/10.4102/sajhrm.v15i0.857

van Riel, A. C. R., Lemmink, J., & Ouwersloot, H. (2004). High-technology Service Innovation Success: A Decision-making Perspective. *Journal of Product Innovation Management*, *21*(5), 348–359. https://doi.org/10.1111/j.0737-6782.2004.00087.x

Veit, D. J., & Thatcher, J. B. (2023). Digitalization as a Problem or Solution? Charting the Path for Research on Sustainable Information Systems. *Journal of Business Economics*, *93*(6-7), 1231–1253. https://doi.org/10.1007/s11573-023-01143-x

VHB. (2024). *VHB Area Ratings*. https://www.vhbonline.org/en/services/vhb-rating-2024/area-ratings

Vial, G. (2019). Understanding Digital Transformation: A Review and a Research Agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

Vicente, P. N., Lucas, M., Carlos, V., & Bem-Haja, P. (2020). Higher Education in a Material World: Constraints to Digital Innovation in Portuguese Universities and Polytechnic Institutes. *Education and Information Technologies*, *25*(6), 5815–5833. https://doi.org/10.1007/s10639-020-10258-5

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 Information Systems Research. *Communications of the Association for Information Systems*, *37*(1). https://doi.org/10.17705/1CAIS.03709

Wahab, M. A. A., Mat Surin, E. S., Mat Nayan, N., & Rahman, H. (2021). Mapping Deforestation in Permanent Forest Reserve of Peninsular Malaysia With Multi-temporal SAR Imagery and U-net Based Semantic Segmentation. *Malaysian Journal of Computer Science*, 15–34. https://doi.org/10.22452/mjcs.sp2021no2.2

Walsham, G. (2012). Are we Making a Better World with ICTs? Reflections on a Future Agenda for the IS Field. *Journal of Information Technology*, *27*(2), 87–93. https://doi.org/10.1057/jit.2012

Wang, J., Hong, Z., & Long, H. (2023). Digital Transformation Empowers ESG Performance in the Manufacturing Industry: From ESG to DESG. *Sage Open*, *13*(4), Article 21582440231204158. https://doi.org/10.1177/21582440231204158

Wang, K., Chen, B., & Li, Y. (2024). Technological, Process or Managerial Innovation? How Does Digital Transformation Affect Green Innovation in Industrial Enterprises? *Economic Change and Restructuring*, *57*(1), 10. https://doi.org/10.1007/s10644-024-09598-w

Weppen, J. von der, & Cochrane, J. (2012). Social Enterprises in Tourism: An Exploratory Study of Operational Models and Success Factors. *Journal of Sustainable Tourism*, *20*(3), 497–511. https://doi.org/10.1080/09669582.2012.663377

Weritz, P., Matute, J., Braojos, J., & Kane, J. (2022). How Much Digital is Too Much? A Study on Employees' Hybrid Workplace Preferences. *Proceedings of the 43rd International*

Conference on Information Systems. https://aisel.aisnet.org/icis2022/is_futureofwork/is_futureofwork/3

Wernerfelt, B. (1984). A Resource-based View of the Firm. *Strategic Management Journal*, *5*(2), 171–180. https://doi.org/10.1002/smj.4250050207

Wessel, L., Baiyere, A., Ologeanu-Taddei, R., Cha, J., & Blegind Jensen, T. (2021). Unpacking the Difference Between Digital Transformation and IT-enabled Organizational Transformation. *Journal of the Association for Information Systems*, *22*(1), 102–129. https://doi.org/10.17705/1jais.00655

Westley, F., Antadze, N., Riddell, D. J., Robinson, K., & Geobey, S. (2014). Five Configurations for Scaling Up Social Innovation. *The Journal of Applied Behavioral Science*, *50*(3), 234–260. https://doi.org/10.1177/0021886314532945

Wiesböck, F., & Hess, T. (2020). Digital Innovations. *Electronic Markets*, *30*(1), 75–86. https://doi.org/10.1007/s12525-019-00364-9

Wirth, S., Bandi Tanner, M., & Mayer, H. (2023). Social Innovations in Tourism: Analysing Processes, Actors, and Tipping Points. *Tourism Geographies*, *25*(5), 1322–1340. https://doi.org/10.1080/14616688.2022.2155697

Wolfswinkel, J. F., Furtmueller, E., & Wilderom, C. P. M. (2013). Using Grounded Theory as a Method for Rigorously Reviewing Literature. *European Journal of Information Systems*, *22*(1), 45–55. https://doi.org/10.1057/ejis.2011.51

Wood, S. (2012). Prone to Progress: Using Personality to Identify Supporters of Innovative Social Entrepreneurship. *Journal of Public Policy & Marketing*, *31*(1), 129–141. https://doi.org/10.1509/jppm.11.060

Wu, J., Guo, S., Huang, H., Liu, W [William], & Xiang, Y. (2018). Information and Communications Technologies for Sustainable Development Goals: State-of-the-art, Needs and Perspectives. *IEEE Communications Surveys & Tutorials*, *20*(3), 2389–2406. https://doi.org/10.1109/COMST.2018.2812301

Xie, W., Zou, Y., Guo, H [Haizhen], & Li, Z. (2024). What Drives Digital Innovation Cycles? Evidence from Manufacturing Enterprises in China. *Technological Forecasting and Social Change*, *204*, 123449. https://doi.org/10.1016/j.techfore.2024.123449

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research Commentary: The New Organizing Logic of Digital Innovation: An Agenda for Information Systems Research. *Information Systems Research*, *21*(4), 724–735. https://doi.org/10.1287/isre.1100.0322

Yu, D., & Hang, C. C. (2010). A Reflective Review of Disruptive Innovation Theory. *International Journal of Management Reviews*, *12*(4), 435–452. https://doi.org/10.1111/j.1468-2370.2009.00272.x

Yu, Y., Zhang, J. Z., Cao, Y., & Kazancoglu, Y. (2021). Intelligent Transformation of the Manufacturing Industry for Industry 4.0: Seizing Financial Benefits from Supply Chain Relationship Capital Through Enterprise Green Management. *Technological Forecasting and Social Change*, *172*, 120999. https://doi.org/10.1016/j.techfore.2021.120999

Yun, J. J., Egbetoku, A. A., & Zhao, X. (2019). How Does a Social Open Innovation Succeed? Learning from Burro Battery and Grassroots Innovation Festival of India. *Science, Technology and Society*, *24*(1), 122–143. https://doi.org/10.1177/0971721818806101

Yusof, M. M., Kuljis, J., Papazafeiropoulou, A., & Stergioulas, L. K. (2008). An Evaluation Framework for Health Information Systems: Human, Organization and Technology-fit Factors (HOT-fit). *International Journal of Medical Informatics*, *77*(6), 386–398. https://doi.org/10.1016/j.ijmedinf.2007.08.011

Zhu, Q., Ma, D., & He, X. (2023). Digital Transformation and Firms' Pollution Emissions. *Technological Forecasting and Social Change*, *197*, 122910. https://doi.org/10.1016/j.techfore.2023.122910

Zimmer, M. P., & Järveläinen, J. (2022). Digital–Sustainable Co-transformation: Introducing the Triple Bottom Line of Sustainability to Digital Transformation Research. In D. Kreps, R. Davison, T. Komukai, & K. Ishii (Eds.), *IFIP Advances in Information and Communication Technology. Human Choice and Digital by Default: Autonomy vs Digital Determination* (Vol. 656, pp. 100–111). Springer International Publishing. https://doi.org/10.1007/978-3-031-15688-5_10

Zulfiqar, A., Ghaffar, M. M., Shahzad, M [Muhammad], Weis, C., Malik, M. I., Shafait, F., & Wehn, N. (2021). AI-ForestWatch: Semantic Segmentation Based End-to-end Framework for Forest Estimation and Change Detection Using Multi-spectral Remote Sensing Imagery. *Journal of Applied Remote Sensing*, *15*(2). https://doi.org/10.1117/1.JRS.15.024518

VI. Appendix

VI.1 Index of Research Papers

Research Paper 1	**Making the Most of Digital Social Innovation: An Exploration into Success Factors** Buck, C.; **Heim, L.**; Körner-Wyrtki, K.; Krombacher, A.; Röglinger, M. (2025). Making the most of digital social innovation: An exploration into success factors. Journal of Business Research. https://doi.org/10.1016/j.jbusres.2025.115215. (VHB-24[1]: B, VHB-JQ3[2]: B)
Research Paper 2	**Barriers along the digital social innovation process: A structured literature review** Buck, C.; **Kempf, L.**; Kneissel, K.; Krombacher, A. (2023). Barriers along the Digital Social Innovation Process: A Structured Literature Review. Proceedings of the 18th International Conference on Wirtschaftsinformatik. (VHB-24: B (Proceedings), VHB-JQ3: C)
Research Paper 3	**Know Your Worth: Resource-centric Patterns for Creating Digital Social Innovation** Buck, C.; **Heim, L.**; Krombacher, A.; Weissmann, H. (2025). Know your worth: Resource-centric patterns for creating digital social innovation, 1st Round of Revisions: The Journal of Strategic Information Systems. (VHB-24: A, VHB-JQ3: A)
Research Paper 4	**AI in the Web of Trees: A Systems Thinking Approach to Understanding How Artificial Intelligence Affects Deforestation** Krombacher, A.; Buck, C.; **Heim, L.**; Röglinger, M. (2025). AI in the web of trees: A systems thinking approach to understanding how artificial intelligence affects deforestation. Under Review: Technological Forecasting and Social Change. (VHB-24: B, VHB-JQ3: B)
Research Paper 5	**Better Together – The Interplay Between Digital Transformation and Sustainability Transformation to Realize Twin Transformation** Lockl, A.; **Heim, L.**; Oberländer, A. M. (2025). Better Together – The interplay between digital transformation and sustainability transformation to realize twin transformation. International Journal of Innovation Management. (VHB-24: B, VHB-JQ3: B) Earlier version published in Proceedings of the 31th European Conference on Information Systems (ECIS) 2023. https://aisel.aisnet.org/ecis2023_rp/255/. (VHB-24: A (Proceedings), VHB-JQ3: B)
Research Paper 6	**Twin to Win: A Resource Orchestration Perspective on Twin Transformation** Burghard, F.; **Heim, L.**; Kreuzer, T.; Wozar, J. (2025). Twin to win: A resource orchestration perspective on twin transformation. Proceedings of the 33th European Conference on Information Systems (ECIS) 2025. https://aisel.aisnet.org/ecis2025/digitrans/digtrans/10/. (VHB-24: A (Proceedings), VHB-JQ3: B)

[1] VHB-24: VHB Publication Media Rating 2024
[2] VHB-JQ3: VHB-JOURQUAL3

Research Paper 7	**Navigating Twin Transformation: A Systematic Approach for Twin Transformation Strategy Development** **Heim, L.**; Buck, C.; Lockl, A.; Oberländer, A. M. (2025). Navigating twin transformation: A systematic approach for twin transformation strategy development. Under Review: Information Systems Frontiers. (VHB-24: B, VHB-JQ3: B)

Table 10. Index of research papers

Further, I also co-authored the following research papers. These research papers are not part of this dissertation.

Executing Design Sprints for Digital Innovation with Incumbents
Buck, C.; **Heim, L.**; Kreuzer, T.; Brugger, P. (2025). Executing Design Sprints for Digital Innovation with Incumbents. IEEE Engineering Management Review. (VHB-24: B, VHB-JQ3: -)
Die erfolgreiche Gestaltung des Distributionsmodells im Rahmen der Digitalisierung
Buck, C.; **Kempf, L.** (2019). Die erfolgreiche Gestaltung des Distributionsmodells im Rahmen der Digitalisierung. Digitale Geschäftsmodelle – Band 1. Edition HMD. Springer Vieweg, Wiesbaden. https://doi.org/10.1007/978-3-658-26314-0_9. (VHB-24: C, VHB-JQ3: D)

Table 11. Further research papers

VI.2 Individual Contribution to the Included Research Articles

This cumulative dissertation includes seven research papers, which were all written with multiple co-authors. The following section outlines the paper settings and describes my contribution to each paper. The explanations follow the contributor roles taxonomy (CRediT) by Allen et al. (2019)[3].

Research Paper 1 *Making the most of digital social innovation: An exploration into success factors* (Buck et al. (2025); Section II.1) was written in a team of five co-authors. I contributed to the conceptualization of the research paper. Moreover, I was responsible for the investigation (i.e., data collection) and data curation (i.e., coding). I played a key role in writing the original draft and revising the manuscript. In sum, I was involved in each part of the manuscript. As a team, we agreed that we all contributed to this research paper in equal parts.

Research Paper 2 *Barriers along the digital social innovation process: A structured literature review* (Buck et al. (2023); Section II.1) was written in a team of four co-authors. I was involved in the conceptualization of the research paper and writing parts of the original draft. In addition, I mainly contributed through the review and editing of the original manuscript as well as during the revision process through taking on a supervising role. As a team, we agreed that we all contributed to this research paper in equal parts.

Research Paper 3 *Know your worth: Resource-centric patterns for creating digital social innovation* (Buck et al. (2025); Section II.2) was written in a team of four co-authors. I was involved in the conceptualization of the research paper and writing parts of the original draft. Moreover, I was involved in data curation and responsible for investigation (i.e., coding, pattern analysis). Furthermore, I fulfilled a supervising role in the beginning of the research project and played a key role in revising the manuscript. In sum, I was involved in each part of the paper. As a team, we agreed that we all contributed to this research paper in equal parts.

Research Paper 4 *AI in the web of trees: A systems thinking approach to understanding how artificial intelligence affects deforestation* (Krombacher et al. (2025); Section II.2) was written in a team of four co-authors. I was involved in the conceptualization of the research paper and writing parts of the original manuscript as well as assisting in data curation. Moreover, I was

[3] Allen, L., O'Connell, A., & Kiermer, V. (2019). How can we ensure visibility and diversity in research contributions? How the Contributor Role Taxonomy (CRediT) is helping the shift from authorship to contributorship. Learned Publishing, 32(1), 71-74.

involved in the review and editing process of the original draft. I acted as a subordinate author on this manuscript.

Research Paper 5 *Better Together – The interplay between digital transformation and sustainability transformation to realize twin transformation* (Lockl et al. (2025); Section III.1) was written in a team of three co-authors. I was involved in the conceptualization of the research paper and writing parts of the original draft. Moreover, I was involved in data curation and responsible for investigation (i.e., coding). Furthermore, I played a key role in revising the manuscript. In sum, I was involved in each part of the paper. I acted as a subordinate author on this manuscript.

Research Paper 6 *Twin to win: A resource orchestration perspective on twin transformation* (Burghard et al. (2025); Section III.2) was written in a team of four co-authors. I contributed significantly to the conceptualization and methodology of the research project. In addition, I mainly contributed through the review and editing of the original manuscript as well as during the revision process through taking on a supervising role. As a team, we agreed that we all contributed to this research paper in equal parts.

Research Paper 7 *Navigating twin transformation: A systematic approach for twin transformation strategy development* (Heim et al. (2025); Section III.2) was written in a team of four co-authors. As the lead author, I had a central role in initiating and driving the entire research project. I was responsible for the conceptualization of the research paper. Moreover, I was responsible for investigation (i.e., conducting expert interviews and evaluation workshops) and data curation. Furthermore, I was responsible for writing and editing the original draft. I acted as the lead author, while the other three co-authors acted as subordinate authors.

VI.3 Research Paper 1: Making the Most of Digital Social Innovation: An Exploration into Success Factors

Authors:

Christoph Buck, Laura Heim, Katrin Körner-Wyrtki, Anna Krombacher, Maximilian Röglinger

Published in:

Journal of Business Research. 190. 115215 (2025). DOI: 10.1016/j.jbusres.2025.115215

Abstract:

Digital social innovation (DSI) is an emerging phenomenon that leverages digital technologies to address societal challenges. With the growing interest of customers, employees, and investors in societal challenges, as well as the availability and affordability of digital technologies, DSI gains importance for organisations to achieve long-term success. Although DSI has evoked increasing interest, research and practice are far from realising the potential of DSI as guidance on its successful development is missing. To minimise the risk of failure and fully exploit the benefits of DSI, this research explores DSI success factors based on a systematic literature review and explorative interview. Building on these valuable insights, we present the DSI success factor framework (DSF) consisting of 18 DSI success factors in three categories, moderating factors, and the DSI success. The DSF contributes descriptive knowledge on DSI development and is a foundation for further research while inspiring practitioners to successfully develop DSI.

Keywords:

Digital Social Innovation, Digital Innovation, Social Innovation, Success Factors, Systematic Literature Review, Interview Study

VI.4 Research Paper 2: Barriers along the digital social innovation process: A structured literature review

Authors:

Christoph Buck, Laura Kempf, Katharina Kneissel, Anna Krombacher

Published in:

Proceedings of the 18th International Conference on Wirtschaftsinformatik. 60. (2023). https://aisel.aisnet.org/wi2023/60

Abstract:

Digital social innovation (DSI) is an emerging phenomenon drawing knowledge from digital innovation (DI) and social innovation (SI), offering opportunities to contribute to societal change by leveraging the potential of digital technologies. Although DSI has evoked increasing interest, research and practice are far from realising its full potential as many barriers arise along the DSI process. Thus, holistic insights into DSI process and its barriers are essential. Therefore, we identify barriers along the DSI process through a structured literature review considering DI, SI, and DSI literature. As a result, we identified 28 barriers and classified them into the DSI barrier framework. The DSI barrier framework builds on the DI framework of Kohli and Melville (2019) and extends it by including the societal environment. We thus shed light on the DSI process and provide holistic insights into the barriers along the DSI process.

Keywords:

Digital Social Innovation, Digital Innovation, Social Innovation, Barriers

VI.5 Research Paper 3: Know Your Worth: Resource-centric Patterns for Creating Digital Social Innovation

Authors:

Christoph Buck, Tim Heidenreich, Laura Heim, Anna Krombacher, Hannah Weissmann

Major Revision:

Outlet hidden due to double-blind review process of the journal

Extended Abstract:

To create impactful solutions during digital social innovation development, incumbent firms can leverage their resource base (e.g., established networks, engaged employees, or financial strengths) (Grant, 1991; Oberländer et al., 2021; D. Yu & Hang, 2010). Innovation often arises by recombining available ideas and resources, enabling incumbents to enhance the impact of digital social innovation (Beverungen et al., 2018; Mulgan et al., 2007). Yet, incumbent firms fail to recognize this potential and lack guidance on using digital technologies to create social and economic value. This results in a gap in structured guidance on systematically leveraging resources for impactful digital social innovation. Accordingly, this research paper asks: What are resource-centric patterns of digital social innovation initiatives?

The research paper employs a three-step cluster analysis to answer this research question. First, 618 digital social innovation initiatives were extracted from the 2018/2019 and 2021/2022 corporate social responsibility and annual reports of the 30 largest incumbent firms in Germany and the United States. Second, the initiatives were categorized according to three dimensions: resources, purpose-related digital technology archetype, and SDG target. The first dimension resources draws on Barney (1991), distinguishing between physical (e.g., capital, buildings, factories, equipment, materials, digital technologies), human (e.g., employees' skills, knowledge, and experience), and social (e.g., internal and external relations) resources. The second dimension purpose-oriented digital technology archetypes distinguishes between nine digital technology archetypes: connectivity and computation, platform provision, personal mobile communication, sensor-based data collection, actor-based data execution, analytical insight generation, self-dependent material agency, augmented interaction, and natural interaction (Baier et al., 2023). The third dimension SDG target refers to the 17 SDGs, which are grouped into people, planet, peace, prosperity, and partnerships (United Nations, 2015). Third, a cluster analysis (Field, 2013; Hair et al., 2010) identified eight resource-centric patterns

of digital social innovation: 1) Employee-Driven Educational Engagement, 2) Cultural-Driven Health and Education, 3) Partnership-Driven Health and Education, 4) Expertise-Driven Planetary Protection, 5) Volunteer-Driven Prosperity Enhancement, 6) Collaboration-Driven Societal Impact, 7) Material-Driven Planetary Protection, 8) Employee-Driven Planetary Protection. For example, the pattern Employee-Driven Educational Engagement shows how human resources combined with platforms can address the SDG target people.

The research paper offers two theoretical implications. First, it advances digital social innovation research by introducing a resource-centric perspective, building a foundation for higher-order theories (Doty & Glick, 1994). Second, the findings demonstrate how incumbent firms can deploy their existing resource base through digital technology to create impactful digital social innovation (Sirmon et al., 2011). Additionally, the research paper presents two practical implications. First, it guides how incumbent firms can effectively harness their current resource base to develop digital social innovation. Second, incumbent firms can utilize the identified digital social innovation patterns as inspiration and guidance for designing new digital social innovation.

Keywords:

Digital Social Innovation, Digital Innovation, Social Innovation, Resources

References:

Baier, M.-S., Berger, S., Kreuzer, T., Oberländer, A., Röglinger, M. (2023). What Makes Digital Technology? A Categorization Based on Purpose. Communications of the Association for Information Systems 52.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. Journal of Management, 17(1), 99–120. https://doi.org/10.1177/014920639101700108.

Beverungen, D., Lüttenberg, H., & Wolf, V. (2018). Recombinant Service Systems Engineering. Business & Information Systems Engineering, 60(5), 377–391. https://doi.org/10.1007/s12599-018-0526-4.

Doty, D. H., & Glick, W. H. (1994). Typologies as a Unique Form of Theory Building: Toward Improved Understanding and Modeling. The Academy of Management Review, 19(2), 230–251. https://doi.org/10.2307/258704.

Field, A.P. (2013). Discovering statistics using IBM SPSS statistics, 4th ed. Sage, Los Angeles.

Grant, R.M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. California Management Review 33, 114–135. https://doi.org/10.2307/41166664.

Hair, J.F. (Ed.) (2010). Multivariate data analysis, 7th ed. Prentice Hall, Upper Saddle River, NJ.

Mulgan, G., Tucker, S., Ali, R., & Sanders, B. (2007). Social Innovation: What It Is, Why It Matters and How It Can Be Accelerated. In https://www.semanticscholar.org/paper/Social-Innovation%3A-What-it-is%2C-why-it-matters-and-Mulgan-Tucker/5b16863e55d8a892bf92e7a4532eca4f56ca0103.

Oberländer, A. M., Röglinger, M., & Rosemann, M. (2021). Digital opportunities for incumbents – A resource-centric perspective. *The Journal of Strategic Information Systems*, *30*(3), 101670.

Sirmon, D.G., Hitt, M.A., Ireland, R.D., Gilbert, B.A., Barney, J.B., Ketchen, D.J., Wright, M. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. Journal of Management 37, 1390–1412. https://doi.org/10.1177/0149206310385695.

United Nations (2015). Transforming our world: The 2030 agenda for sustainable development. https://sustainabledevelopment.un.org/content/documents/21252030 Agenda for Sustainable Development web.pdf (accessed 7 May 2025).

Yu, D., & Hang, C. C. (2010). A Reflective Review of Disruptive Innovation Theory. International Journal of Management Reviews, 12(4), 435–452. https://doi.org/10.1111/j.1468-2370.2009.00272.x

VI.6 Research Paper 4: AI in the Web of Trees: A Systems Thinking Approach to Understanding How AI Affects Deforestation

Authors:

Anna Krombacher, Christoph Buck, Laura Heim, Maximilian Röglinger

Submitted to:

Outlet hidden due to double-blind review process of the journal

Abstract:

Deforestation is one of the most urgent societal challenges, driving global CO2 emissions and exacerbating climate change (Harris et al., 2021). Digital technologies, especially Artificial Intelligence (AI), offer promising opportunities to combat deforestation, for example, through forest monitoring or fire detection (Alshehri et al., 2023; Ball et al., 2022; Cowls et al., 2021). However, despite these contributions, current research lacks a comprehensive understanding of how AI influences the deforestation system. Accordingly, the research paper investigates the overarching question: How can AI impact the system of deforestation?

To answer the research question, the research paper applies a systems thinking perspective, using causal loop diagrams (CLDs) to capture interdependencies between variables and relationships (Coletta et al., 2021; Haraldsson, 2004). First, the system of deforestation was delineated by scanning grey literature, including reports and websites from various institutions. This enabled the extraction of variables, their relationships, and their polarity, forming an initial draft of the CLD. Scientific literature was then used to validate and extend this draft. Second, a structured literature review (Boell and Cecez-Kecmanovic, 2015) was conducted to explore the role of AI within the deforestation system, resulting in a final pool of 125 papers. Third, these papers were coded following the techniques by Wolfswinkel et al. (2013), resulting in 45 variables and 85 relationships. Further, 12 direct relationships were drawn, depicting AI's influence on the system of deforestation. Fourth, building on the overall CLD, five systems-informed propositions were derived, offering insights into how AI impacts the deforestation system. Finally, six semi-structured expert interviews (Myers and Newman, 2007) were conducted to validate the 12 relationships between AI and deforestation and the five systems-informed propositions.

Thus, the results of the research paper are an overarching CLD and the systems-informed propositions. The CLD integrates the system of deforestation and AI's systemic effects and comprises 84 variables and 172 relationships, whereas 142 of those relationships move in the same direction and 30 in inverse directions. Within the overall CLD, three scenarios can be derived: 1) the more AI, the better, 2) the more AI, the worse, and 3) the more AI, the greater the backfire. Based on the CLD, five system-informed propositions are formulated: 1) AI solutions mainly address the symptoms of deforestation rather than its root causes, 2) AI solutions assist in informed decision-making regarding combatting deforestation, 3) AI can only unfold its potential in addressing deforestation when data quality is ensured, 4) AI can have negative consequences in combatting deforestation, and 5) AI can optimize locally and centered on specific needs, which might not lead to a destined outcome within the overall system.

The research paper offers two theoretical implications. First, the presented CLD is a theory for explaining (Gregor, 2006), forming the basis for future system dynamics models (Binder et al., 2004). The insights into AI's role in the system of deforestation outlined through the CLD provide the groundwork for dynamic scenario development within a comprehensive system dynamics model. Second, the research approach serves as a blueprint for examining the systemic impacts of digital technologies on various societal challenges. Future studies could use these insights to investigate, for example, AI's influence on marine plastic pollution or assess remote sensing technology's role in biodiversity loss. Additionally, the research paper provides three practical implications. First, the findings can support organizations in developing AI-based interventions to mitigate deforestation. Second, organizations may apply the findings to evaluate the impact of their existing AI applications. Third, policymakers can use these results to design incentive structures encouraging the implementation of AI solutions to reduce deforestation.

Keywords:

AI, Deforestation, Systems Thinking, Causal Loop Diagram

References:

Alshehri, M., Ouadou, A., Scott, G. (2023). Deforestation detection in the Brazilian Amazon using transformer-based networks, in: 2023 IEEE Conference on Artificial Intelligence (CAI), pp. 292–293.

Ball, J.G.C., Petrova, K., Coomes, D.A., Flaxman, S. (2022). Using deep convolutional neural networks to forecast spatial patterns of Amazonian deforestation. Methods Ecol Evol 13, 2622–2634. https://doi.org/10.1111/2041-210X.13953.

Binder, T., Vox, A., Belyazid, S., Haraldsson, H., Svensson, M. (2004). Developing system dynamics models from causal loop diagrams, in: Proceedings of the 22nd International Conference of the System Dynamic Society.

Boell, S.K., Cecez-Kecmanovic, D. (2015). On being 'systematic' in literature reviews in IS. Journal of Information Technology 30, 161–173. https://doi.org/10.1057/jit.2014.26.

Coletta, V.R., Pagano, A., Pluchinotta, I., Fratino, U., Scrieciu, A., Nanu, F., Giordano, R. (2021). Causal Loop Diagrams for supporting Nature Based Solutions participatory design and performance assessment. Research in Organizational Behavior 280, 111668. https://doi.org/10.1016/j.jenvman.2020.111668.

Cowls, J., Tsamados, A., Taddeo, M., Floridi, L. (2021). A definition, benchmark and database of AI for social good initiatives. Nat Mach Intell 3, 111–115. https://doi.org/10.1038/s42256-021-00296-0.

Gregor (2006). The nature of theory in information systems. MIS Quarterly 30, 611. https://doi.org/10.2307/25148742.

Haraldsson, H.V. (2004). Introduction to System Thinking and Causal Loop Diagrams. Department of Chemical Engineering, Lund Univserity.

Harris, N.L., Gibbs, D.A., Baccini, A., Birdsey, R.A., Bruin, S. de, Farina, M., Fatoyinbo, L., Hansen, M.C., Herold, M., Houghton, R.A., Potapov, P.V., Suarez, D.R., Roman-Cuesta, R.M., Saatchi, S.S., Slay, C.M., Turubanova, S.A., Tyukavina, A. (2021). Global maps of twenty-first century forest carbon fluxes. Nat. Clim. Chang. 11, 234–240. https://doi.org/10.1038/s41558-020-00976-6.

Myers, M.D., Newman, M. (2007). The qualitative interview in IS research: Examining the craft. Information and Organization 17, 2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001.

Wolfswinkel, J.F., Furtmueller, E., Wilderom, C.P.M. (2013). Using grounded theory as a method for rigorously reviewing literature. European Journal of Information Systems 22, 45–55. https://doi.org/10.1057/ejis.2011.51.

VI.7 Research Paper 5: Better Together: The Interplay Between Digital Transformation and Sustainability Transformation to Realize Twin Transformation

Authors:

Antonie Lockl, Laura Heim, Anna Maria Oberländer

Published in:

International Journal of Innovation Management. 29(05n06). 2540001 (2025). DOI: 10.1142/S1363919625400018

Abstract:

The urgency of digital transformation is undeniable. At the same time, societal challenges have brought sustainability transformation to the top of research and management agendas. Driven by the growing demands of digitalization and sustainability, organizations must think about both transformations together to leverage synergies, save resources, and act effectively. However, the convergence of both transformations remains poorly understood, and an integrated perspective that focuses on the two transformations' detailed interplay is required. We refer to this interplay as twin transformation and present a twin transformation model based on a structured literature review and 32 exploratory interviews as the key finding of our study. Building on the work system theory, the twin transformation model illustrates the mutually reinforcing relationships between both transformations across eight organizational layers. Our research contributes to the explanatory knowledge of twin transformation and serves as a foundation for further theorizing about this novel phenomenon. As for practice, the twin transformation model provides valuable insights for organizations on how to leverage the strengths of both transformations and become twin transformers.

Keywords:

Twin Transformation, Digital Transformation, Sustainability Transformation, Work System Theory, Interview Study

VI.8 Research Paper 6: Twin to Win: A Resource Orchestration Perspective on Twin Transformation

Authors:

Franziska Burghard, Laura Heim, Thomas Kreuzer, Jana Wozar

Published in:

Proceedings of the 33th European Conference on Information Systems. 10. (2025).
https://aisel.aisnet.org/ecis2025/digitrans/digtrans/10

Abstract:

Organizations today need to drive both digital transformation and sustainability transformation. Twin transformation (TT) suggests that these transformations should be integrated to leverage synergies and optimize resource utilization. While previous research has identified novel resources necessary for TT, such as dynamic capabilities, little is known about how organizations can effectively create and exploit them. We adopt a resource orchestration lens on TT to address this shortcoming and analyze how organizations structure, bundle, and leverage their resources for TT. Based on 20 in-depth interviews with TT industry experts, we present the TT resource orchestration pyramid, through which we unfold the processes and sub-processes of resource orchestration for TT. Our findings enhance our understanding of TT resources and contribute to the emerging body of knowledge on how organizations drive TT. In doing so, we also provide guidance for practitioners to better manage the complexity of TT.

Keywords:

Twin Transformation, Digital Transformation, Sustainability Transformation, Resource Orchestration

VI.9 Research Paper 7: Navigating Twin Transformation: A Systematic Approach for Twin Transformation Strategy Development

Authors:

Laura Heim, Christoph Buck, Antonie Lockl, Anna Maria Oberländer

Submitted to:

Outlet hidden due to double-blind review process of the journal

Abstract:

The growing urgency of digital transformation and the increasing relevance of sustainability require organizations to rethink their strategies in an integrated manner. Twin transformation, the simultaneous pursuit of digital and sustainable transformation, has become a key priority for building long-term competitiveness. However, organizations lack a structured approach for developing and aligning twin transformation into their business strategy (Breiter et al., 2024; Christmann et al., 2024). Existing methods fall short, as they treat digital and sustainability transformations in isolation (Bharadwaj et al., 2013; Broman & Robèrt, 2017; Kopnina, 2017; Vial, 2019). As a result, there is a lack of methodological support for designing a twin transformation strategy that provides a structured, step-by-step approach, ensuring alignment with the overarching business strategy. To address this gap, the research paper investigates the following research question: How can organizations develop and integrate a twin transformation strategy into their overarching business strategy?

To address this gap, the research paper adopted a Design Science Research approach to develop the Twin Transformation Strategy Framework, which provides a structured representation of an organization's twin transformation strategy. Complementing this framework, the research paper also designed a step-by-step methodology that systematically guides the development process, from defining the strategic direction to embedding twin transformation into the business strategy. To ensure the development of a problem-solving artifact that is both practically relevant and scientifically rigorous, we adopt the Design Science Research approach as outlined by Peffers et al. (2007). In the early phases, 22 expert interviews helped identify major challenges such as misalignment, leadership issues, or regulatory constraints, and from these insights, six design objectives were derived. Subsequent phases combined theoretical and practical perspectives to build the framework, which was evaluated through two formative

artificial evaluations with students and research assistants and a summative naturalistic evaluation with practitioners from a manufacturing firm.

The completed Twin Transformation Strategy Framework represents the twin transformation strategy itself as the tangible outcome of the strategy development process. By placing the identified twin transformation action fields at its core and embedding them within the broader context of digital and sustainability transformations, as well as the overarching business strategy, the framework offers a holistic perspective of an organization's twin transformation strategy. The accompanying methodology consists of five consecutive activities that guide users through developing a twin transformation strategy: 1) Strategic Direction, 2) Strategic Planning, 3) Strategic Fit, 4) Strategic Prioritization, and 5) Strategic Integration.

The research paper offers theoretical implications by providing a structured approach for managing multiple transformation logics. The Twin Transformation Strategy Framework and its step-by-step methodology show how organizations can navigate and operationalize such plural transformation logics through a structured, stepwise approach that aligns digital and sustainability ambitions with overarching business goals. Therefore, the research paper expands the concept of strategic alignment toward a triadic view, incorporating additional strategic dimensions. Additionally, the research paper offers two practical implications. First, the Twin Transformation Strategy Framework serves as a visual representation of an organization's twin transformation strategy once completed, enhancing transparency, promoting strategic clarity, and empowering organizations to maintain direction, focus on high-impact initiatives, and drive long-term competitiveness. Second, the step-by-step methodology provides practical guidance for collaboratively developing the twin transformation strategy. The methodology operationalizes the framework by breaking the twin transformation strategy development process into manageable, actionable steps. For each activity, managers are given a clear objective, a description of the process, illustrative examples, and guiding questions to facilitate application.

Keywords:

Twin Transformation, Digital Transformation, Sustainability Transformation, Strategy, Design Science Research

References:

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. https://doi.org/10.25300/misq/2013/37:2.3.

Breiter, K., Crome, C., Oberländer, A. M., & Schnaak, F. (2024). Dynamic Capabilities for the Twin Transformation Climb: A Capability Maturity Model. Information Systems Frontiers. Advance online publication. https://doi.org/10.1007/s10796-024-10520-y.

Broman, G. I., & Robèrt, K.-H. (2017). A framework for strategic sustainable development. Journal of Cleaner Production, 140, 17–31. https://doi.org/10.1016/j.jclepro.2015.10.121.

Christmann, A.-S., Crome, C., Graf-Drasch, V., Oberländer, A. M., & Schmidt, L. (2024). The Twin Transformation Butterfly. Business & Information Systems Engineering, 66(4), 489–505. https://doi.org/10.1007/s12599-023-00847-2.

Kopnina, H. (2017). Sustainability: new strategic thinking for business. Environment, Development and Sustainability, 19(1), 27–43. https://doi.org/10.1007/s10668-015-9723-1.

Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A Design Science Research Methodology for Information Systems Research. Journal of Management Information Systems, 24(3), 45–77. https://doi.org/10.2753/MIS0742-1222240302.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003.