Navigating the Strategic Use of Artificial Intelligence in Incumbent Firms: From Business Potential to Business Value

Dissertation

zur Erlangung des Grades eines Doktors der Wirtschaftswissenschaft

der Rechts- und Wirtschaftswissenschaftlichen Fakultät

der Universität Bayreuth

Vorgelegt

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Tag der mündlichen Prüfung:	26.06.2025

“Every accomplishment starts with the decision to try.”

John F. Kennedy

Mit der Fertigstellung dieser Dissertation blicke ich auf einen äußerst lehrreichen und prägenden Lebensabschnitt zurück. Ich möchte die Gelegenheit nutzen, um mich bei allen Menschen zu bedanken, die zu diesem bedeutsamen Meilenstein beigetragen haben.

Vielen Dank an meine akademischen Betreuer und Mentoren Prof. Dr. Maximilian Röglinger und Prof. Dr. Björn Häckel sowie Prof. Dr. Anna Maria Oberländer. Ich danke Euch für das Vertrauen, das Ihr mir während meiner gesamten Dissertation entgegengebracht habt, für Euer Fordern und Fördern. Ihr habt einen maßgeblichen Anteil an meiner fachlichen und persönlichen Entwicklung in den vergangenen Jahren.

Herzlichen Dank an meine Kollegen, Co-Autoren und Freunde am FIM Forschungsinstitut für Informationsmanagement, am Institutsteil Wirtschaftsinformatik des Fraunhofer FIT und an der Universität Bayreuth, welche die vergangenen Jahre zu etwas Besonderem gemacht haben. Ich danke Euch für die konstruktive und produktive Zusammenarbeit in Forschung, Lehre und Praxis.

Vielen Dank an meine Familie, insbesondere an meine Eltern Norbert und Sabine Meierhöfer sowie meine Geschwister Lea und David Meierhöfer. Ich danke Euch für die bedingungslose Liebe und uneingeschränkte Unterstützung, die das Fundament bilden, auf dem diese Arbeit ruht. Ihr habt mir durch Euren Glauben und Rückhalt die Kraft gegeben, den Weg von der Schule über das Studium bis zur Dissertation zu gehen. Danke, dass Ihr mir das alles ermöglicht habt und mich zu dem Menschen gemacht habt, der ich heute bin. Ich bin sehr stolz darauf, immer auf Euch zählen zu dürfen.

Herzlichen Dank an meine Großeltern Helmut und Lieselotte Strobel sowie Johann und Hildegard (†) Meierhöfer für die grenzenlose Zuneigung, die mir von Kindheit an bis heute zuteilwird. Ihr habt mir früh die Normen und Werte vermittelt, die meinen Werdegang geebnet haben und mich bis heute prägen. Ich bin so glücklich, Euch als meine Vorbilder immer noch an meiner Seite zu haben bzw. gehabt zu haben.

In der Gesamtheit seid Ihr alle das, was mich im Leben antreibt. Ohne Euch wäre diese Arbeit in der vorliegenden Form nicht möglich gewesen. Euch allen widme ich diese Dissertation mit tiefster Dankbarkeit und höchster Wertschätzung.

Copyright Statement

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

Abstract

Artificial intelligence (AI) – the ever-evolving frontier of computational advancement – is currently causing an undeniable wave of excitement among both researchers and practitioners. While the tremendous market potential is evident from the considerable attention that this nascent technology has received across industries worldwide in recent years, organizations that are not technology leaders are struggling to take advantage of AI. Specifically, incumbent firms that were founded before the emergence of digital technologies lack the knowledge of the methods and practices required to overcome a host of thorny challenges that are inherent to contemporary AI. As a result, for incumbent firms, the disparity between the business potential of AI and its de facto business value remains one of the most critical challenges faced by researchers and practitioners in various facets.

Against this backdrop, this doctoral thesis proposes an end-to-end perspective on the exploration of AI. Specifically, it provides theoretical guidance on and actionable insights into how to navigate the strategic use of AI in incumbent firms. This ranges from aspects relating to understanding the business potential of AI (i.e., *scoping*) over preparing the business use of AI (i.e., *strategizing*) to realizing the business value of AI (i.e., *scaling*). On the foundation of six research papers, this cumulative dissertation offers theoretically grounded and practically relevant conceptual and empirical work that serves as a way for incumbent firms to bridge the gap between the business potential of AI and its de facto business value. Thereby, it seeks to give researchers and practitioners a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms, in three ways.

First, regarding *scoping*, this cumulative dissertation provides theoretical guidance on and actionable insights into how to align the technological opportunities of AI with business problems under consideration of the domain-specific environment. *Research Paper P1* outlines an overview over how the action potentials of individual cognitive functions of AI vary across different contextual factors of business processes, serving as a foundation to support the state-of-the-art analysis of potential AI applications. *Research Paper P2* introduces a conceptual framework of affordance layers, serving as a way to facilitate the identification, assessment, and selection of potential AI use cases. Together, these two studies demonstrate how incumbent firms can understand the business potential of AI and can move from an interest in AI to an intention with AI.

Second, regarding *strategizing*, this doctoral thesis advances the scientific knowledge on how to set a strategic frame for AI. Specifically, it provides theoretical guidance on and actionable insights into how incumbent firms can approach the strategic use of AI in line with firm-specific goals as well as internal and external constraints. *Research Paper P3* provides a taxonomy and corresponding clusters that conceptualize the design space of an AI strategy, while *Research Paper P4* offers pathways that describe the process of AI capability development along six core capability areas. Together, these two studies advance knowledge on how incumbent firms can prepare the business use of AI and can move from an intention with AI to an implementation of AI.

Third, regarding *scaling*, this cumulative dissertation provides theoretical guidance on and actionable insights into how to transform the technological affordances of AI into specific actions toward achieving sustainable performance gains. *Research Paper P5* outlines a framework of success factors for AI projects, serving as a foundation for the transition of conceptual use cases into productive systems. *Research Paper P6* introduces an architectural model for AI innovations, serving as a way to facilitate the generation of innovative ideas. Together, these two studies demonstrate how incumbent firms can realize the business value of AI and can move from an implementation of AI to an impact from AI.

This doctoral thesis concludes by summarizing the key results of the presented work and pointing to limitations, which open avenues for future research. Motivated by the need to navigate the strategic use of AI in incumbent firms, the overall purpose of this cumulative dissertation is to provide researchers and practitioners with a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms. It contributes to this research area by taking an end-to-end perspective on the exploration of AI as a way to move from an initial interest in AI, to a sound intention with AI, to a targeted implementation of AI, to an actual impact from AI.

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List of Acronyms

AI	artificial intelligence
BPM	business process management
CAGR	compound annual growth rate
CRediT	contributor roles taxonomy
DSR	design science research
GenAI	generative artificial intelligence
IS	information systems
IT	information technology
LLMs	large language models
SMEs	small and medium-sized enterprises

I. Introduction

I.1 Motivation

Artificial intelligence (AI) – the ever-evolving frontier of computational advancement – has emerged from a visionary concept in computer science to a transformative force in business, driving innovation across industries worldwide (Ågerfalk et al. 2022; Benbya et al. 2020; Berente et al. 2021). Fueled by the affordability of powerful hardware, the availability of extensive datasets, and the discovery of new algorithms, the performance and scope of AI have grown at an astonishing pace over the past few years (Kaplan and Haenlein 2019). Today, both researchers and practitioners attribute AI with transformative impacts on countless domains, ranging from finance (Weber et al. 2024; Zakaria et al. 2023), to manufacturing (Chatterjee et al. 2021; Jan et al. 2023), to logistics (Richey et al. 2023; Toorajipour et al. 2021), to healthcare (Fechner et al. 2024; Lämmermann et al. 2024), among others. In this spirit, recent technological advances in AI have enabled the emergence of intelligent systems that provide unprecedented opportunities to improve and innovate business processes (Fehrer et al. 2025; van Dun et al. 2023), reinvent products and services (Brem et al. 2023; Mariani et al. 2023), and even create new business models (Burström et al. 2021; Sjödin et al. 2021). As a result, AI holds great promise to not only promote economic benefits, but also to foster environmental sustainability (Leuthe et al. 2024; Schoormann et al. 2023).

According to information systems (IS) research, AI is typically associated with the ability of machines to accomplish human-like cognitive functions such as thinking, learning, or conversing (Benbya et al. 2020). Thus, AI does not describe a specific information technology (IT), but rather represents a multitude of algorithmic approaches, methods, and techniques that have emerged over the past few years in line with the nature of AI as a moving frontier (Stone et al. 2022). In this doctoral thesis, the multitude of technological manifestations are subsumed under the umbrella term AI. To differentiate contemporary AI from previous generations of IT, Berente et al. (2021) point to three facets: First, autonomy, which describes the extent to which intelligent systems act without human intervention (Baird and Maruping 2021). Second, learning, which refers to the unique way intelligent systems improve their performance through data and experience (Janiesch et al. 2021). Third, inscrutability, which describes the unintelligibility of intelligent systems, considering the opaque workflows and probabilistic outcomes (Asatiani et al.

2021). Taken together, these three interrelated and interdependent facets make contemporary AI unique and distinct from traditional IT. As a result, it is only somewhat possible to transfer the extant knowledge about the management of IT to the management of AI, highlighting the necessity for a nuanced perspective and the discrete study of the affordances and constraints of this nascent technology (Ågerfalk et al. 2022; Benbya et al. 2020; Berente et al. 2021).

With the ever-improving execution of tasks (i.e., *performance frontier*) and the ever-expanding range of contexts (i.e., *scope frontier*) to which AI can be applied, there is already a wide array of possible AI applications, from automating simple tasks to solving complex problems (Berente et al. 2021). Especially at present, sophisticated AI tools such as ChatGPT, Microsoft Copilot, or Midjourney highlight the ubiquitous availability and immediate accessibility of AI applications even for humans with low technical know-how on the individual, organizational, and societal levels (Cupać et al. 2024; van der Sommen and Groof 2024). This burgeoning versatility underscores the tremendous market potential of AI, which is also evident from the considerable attention that this nascent technology has received across industries worldwide (Maslej et al. 2024). Accordingly, the global spending on AI reached $184 billion in 2024 and is even predicted to grow to $827 billion by 2030 (Statista 2025). This corresponds to an almost doubling of the expenditure on AI from $93 billion in 2020, which is in line with a projected compound annual growth rate (CAGR) of 24.6% in the global market size for AI from 2020 to 2030. According to a comprehensive survey by McKinsey & Company, the surge in interest in AI has spiked along this curve, especially in the last year, after a period of only moderate to slight change (McKinsey & Company 2024). As a result, it is now possible, for the first time, to reap benefits from large-scale investments in AI, as long predicted in market studies and industry reports (Åström et al. 2022; Berg et al. 2023; Enholm et al. 2022).

Recognizing that AI is not a temporary trend but a future force, both researchers and practitioners are seeking to better understand the theoretical foundations and managerial implications of AI (Ågerfalk et al. 2022; Benbya et al. 2020; Berente et al. 2021). While in research, scholars seek to keep pace with the rapid technological advances in AI, such as the recent rise of generative AI (GenAI) in general and the release of large language models (LLMs) in particular, through publications in scientific journals or conference proceedings (Banh and Strobel 2023; Benbya et al. 2024; Feuerriegel et al. 2024), in practice, organizations that – unlike for instance Apple, Google, or Microsoft – are not technology leaders are struggling to take advantage of this nascent technology

(Schönberger 2023; Zavodna et al. 2024). Specifically, incumbent firms (i.e., established organizations in an industry) that were founded before the emergence of digital technologies are reluctant to initiate their digital journey with AI, despite their ambition and willingness to do so (D'Ippolito et al. 2019; Oberländer et al. 2021). Besides resource constraints such as the presence of financial resources or the engagement of qualified personnel that prevent the exploration of AI at speed and scale (Horváth and Szabó 2019; Keller et al. 2022), incumbent firms lack the knowledge of the methods and practices required to overcome a host of thorny challenges that are inherent to contemporary AI (Lee et al. 2023; Merhi 2023). Appropriately, a recent study by Boston Consulting Group noted that, to date, only a quarter of incumbent firms have achieved sustainable performance gains with AI (Boston Consulting Group 2024). Thus, incumbent firms require theoretical guidance on and actionable insights into how to thrive in the trajectory of AI despite these limitations (Oldemeyer et al. 2024; Schwaeke et al. 2025).

In response, the scientific literature has intensively scrutinized how to navigate the strategic use of AI in incumbent firms and therefore how to bridge the disparity between the business potential of AI and its de facto business value. Here, scholars discuss the exploration of AI mainly against the backdrop of the antecedents for AI adoption in general (Kinkel et al. 2022; Merhi and Harfouche 2024) or AI readiness in particular (Jöhnk et al. 2021; Uren and Edwards 2023). Further, the scientific literature has pointed to the need to develop capabilities (Mikalef and Gupta 2021; Sjödin et al. 2021; Weber et al. 2023) or to orchestrate resources for the strategic use of AI (Duda et al. 2024; Hanelt et al. 2025; Peretz-Andersson et al. 2024). Further, scholars have proposed strategies and recommendations to overcome a host of thorny challenges that are inherent to contemporary AI (Oehmichen et al. 2023; Sagodi et al. 2024; van Giffen and Ludwig 2023). In this sense, the scientific literature has also provided standardized procedures for the development, deployment, and operation of AI through AI lifecycle models and AI project workflows with considerable technical depth (Ashmore et al. 2022; Kreuzberger et al. 2023). Thus, while there is already a wealth of evidence on the barriers that aggravate and the enablers that facilitate the strategic use of AI in incumbent firms, related contributions offer either only selected insights or focus, by design, on the technical intricacies associated with the exploration of AI. As a result, for incumbent firms, the disparity between the business potential of AI and its de facto business value remains one of the most critical challenges faced by researchers and practitioners in various facets (Lee et al. 2023; Merhi 2023).

Against this backdrop, this doctoral thesis proposes an end-to-end perspective on the exploration of AI, considering both technical intricacies and organizational imperatives. This ranges from aspects that relate to understanding the business potential of AI (i.e., *scoping*), to preparing the business use of AI (i.e., *strategizing*), to realizing the business value of AI (i.e., *scaling*). Taken together, these three phases provide a holistic and integrative framework to navigate the strategic use of AI in incumbent firms. In other words, an end-to-end perspective on the exploration of AI allows incumbent firms to move from an initial interest in AI, to a sound intention with AI, to a targeted implementation of AI, to an actual impact from AI. Figure 1 visualizes the three phases of scoping, strategizing, and scaling as the focus areas of this doctoral thesis.

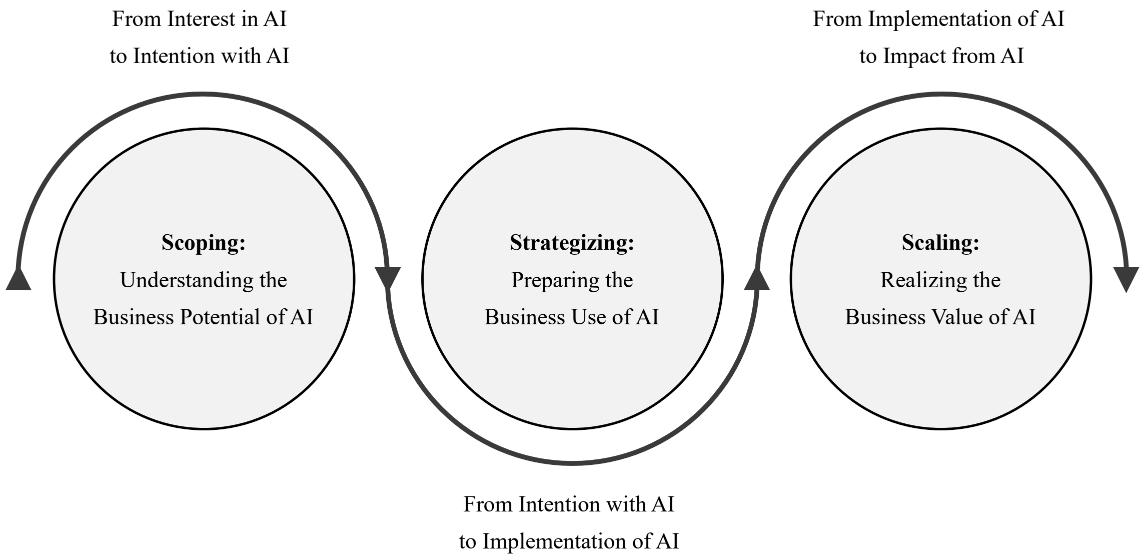

Figure 1 Focus areas of this cumulative dissertation

While the three phases in their entirety serve as a way to bridge the gap between the business potential of AI and its de facto business value, they differ regarding their foci. First, in the *scoping* phase, the main focus is on the state-of-the-art analysis of potential AI applications as well as the technology-led and problem-centered identification, the techno-economic and techno-ecological assessment, and the goal-oriented and purpose-driven selection of potential AI use cases, among others (Bodendorf 2025; Brunnbauer et al. 2021; Sturm et al. 2021). Therefore, in the scoping phase, incumbent firms move from an interest in AI to an intention with AI. Second, in the *strategizing* phase, the primary objectives are, among others, to develop an AI strategy, implement mechanisms of an AI governance, and set up an AI roadmap (Papagiannidis et al. 2023; Papagiannidis et al. 2025; Sturm and van Giffen 2025). It also involves the build-up of the required capabilities for the strategic use of AI along an enterprise architecture, including technological infrastructure, human competencies, business processes, and hierarchical structures, among others (Ritala et al. 2024; Wang et al. 2024; Weber et al. 2023). Thus, in the strategizing phase, incumbent firms move from an intention with AI to an implementation of AI. Third, in the *scaling* phase, the main focus is on the transition of conceptual use cases into productive systems, the integration of monitoring tools (i.e., to analyze the returns on investment) and control systems (i.e., to ensure ethics, fairness, and responsibility), as well as the establishment of continuous change management practices, among others (Haefner et al. 2023; Hansen et al. 2024; Sjödin et al. 2021). Therefore, in the scaling phase, incumbent firms move from an implementation of AI to an impact from AI.

In sum, the scientific literature provides valuable prospects regarding how to navigate the strategic use of AI in incumbent firms and therefore how to bridge the disparity between the business potential of AI and its de facto business value (Oldemeyer et al. 2024; Schwaeke et al. 2025). In contrast, an end-to-end perspective on the exploration of AI, considering both technical intricacies and organizational imperatives, remains on the research agenda (Grebe et al. 2023; Shollo et al. 2022). To take this next step, there is a need for a holistic and integrative framework to navigate the strategic use of AI in incumbent firms and move from an initial interest in AI, to a sound intention with AI, to a targeted implementation of AI, to an actual impact from AI. As the scientific literature lacks such an end-to-end perspective on the exploration of AI, this doctoral thesis offers theoretically grounded and practically relevant conceptual and empirical work that serves as a way for incumbent firms to bridge the gap between the business potential of AI and its de facto business value. To do so, it introduces the notions of understanding the business potential of AI (i.e., *scoping*), preparing the business use of AI (i.e., *strategizing*), and realizing the business value of AI (i.e., *scaling*) to provide an end-to-end perspective on the exploration of AI. In this way, in this cumulative dissertation provides researchers and practitioners with theoretical guidance on and actionable insights into how to navigate the strategic use of AI in incumbent firms in order to advance the real-world use of AI.

I.2 Research Objectives

Building on the identified research needs, this doctoral thesis seeks to give researchers and practitioners a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms, in three ways.

First, regarding *scoping*, it is necessary to provide more scientific evidence of how incumbent firms can align the technological opportunities of AI with business problems under consideration of the domain-specific environment. Specifically, there is a need for theoretical guidance and actionable insights for researchers and practitioners that demonstrate how incumbent firms can move from an interest in AI to an intention with AI. Therefore, this doctoral thesis seeks to support the state-of-the-art analysis of potential AI applications through an overview over how the action potentials of individual cognitive functions of AI vary across different contextual factors of business processes. In addition, it seeks to facilitate the identification, assessment, and selection of potential AI use cases through a conceptual framework of affordance layers.

Second, regarding *strategizing*, there is a need for more scientific knowledge on how to set a strategic frame for AI. Specifically, researchers and practitioners require theoretical guidance on and actionable insights into how incumbent firms can approach the strategic use of AI in line with firm-specific goals as well as internal and external constraints. In response, this cumulative dissertation advances the knowledge of how incumbent firms can move from an intention with AI to an implementation of AI. In this connection, it seeks to make a contribution by synthesizing theoretical insights and practical observations on how to design an AI strategy and how to develop relevant AI capabilities so as to operationalize the strategic use of AI in line with firm-specific goals as well as internal and external constraints.

Third, regarding *scaling*, it is necessary to provide more scientific evidence of how incumbent firms can transform the technological affordances of AI into specific actions toward achieving sustainable performance gains. Specifically, there is a need for theoretical guidance and actionable insights for researchers and practitioners that demonstrate how incumbent firms can move from an implementation of AI to an impact from AI. Therefore, this doctoral thesis seeks to support the transition of conceptual use cases into productive systems through a framework of success factors for AI projects. In addition, it seeks to facilitate the generation of innovative ideas through an architectural model for AI innovations.

This doctoral thesis is motivated by the need to navigate the strategic use of AI in incumbent firms. It seeks to provide researchers (e.g., IS scholars) and practitioners (e.g., high- and mid-level decision-makers) with a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms. The overall purpose of this cumulative dissertation is to contribute to this research area by taking an end-to-end perspective on the exploration of AI as a way to move from an initial interest in AI, to a sound intention with AI, to a targeted implementation of AI, to an actual impact from AI.

I.3 Structure of the Doctoral Thesis and the Embedding of the Research Papers

This doctoral thesis comprises six research papers that contribute to the stated research objectives. These research papers have been published in or submitted to renowned peer-reviewed scientific journals or conference proceedings. Table 1 provides an overview over the structure of this doctoral thesis and the embedding of the research papers.

I		**Introduction**
II		**Understanding the Business Potential of Artificial Intelligence**
	1	**Through the Lens of Cognitive Functions and Contextual Factors: A Study of the Action Potentials of Artificial Intelligence in Business Process Management** *Meierhöfer, S., Dorner C.M.*
	2	**Leveraging Digital Technologies in Logistics 4.0: Insights on Affordances from Intralogistics Processes** *Albrecht T., Baier M.S., Gimpel H., Meierhöfer S., Röglinger M., Schlüchtermann J., Will L*
III		**Preparing the Business Use of Artificial Intelligence**
	3	**Conceptualizing the Design Space of Artificial Intelligence Strategy: A Taxonomy and Corresponding Clusters** *Hofmann P., Meierhöfer S., Müller L., Oberländer A.M., Protschky D.*
	4	**Pathways to Developing Artificial Intelligence Capabilities: Insights from Small and Medium-sized Enterprises in the Manufacturing Sector** *Meierhöfer, S., Oberländer A.M., Weidlich R.*
IV		**Realizing the Business Value of Artificial Intelligence**
	5	**Uncovering the Sweet Spot of Artificial Intelligence Projects: An Exploration of Success Factors** *Leuthe, D., Meierhöfer, S., Häckel B., Kolbeck T.*
	6	**Augmenting Divergent and Convergent Thinking in the Ideation Process: An LLM-Based Agent System** *Fischer-Brandies L., Meierhöfer S., Protschky D.*
V		**Conclusion**
VI		**References**

Table 1 Structure of the doctoral thesis and the embedding of the research papers

After motivating the aims of this doctoral thesis and defining the research objectives in *Section I*, *Sections II to IV* provide researchers and practitioners with theoretical guidance on and actionable insights into how to navigate the strategic use of AI in incumbent firms.

Section II, which includes *Research Papers P1 and P2*, presents scientific research that advances the knowledge on the strategic use of AI with a focus on understanding the business potential of AI for incumbent firms. It provides guidance on how incumbent firms can align the technological opportunities of AI with business problems under consideration of the domain-specific environment. Accordingly, the following two research papers can help incumbent firms to move from an interest in AI to an intention with AI. *Research Paper P1* examines how incumbent firms can analyze what type of AI technology provides action potentials for what type of business process. The main results are an overview over how the action potentials of individual cognitive functions of AI vary across different contextual factors of business processes as a foundation for systematically analyzing application scenarios for the productive and efficient use of AI in business process management (BPM). *Research Paper P2* investigates how incumbent firms can identify and systemize the opportunities afforded by digital technologies such as AI, emerging from the dynamic interrelationship between technologies, business processes, and the domain-specific environment. The main results are a conceptual framework of affordance layers in a leading-edge IS application domain (i.e., Logistics 4.0) as a way to develop a fine-grained understanding of affordances in different organizational environments.

Section III, which includes *Research Papers P3 and P4*, presents scientific research that extends the scientific knowledge on the strategic use of AI in terms of preparing the business use of AI for incumbent firms. Thus, this cumulative dissertation makes a contribution to how to approach the strategic use of AI in line with firm-specific goals as well as internal and external constraints. Thus, the following two research papers of this doctoral thesis help incumbent firms to move from an intention with AI to an implementation of AI. *Research Paper P3* explores how incumbent firms can design an AI strategy. The main results are a taxonomy that unveils how incumbent firms currently structure and organize an AI strategy and clusters that delineate predominant design options for developing a new AI strategy or evaluating an existing one. *Research Paper P4* studies how incumbent firms can develop relevant AI capabilities. The main results are pathways that incumbent firms can take to develop relevant AI capabilities in a leading-edge IS application domain (i.e., Industry 4.0), depending on the source of AI capability development and the setup of the actors involved in AI capability development.

Section IV, which includes *Research Papers P5 and P6*, presents scientific research that advances the knowledge on the strategic use of AI with a focus on realizing the business value of AI for incumbent firms. It provides guidance on how incumbent firms can transform the technological affordances of AI into specific actions toward achieving sustainable performance gains. Accordingly, the following two research papers can help incumbent firms to move from an implementation of AI to an impact from AI. *Research Paper P5* examines how incumbent firms can successfully plan and execute AI projects. The main results are a framework of success factors for AI projects, structured along four overarching success dimensions and specified by subordinate success manifestations as a foundation for the transition of conceptual use cases into productive systems. *Research Paper P6* investigates how incumbent firms can embrace AI innovations, drawing on the example of LLMs as technological manifestations of AI and idea generation as the core of the innovation process. The main results are an architectural model that augments divergent and convergent thinking in the ideation process with the help of LLMs (i.e., an LLM-based agent system) as a way to facilitate the generation of innovative ideas.

Section V concludes this cumulative dissertation by summarizing the key results of the presented work and pointing to limitations, which open avenues for future research. Subsequently, *Section VI* provides a comprehensive list of all the references cited throughout this doctoral thesis. Finally, *Section VII* contains an index of the six research papers, a specification of the individual contributions of the authors to them, and a compilation of the research papers.

II. Understanding the Business Potential of Artificial Intelligence

For incumbent firms to move from an interest in AI to an intention with AI, there is a need for theoretical guidance on and actionable insights into how to align the technological opportunities of AI with business problems under consideration of the domain-specific environment. This doctoral thesis addresses this issue by investigating how incumbent firms can understand the business potential of AI. Specifically, it provides scientific research on the action potentials of AI in BPM through an online survey and an interview study (*Section II.1; Research Paper P1*). It further presents scientific research on the affordances of digital technologies such as AI in domain-specific environments through a systematic literature review and an interview study (*Section II.2; Research Paper P2*).

II.1 Action Potentials of Artificial Intelligence in Business Process Management

In the wake of recent developments, AI provides a multitude of action potentials in business processes, the central unit of BPM (Dumas et al. 2023; Rosemann et al. 2024). Despite these unprecedented opportunities, the diversity and complexity of the underlying tools and methods of AI often make it hard for incumbent firms to determine appropriate use cases in business processes (Di Francescomarino and Maggi 2020). Building on the individual requirements and different goals of business processes, it is even harder for incumbent firms to analyze in which contexts AI offers a business potential (Hofmann et al. 2020; vom Brocke et al. 2016). However, to determine appropriate use cases for the strategic use of AI, a fit with business processes is imperative (Dumas et al. 2023; Rosemann et al. 2024).

With this in mind, Research Paper P1 argues that there is a need for a collective framework to establish connections between AI and BPM. However, as both AI and BPM are broad and elusive terms that are hard to study in an integrated way, this study abstracts AI and BPM into more specific concepts. For AI, it follows Hofmann et al. (2020), who describe individual cognitive functions (i.e., perceiving, recognizing, reasoning, predicting, decision-making, generating, acting) that cover the entire spectrum of underlying tools and methods of AI. For BPM, it follows vom Brocke et al. (2016), who describe different contextual factors (i.e., value contribution, repetitiveness, knowledgeintensity, creativity, interdependence, variability) that are crucial for the management of business processes. As a result, Figure 2 establishes a collective framework that conceptualizes the interplay between AI and BPM using cognitive functions and contextual factors.

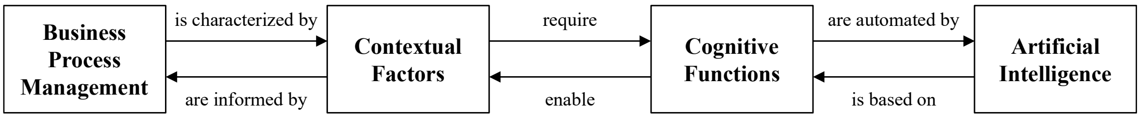

Figure 2 Collective framework of cognitive functions and contextual factors

While this collective framework of cognitive functions and contextual factors serves as a foundation to establish a connection between AI and BPM, it does not provide a comprehensive overview over action potentials. In fact, the scientific literature has already thematized numerous application scenarios for the productive and efficient use of AI in BPM (Fehrer et al. 2025; van Dun et al. 2023). Still, it has not indicated what type of AI technology provides action potentials for what type of business process. Accordingly, researchers and practitioners are struggling to understand how to conceptualize the use of AI in BPM (Di Francescomarino and Maggi 2020). To address this issue, Research Paper P1 states the following research question: *What are the action potentials of individual cognitive functions of AI across different contextual factors of business processes?*

To answer this research question, Research Paper P1 adopts a mixed-methods approach, combining a quantitative study and a qualitative one to gather multiple perspectives on the phenomenon at hand (Venkatesh et al. 2013; Venkatesh et al. 2016). In the first phase, it conducts an online survey with 32 experts in the fields of AI and/or BPM to collect initial quantitative insights. In the second phase, it conducts an interview study with seven experts from academia and industry to synthesize further qualitative data. Overall, this approach has two purposes: First, corroboration, as mixed methods allow the assessment of the credibility of the results by drawing from the quantitative to the qualitative results, and vice versa. Second, meaningfulness, as mixed methods provide a more conclusive and even richer explanation of the results.

Table 2 presents the main results of Research Paper P1 as an overview over how the action potentials of individual cognitive functions of AI vary across different contextual factors of business processes. To do so, it calculates the mean score of the responses from an online survey using a five-point Likert scale with subdivisions from 0 to 4 to determine the action potentials of individual cognitive functions of AI across different contextual factors of business processes. A score below 1.75 indicates a low action potential (light gray), a score between 1.75 and 2.75 represents a medium action potential (medium gray), and a score above 2.75 indicates a high action potential (dark gray). Augmented by insights from an interview study, this study provides four salient clusters. First, cognitive functions have a high action potential for all levels of value contribution. Here, the action potential ranges from moderately important to extremely important. Second, cognitive functions have a high action potential for non-repetitive, knowledge-intensive, creative, interdependent, and variable contextual factors. Third, cognitive functions have a low action potential for repetitive, non-knowledge-intensive, non-creative, non-interdependent, and non-variable contextual factors. Fourth, the cognitive functions of perceiving, recognizing, and acting are prevalent with a high action potential across all contextual factors, while the cognitive functions of reasoning, predicting, decision-making, and generating are only dominant with a high action potential in certain contextual factors.

		Contextual Factors													Ø
		Value contribution			Repetitive		Knowledge-int.		Creative		Interdependent		Variable		
		Core	Support	Mgmt	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Cognitive Functions	Perceiving	2,50	2,69	2,88	1,81	3,13	2,97	1,91	2,88	1,94	2,78	1,97	3,00	2,16	2,51
	Recognizing	2,84	2,97	3,03	2,13	3,28	3,31	1,91	2,81	2,13	3,00	2,13	3,22	2,28	2,69
	Reasoning	2,47	2,13	2,88	1,53	2,94	2,97	1,28	2,16	1,56	2,84	2,03	2,88	1,44	2,24
	Predicting	2,50	2,38	3,09	1,19	2,78	3,06	1,19	2,25	1,56	3,06	1,56	3,09	1,47	2,25
	Decision-making	3,19	2,53	3,56	1,47	2,78	2,91	1,41	2,44	1,66	3,13	2,13	3,00	1,66	2,45
	Generating	3,19	2,22	2,94	1,56	2,59	2,63	1,38	3,09	1,66	2,38	1,69	2,69	1,31	2,25
	Acting	3,50	2,97	2,88	2,69	2,66	3,09	2,16	2,59	2,34	2,91	2,47	2,94	2,09	2,71
Ø		2,88	2,55	3,04	1,77	2,88	2,99	1,60	2,60	1,83	2,87	2,00	2,97	1,77	

Table 2 Action potentials of cognitive functions across contextual factors

The results of Research Paper P1 are novel, because they are the first to conceptualize the interplay between AI and BPM in a collective framework. By synthesizing quantitative insights from an online survey and qualitative data from an interview study, this study reveals, most notably, that cognitive functions do not provide a high action potential across the entire spectrum of contextual factors, but rather unfold only in distinct ones with a high action potential. Further, this study demonstrates that the action potentials of cognitive functions range from not important to extremely important, revealing different maturity levels of underlying tools and methods of AI.

In this way, Research Paper P1 provides researchers and practitioners with valuable implications. From a theoretical perspective, the results provide researchers with a solid foundation to better grasp what type of AI technology provides action potentials for what type of business process. Building on the collective framework, the results foster a comprehensive understanding of enabling and limiting contextual factors regarding the use of cognitive functions, and vice versa. Further, from a practical perspective, the results provide managers with a guide on where to start or proceed when exploring the action potentials of individual cognitive functions of AI across different contextual factors of business processes. By highlighting application scenarios for the productive and efficient use of AI in BPM, managers can either search for a distinct cognitive function to solve a problem in a particular contextual factor, or vice versa. At the same time, the collective framework serves as an opportunity space for managers to uncover action potentials for improving or innovating business processes with the help of AI.

In sum, the primary contribution of Research Paper P1 to the research objectives of this doctoral thesis is to provide actionable insights into how incumbent firms can analyze what type of AI technology provides action potentials for what type of business process. Thus, it views AI through the lens of individual cognitive functions and BPM through the lens of different contextual factors to systematically analyze application scenarios for the productive and efficient use of AI in BPM.

II.2 Affordances of Artificial Intelligence in Domain-Specific Environments

While the dynamic interrelationship between technologies and business processes constitutes the foundation for the presence of action potentials, the business potential of AI is simultaneously closely linked to the organizational environment in which the action potentials unfold (Majchrzak and Markus 2013; Seidel et al. 2013). It is therefore essential for incumbent firms to align the technological opportunities of AI with business problems under consideration of the domain-specific environment (i.e., task-technology-fit) (Holmström and Hällgren 2022; Muchenje and Seppänen 2023). For incumbent firms, this fit is particularly relevant in leading-edge IS application domains where business processes are swiftly transforming in times of digitalization and the strategic use of AI is most pervasive (Jan et al. 2023; Richey et al. 2023).

Against this backdrop, Research Paper P2 seeks to identify and systemize the opportunities afforded by digital technologies such as AI as an interplay between technologies, business processes, and the domain-specific environment. To this end, it regards the frontline industrial development of Logistics 4.0 as a leading-edge IS application domain (Strandhagen et al. 2017; Winkelhaus and Grosse 2020). In Logistics 4.0, the efforts in digital transformation in general and AI in particular are challenged by cyber-physical processes and cross-organizational flows of data and information at different levels of the supply chain (Klumpp and Zijm 2019; Sigov et al. 2022). Accordingly, Research Paper P2 poses the following research question: *Which opportunities afford digital technologies such as AI, emerging from the dynamic interrelationship between technologies, business processes, and the domain-specific environment?*

To address this research question, Research Paper P2 synthesizes current academic research and frontline industrial insights through the theoretical lens of affordance theory (Gibson 1986; Majchrzak and Markus 2013). In the scientific literature, affordance theory has drawn momentum for developing a fine-grained understanding of the affordances of digital technologies such as AI in different organizational environments (Seidel et al. 2013; Wendt et al. 2022). Overall, this study draws on a two-phase research approach. First, it performs a systematic literature review to rigorously develop a catalog of affordances and associated practical manifestations as well as a conceptual framework of affordance layers (Webster and Watson 2002; Wolfswinkel et al. 2013). Second, it conducts a qualitative interview study with ten subject matter experts from academia and industry to evaluate, expand, and refine the results (Bettis et al. 2015; Goldkuhl 2012).

Figure 3 presents the main results of Research Paper P2. The conceptual framework of affordance layers illustrates the scope and interrelation between the affordances in four layers: data, manual tasks, goods & assets, and decisions & management. These four layers emerge from the logistics tasks and functions that the affordances address and reflect key aspects of the research into the impact of digital technologies such as AI on logistics systems. The conceptual framework of affordance layers is supplemented by a catalog of ten affordances that explicate 46 associated practical manifestations as cues for potential use and provide concrete examples for application from the scientific literature to foster practical understanding. It is also complemented by a mapping of the affordances to the archetypes of digital technologies such as AI and the intralogistics process elements they apply in order to allow deeper insights into how (i.e., a technology perspective) and where (i.e., a process perspective) the affordances emerge in the frontline industrial development of Logistics 4.0.

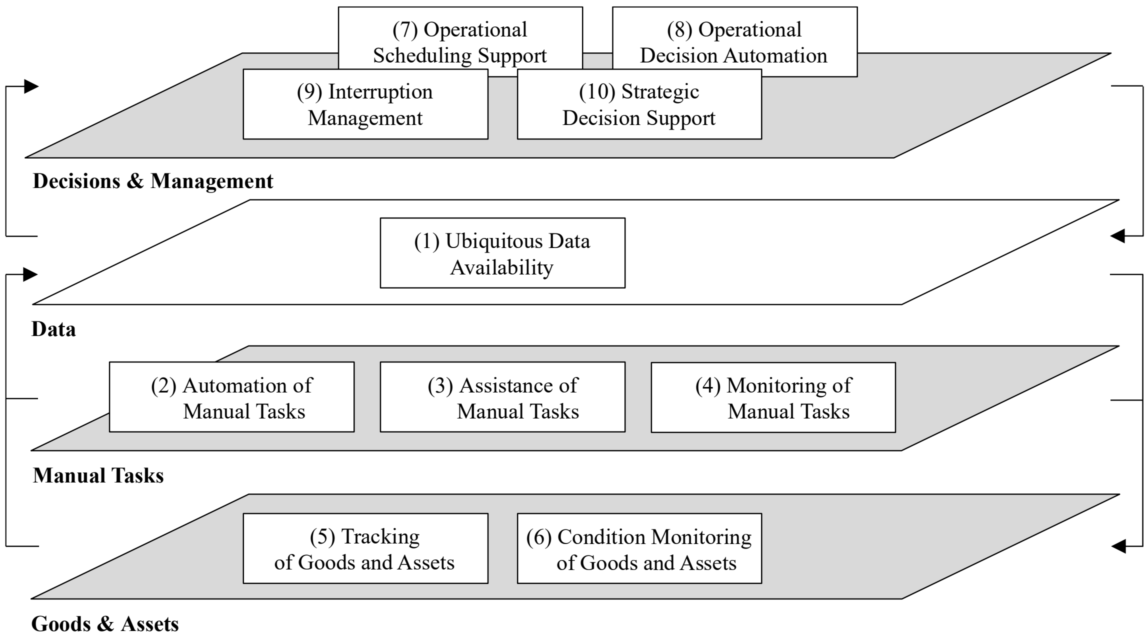

Figure 3 Conceptual framework of affordance layers

The results of Research Paper P2 offer valuable implications for research in terms of understanding the opportunities afforded by digital technologies such as AI in frontline industrial developments. While the scientific literature provides a useful overview over the predominant technological developments in Logistics 4.0 and detailed insights into individual use cases (Frank et al. 2019; Leofante et al. 2019), it has not offered a comprehensive perspective on the opportunities afforded by digital technologies such as AI. Further, previous studies have not related their potential to specific business processes (Shao et al. 2021; Winkelhaus and Grosse 2020). Consequently, this study enhances the existing body of knowledge by presenting a novel perspective on Logistics 4.0 that is in line with recent work drawing on affordance theory. In addition, this study provides valuable implications for practice. Specifically, it supports managers in assessing and actively monitoring the extent to which they are leveraging the opportunities afforded by digital technologies such as AI in frontline industrial developments. Building on the results, managers can determine the technological status quo of their business processes by assessing which affordances are currently covered and which may advance certain business processes. As managers are facing various technological manifestations of AI, abstracting from technological fads and taking a process-oriented perspective can help them to identify untapped affordances. This orientation further encourages managers to adopt a task-technology-fit perspective when discussing where to catch up or how and where to proceed with AI. In turn, this helps avoid isolated solutions and offsets potential subjective biases toward certain technological manifestations of AI.

Overall, the primary contribution of Research Paper P2 to the research objectives of this cumulative dissertation is to provide theoretical guidance on how incumbent firms can identify and systemize the opportunities afforded by digital technologies such as AI, emerging from the dynamic interrelationship between technologies, business processes, and the domain-specific environment. To do so, it utilizes affordance theory as a theoretical lens to derive patterns that exist through the symbiotic relationship between AI as the technological artifact and an actor's set of actions in leading-edge IS application domains instead of focusing only on latent technology capabilities.

III. Preparing the Business Use of Artificial Intelligence

For incumbent firms to move from an intention with AI to an implementation of AI, there is a need for theoretical guidance on and actionable insights into how to approach the strategic use of AI in line with firm-specific goals as well as internal and external constraints. This doctoral thesis addresses this issue by investigating how incumbent firms can prepare the business use of AI. Specifically, it presents scientific research on the design space of an AI strategy through the development of a taxonomy and the derivation of corresponding clusters (*Section III.1; Research Paper P3*). It also provides scientific research on the pathways for AI capability development through a multiple case study (*Section III.2; Research Paper P4*).

III.1 Design Space of Artificial Intelligence Strategy

While incumbent firms are increasingly moving beyond opportunistic and tactical decisions toward a more strategic direction with AI (Borges et al. 2021; Keding 2021), their endeavors with AI still have not achieved the aspired outcomes or have even failed (Vial et al. 2023; Wamba-Taguimdje et al. 2020). One reason is that incumbent firms often establish their endeavors with AI in unstructured ways rather than following a distinct strategic direction (Sagodi et al. 2024; van Giffen and Ludwig 2023). Accordingly, to succeed with AI and sustainably strengthen their competitive position in the market, incumbent firms must implement an AI strategy as guidelines for courses of action and sets of decisions that guides their endeavors with AI in line with firm-specific goals as well as with internal and external constraints to a distinct strategic direction.

With this in mind, Research Paper P3 argues that there is a need to reflect on the present understanding of how to design a strategy in the age of AI (Buxmann et al. 2021). While responding to technological breakthroughs at a strategic level so as to remain competitive is not a new phenomenon and has been thoroughly discussed in the strategy discourse (Bharadwaj et al. 2013; Woodard et al. 2013), AI has a transformative impact on the scope, scale, speed, and source from which incumbent firms set courses of action and sets of decisions (Borges et al. 2021; Keding 2021). In response, Figure 4 establishes the chain of argumentation that (1) the facets of contemporary AI lead to (2) AI-induced market and resource shifts, which, in turn, result in (3) AI-related strategic challenges. These AI-related strategic challenges require a strategic response from incumbent firms in the form of (4) an AI strategy.

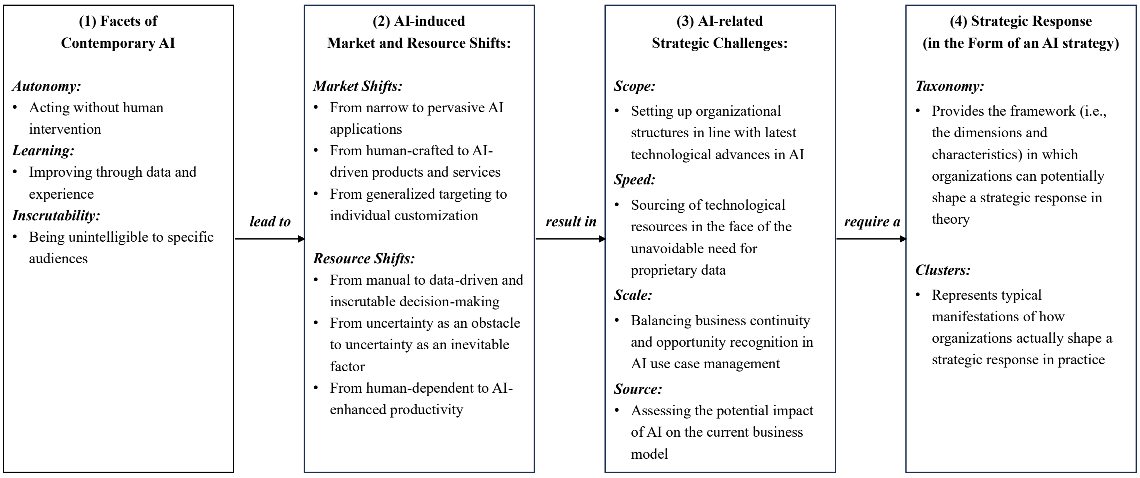

Figure 4 Chain of argumentation for the need for an artificial intelligence strategy

While this chain of argumentation underpins the strategic relevance of AI, the knowledge of the emergent phenomenon of AI strategy is still in its infancy in the scientific literature (Collins et al. 2021; Enholm et al. 2022). Instead, recent work has focused on the definition of a cognitive strategy (Davenport and Mahidhar 2018), the convergence of AI and corporate strategy (Kitsios and Kamariotou 2021), the integration of AI into organizational strategy (Borges et al. 2021), or the components of a data science strategy (Reddy et al. 2022). Although these valuable contributions have paved the way for investigating the emergent phenomenon of AI strategy, to date, no study has condensed the extant knowledge in a comprehensive way. Thus, there is not yet a shared understanding of what the design space of an AI strategy entails. To address this issue, Research Paper P3 states the following research question: *What is the design space of an AI strategy in the context of incumbent firms?*

To answer this research question, Research Paper P3 develops a taxonomy and derives corresponding clusters of AI strategy in line with the organizational systematics approach (Bozeman and McKelvey 1983). Following the methodological guidance of Kundisch et al. (2022), this study iteratively applies conceptual-to-empirical and empirical-to-conceptual iterations to build a multi-layer taxonomy that characterizes the design space of an AI strategy. Thereby, it relies on knowledge from scientific and professional literature as well as 15 semi-structured interviews. To ensure that the taxonomy reflects the properties of an AI strategy in practice, this study further draws on empirical evidence from a sample of 51 real-world objects (i.e., real-world instances of AI strategy from incumbent firms in the largest economies worldwide), which it sorts into the taxonomy to identify clusters via cluster analysis (Ketchen and Shook 1996).

Table 3 presents the main results of Research Paper P3 as a taxonomy of AI strategy. The taxonomy consists of 15 dimensions and 45 characteristics, which are in line with the meta-characteristics as the design space of an AI strategy in the context of incumbent firms. Building on Bharadwaj et al. (2013), it applies the four core themes that guide the definition of a digital strategy to the context of an AI strategy to structure the taxonomy into four overarching layers: scope, scale, speed, and source. Respectively, the scope layer comprises dimensions that describe the activities that incumbent firms perform within their direct control and ownership, while the scale layer encompasses dimensions that refer to the leverage effects that help incumbent firms to establish AI. Further, the speed layer includes dimensions that relate to the time and sequence in which incumbent firms release products and services, while the source layer covers dimensions that reflect the mechanisms and activities through which incumbent firms gain value from products or services.

Layer	Dimension	Characteristics			
Scope	Strategic Ownership	Central Staff Unit	Separate Department	Integrated Team	Cross-functional Unit
	Organizational Anchoring	Corporate	Divisional	Functional	Proprietary
	Life Cycle Management	Centralized	Decentralized	Federal	
	Governance Level	Enterprise-wide	Portfolio-based	Application-specific	
	Control Mechanisms	Guiding	Restricting	No Additional	
	Data Governance Framework	Isolated	Hybrid	Integrated	
Scale	Knowledge Acquisition	Training	Hiring	Contracting	
	Technology Sourcing	Make	Hybrid	Buy	
Speed	Use Case Identification	Systematical	Experimental		
	Use Case Expansion	One-to-Many	Many-to-One		
Source	Technology Aspiration	Established	Cutting-edge	Bleeding-edge	
	Business Model Impact	Complementing	Extending	Renewing	
	Risk Tolerance	High Risk	Limited Risk	Minimal Risk	
	Value Creation	Frontstage	Backstage	Front- & Backstage	

Table 3 Taxonomy of artificial intelligence strategy

Building on the taxonomy as an intermediate result, Table 4 presents four clusters of AI strategy as a further result. These clusters represent typical combinations of characteristics of an AI strategy that co-occur in real-world objects. Respectively, technology navigators are incumbent firms that are the driving force behind the trajectory of AI, pushing and shaping the frontiers of the ever-evolving performance and scope of AI applications, while innovation explorers represent incumbent firms that embrace a forward-thinking approach to the strategic use of AI toward transformative growth. Further, business enhancers are incumbent firms that embrace a purpose-driven approach to the strategic use of AI toward incremental growth, while operations stabilizers represent incumbent firms that focus on the careful and thoughtful integration of AI through use cases that promise enhancements in operational efficiency performance, rather than breakthrough innovation or radical change.

ID	Name	Description	Cluster	Number	Examples
1	**Technology Navigator**	Push the boundaries of AI through continuous research and development. Respective organizations undertake risky but rewarding projects to achieve technological breakthroughs at the forefront of AI.	1	12	JPMorgan, Microsoft, Infineon, SAP
2	**Innovation Explorer**	Delve into promising emerging and previously uncharted territories with AI. Respective organizations invest substantial resources in AI to unlock new value streams alongside existing products and services.	2	18	American Express, Bayer, E.ON, Volkswagen
3	**Business Enhancer**	Focus on improving the operational performance of processes or routines with AI. Respective organizations explore AI in initial use cases but are cautious about the widespread application.	3	6	MTU Aero Engines, Procter & Gamble, Linde, Chevron
4	**Operations Stabilizer**	Resort to AI to date in only a few isolated or scattered use cases. Respective organizations prefer stability and reliability over breakthrough innovations due to the potential risks and adverse outcomes of AI.	4	15	Henkel, Nike, McDonald’s, Coca-Cola

Table 4 Clusters of artificial intelligence strategy

The results of Research Paper P3 are novel, because they are the first to provide researchers and practitioners with a shared understanding of what the design space of an AI strategy entails. While the taxonomy unveils how incumbent firms currently structure and organize an AI strategy, the clusters delineate predominant design options for developing a new AI strategy or evaluating an existing one. Accordingly, the results contribute to a fundamental understanding of the design space of an AI strategy.

In this way, Research Paper P3 provides researchers and practitioners with valuable implications. From a theoretical perspective, the results add descriptive knowledge to the scientific discourse at the nexus of IS and strategic management. While both research streams have highlighted the mutual relevance to advance the real-world use of AI, the scientific literature has considered them as separate entities, leading to a discrepancy in the understanding of the interplay between the operational implementation of AI and its strategic implications. With the conceptualization of the design space of an AI strategy, this study transcends the boundaries of both research areas and lays a solid foundation to further theorize on the design of an AI strategy in general by means of higher-level theories. Thus, the taxonomy and the corresponding clusters contribute to theory-building as a springboard for further sense-making and design-led research into AI strategy. Further, from a practical perspective, the results can help incumbent firms to establish their endeavors with AI with a distinct strategic direction. Particularly, this study supports managers in designing an AI strategy in line with firm-specific goals as well as with internal and external constraints. Thus, managers can use the taxonomy to understand which combination of characteristics constitutes an existing AI strategy in incumbent firms. At the same time, the taxonomy serves as a morphological box, meaning that each combination of characteristics leads to a new AI strategy for incumbent firms. Further, managers can use the clusters as a source of inspiration for developing a new AI strategy or as a metric for evaluating an existing one. In this way, the clusters can help managers to take more informed decisions on the design of an AI strategy.

In sum, the primary contribution of Research Paper P3 to the research objectives of this doctoral thesis is to provide theoretical guidance on and actionable insights into how incumbent firms can design an AI strategy in line with the firm-specific goals as well as internal and external constraints. Thus, it builds on the four core themes that guide the definition of a digital strategy to present the design space of an AI strategy in the context of incumbent firms in a coherent framework.

III.2 Pathways for Artificial Intelligence Capability Development

While guidelines for courses of action and sets of decisions form the basis to guide endeavors with AI toward a distinct strategic direction, the strategic use of AI is simultaneously closely linked to the presence of relevant AI capabilities (Hansen et al. 2024; Sjödin et al. 2021; Weber et al. 2023). It is therefore crucial that incumbent firms find pathways for the acquisition of new capabilities or the accumulation of existing capabilities that are inherent to contemporary AI (Ritala et al. 2024; Wang et al. 2024). This need is particularly relevant for small and medium-sized enterprises (SMEs) that face resource constraints when it comes to the strategic use of AI (Oldemeyer et al. 2024; Schwaeke et al. 2025). While there is mature knowledge of what relevant AI capabilities are, there is no evidence of how incumbent firms can proceed to develop relevant AI capabilities (Keller et al. 2022; Soh et al. 2023; van der Meulen et al. 2020).

Against this backdrop, Research Paper P4 seeks to determine the pathways that incumbent firms can take to develop relevant AI capabilities in line with the firm-specific objectives and the specific organizational context. To this end, it regards the frontline industrial development of Industry 4.0 as a leading-edge IS application domain (Ghobakhloo and Iranmanesh 2021; Huber et al. 2022). In Industry 4.0, the efforts in digital transformation in general and AI in particular are facilitated by the wealth of available and accessible data as well as the equipment of the production environment with sensors and actuators that foster connectivity and interoperability between smart machines, control systems, and enterprise software systems (Pivoto et al. 2021; Yao et al. 2019). Accordingly, Research Paper P4 poses the following research question: *What pathways can SMEs in the manufacturing sector take to develop relevant AI capabilities?*

To address this research question, Research Paper P4 conducts a multiple case study and synthesizes qualitative data from eight cases (Mills et al. 2010; Yin 2018). These cases involve SMEs in the manufacturing sector that are undergoing digital transformation by means of the strategic use of AI. Building on 22 semi-structured interviews with subject matter experts as well as insights from secondary data, the cases provide in-depth insights into how incumbent firms can proceed to develop relevant AI capabilities. Following a three-step coding approach, including the derivation of first-order concepts, second-order themes, and aggregate dimensions to structure and interpret the data from the cases in line with the methodological guidance of Gioia et al. (2013), this study synthesizes core capability areas in which incumbent firms must develop relevant AI capabilities. On this foundation, it further identifies pathways that incumbent firms can take to develop relevant AI capabilities.

Figure 5 presents the main results of Research Paper P4. The six core capability areas represent emergent patterns of action for AI capability development repeatedly mentioned in the interviews and the secondary data. Together, the six core capability areas form a comprehensive framework of relevant AI capabilities.

Capability Area	Capability Description
Strategy and Leadership Prioritization	… encompasses capabilities that sketch out how SMEs in the manufacturing sector shape the engagement and involvement of the management board. For SMEs, it is essential to ensure the provision of financial and personnel resources through the management board to steer the transformation process.
Processual and Structural Alignment	… relates to AI capabilities that illustrate how SMEs in the manufacturing sector manage the establishment and adjustment of the organizational hierarchy, framework, and network (i.e., operations and workflows), including the safe and secure use of AI applications. For SMEs, it is vital to establish new or redesign existing roles and responsibilities.
Knowledge and Skill Building	… encompasses AI capabilities that illustrate how SMEs in the manufacturing sector elevate the technical and non-technical proficiency of employees. For SMEs, it is vital to equip their employees with emerging competencies in the rapidly evolving technology landscape to enable informed engagement with AI.
Network and Partnership Engagement	… relates to AI capabilities that sketch out how SMEs in the manufacturing sector create collaborations with third-party entities to acquire or accumulate resources externally that are not present internally. For SMEs, it is essential to leverage external expertise to intensify and accelerate the exploration of AI, as their internal focus is often limited to the operation of the core business.
Use Case Management	… encompasses AI capabilities that sketch out how SMEs in the manufacturing sector discern and realize the most impactful AI use cases. For SMEs, it is vital to focus only on AI use cases that align with business objectives and deliver tangible benefits, as their room for experimentation and innovation activities is often limited due to resource constraints.
Data and Infrastructure Setup	… relates to AI capabilities that illustrate how SMEs in the manufacturing sector establish a robust technological framework to handle the development, deployment, and operation of AI in an efficacious manner. For SMEs, it is essential to build a technological foundation that allows the exploration but also the seamless embedding and integration of AI in the first place.

Table 5 Core capabilities for artificial intelligence capability development

Building on the six core capability areas as an intermediate result, Figure 5 presents the four pathways that incumbent firms can take to develop relevant AI capabilities as a further result. These pathways result from the analysis of eight cases with different industry affiliations (i.e., medical, toys, press, materials, printing, farming, electrical, mining) and represent strategic actions as design moves for AI capability development. Thereby, the pathways can be delimited according to two dimensions (Keller et al. 2022). First, the pathways differ in the source from which they amass relevant AI capabilities. The source may be either inorganic (i.e., through acquisitions or partnerships) or organic (i.e., through one unit or across multiple units). Second, the pathways differ in the setup of the actors involved in developing relevant AI capabilities. The setup may be either independent (i.e., no other actors, either internally or externally) or interdependent (i.e., via external partnerships or across units). Respectively, an AI ambassador group adopts an organic approach to capability development and features an interdependent setup of actors. Here, the medical case is a prime example, because it formed an internal task force to develop relevant AI capabilities. The AI ambassador group consists of an interdisciplinary team who consolidate all AI-related activities, driving the AI capability development process closely integrated with the activities in the core business. Next, an AI ecosystem alliance takes an inorganic approach to capability development and features an interdependent setup of actors. The cases of glass, machinery, and toys engaged in strategic partnerships with external parties to develop relevant AI capabilities. They all involved employees who are part of an AI ecosystem alliance in the AI capability development process. Further, an AI innovation hub takes an organic approach to capability development and features an independent setup of actors. The cases of electrical, farming, and printing established internal units to develop relevant AI capabilities. They all involved an interdisciplinary team who are part of an AI innovation hub in the AI capability development process. Finally, an AI venture spin-off adopts an inorganic approach to capability development and features an independent setup of actors. Here, the mining case is a prime example, because it founded an external venture arm to develop relevant AI capabilities. The AI venture spin-off consists of employees who consolidate all AI-related activities, driving the AI capability development process widely decoupled from the activities in the core business.

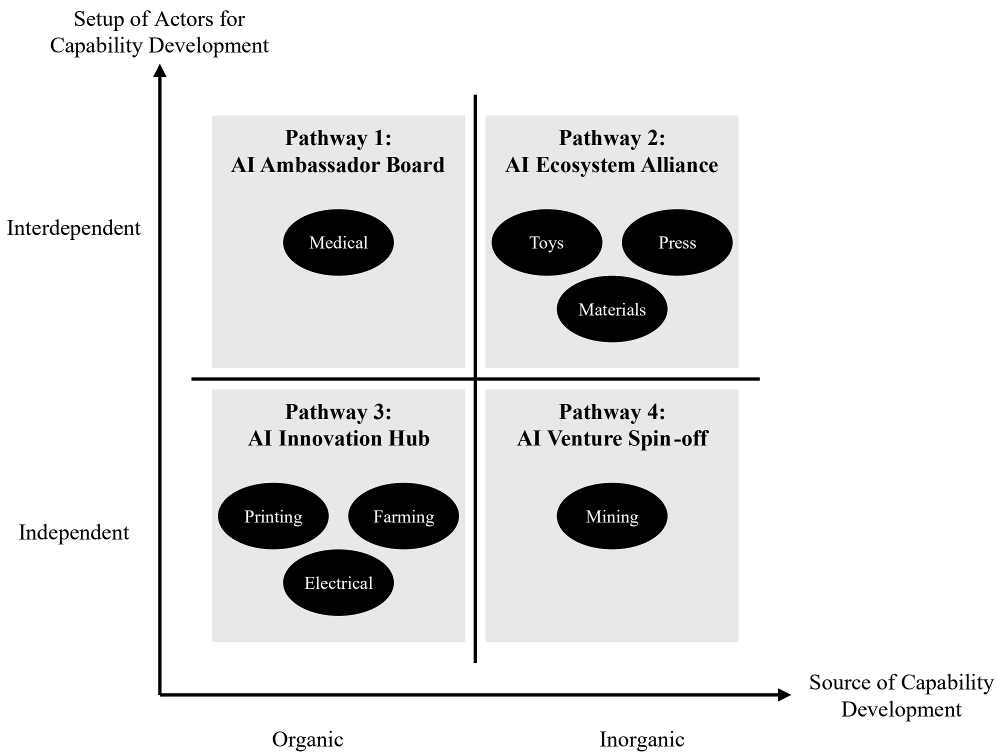

Figure 5 Pathway matrix for artificial intelligence capability development

The results of Research Paper P2 offer valuable implications for research in terms of understanding the pathways incumbent firms can take to develop relevant AI capabilities. While the scientific literature has appreciated the conceptualization of pathways to understand how incumbent firms can respond to emergent phenomena through capability development (Soh et al. 2023; van der Meulen et al. 2020) and outlines the need for a nuanced perspective on how to develop relevant AI capabilities (Ritala et al. 2024; Wang et al. 2024), this study adds a new level of granularity to the field of AI capability development. It complements and advances the existing body of knowledge on capability development by providing insights into how incumbent firms can proceed to develop relevant AI capabilities, depending on the source of AI capability development and the setup of the actors involved in AI capability development. In addition, this study provides valuable implications for practice. Specifically, it provides incumbent firms with a comprehensive perspective on the spectrum of pathways for AI capability development as a foundation for strategic deliberations on how to develop relevant AI capabilities in line with the firm-specific objectives and the specific organizational context. The six core capability areas also provide managers with a coherent and cohesive framework that describes the key activities that they must perform to develop relevant AI capabilities. Managers can also use the results as a starting point for determining the status quo of AI capability development, identifying the target state of AI capability development, and understanding the process of AI capability development.

Overall, the primary contribution of Research Paper P4 to the research objectives of this cumulative dissertation is to provide theoretical guidance on and actionable insights into how incumbent firms can develop relevant AI capabilities in line with the firm-specific objectives and the specific organizational context. To do so, it considers the source of AI capability development and the setup of the actors involved in AI capability development to present the pathways for AI capability development in the context of incumbent firms in a coherent framework.

IV. Realizing the Business Value of Artificial Intelligence

For incumbent firms to move from an implementation of AI to an impact from AI, there is a need for theoretical guidance on and actionable insights into how to transform the technological affordances of AI into specific actions toward achieving sustainable performance gains. This doctoral thesis addresses this issue by investigating how incumbent firms can realize the business value of AI. Specifically, it provides scientific research on the success factors for AI projects through a systematic literature review and an interview study (*Section IV.1; Research Paper P5*). It further presents scientific research on an architectural model for AI innovations through design science research (DSR) (*Section IV.2; Research Paper P6*).

IV.1 Success Factors for Artificial Intelligence Projects

To deploy a software product or service with AI functionality in a productive environment, incumbent firms initiate AI projects (Vial et al. 2023; Wamba-Taguimdje et al. 2020). However, incumbent firms encounter significant pitfalls when planning and executing AI projects (Lee et al. 2023; Merhi 2023). Specifically, AI projects tend to get stuck in an experimental pilot phase without transitioning from conceptual use cases to productive systems (Benbya et al. 2020). As a result, AI projects often fail to live up to the intended outcomes or are even terminated before completion (Vial et al. 2023; Wamba-Taguimdje et al. 2020).

With this in mind, Research Paper P3 argues that there is a lack of a systematic understanding of the success factors for AI projects, which is necessary to turn conceptual use cases into productive systems (Duan et al. 2019; Dwivedi et al. 2021). In general, success factors refer to settings and conditions that directly or indirectly influence a project outcome (Baccarini 1999; Ika 2009; Turner and Müller 2003). While the study of the determinants that influence the success and failure of IT projects is among the most prominent research streams in the scientific literature (Dwivedi et al. 2015; Xu et al. 2010), researchers and practitioners seeking a systematic understanding of the success factors for AI projects can only draw on a limited number of studies (Duan et al. 2019; Dwivedi et al. 2021). However, to turn conceptual use cases into productive systems, there is a need for a systematic understanding of the antecedents for successfully planning and executing AI projects. To address this issue, Research Paper P5 states the following research question: *What are the success factors for AI projects?*

To answer this research question, Research Paper P5 follows a three-stage research approach. First, it conducts a systematic literature review to develop an initial set of success factors. In line with the recommendations of Webster and Watson (2002) as well as Wolfswinkel et al. (2013), it applies a three-step coding approach based on grounded theory analysis techniques (i.e., open, axial, and selective coding). Second, it performs an interview study with 20 subject matter experts from academia and industry to validate, refine, and extend the results against first-hand practical experience. Following the guidelines of Bettis et al. (2015) and Goldkuhl (2012), it revises the initial set of success factors toward a final set. Third, it conducts a focus group discussion with 18 researchers who have sufficient knowledge of the trajectory of AI to situate the success factors in a broader context and determine how they manifest in the AI project workflow. In line with the recommendations of Nyumba et al. (2018) and Tremblay et al. (2010), it maps the success factors to the AI project workflow for a systematic understanding of the scope and scale in which they emerge in AI projects.

Table 6 presents the main results of Research Paper P5 as a framework of success factors for AI projects that structures the 24 success factors along four overarching success dimensions (i.e., datability, desirability, feasibility, and viability) and specifies them by 93 subordinate success manifestations. For each success factor, it not only provides a comprehensive description, but also depicts the specific AI characteristics that illustrate their relevance and necessity. In this context, the success dimensions specify the key action fields when planning and executing AI projects from a higher-level perspective, while the success manifestations provide operational support for AI projects from a lower-level perspective.

	#	Success Factor	Description	AI Characteristics	Success Manifestations
Datability	**1**	**Data Quality**	Account for accurate, structured, labeled, and high-quality training and evaluation data.	AI systems demand high-quality input data to provide valuable outcomes for further processing.	Data Cleanliness, Data Structure, Data Labeling, Data Understandability
	2	**Data Quantity**	Ensure the availability of required large amounts of data of different types and sources and their smooth accessibility.	AI systems require a sufficient amount of training data to identify patterns and relationships.	Data Availability, Data Accessibility, Data Acquisition, Data Source Variety, Data Type Variety
	…	**…**	…	…	…

Table 6 Framework of success factors for artificial intelligence projects

Building on the framework of success factors for AI projects as an intermediate result, Figure 6 illustrates how the success factors manifest in the four key phases of the AI project workflow (i.e., demand specification, data collection & preparation, modeling & training, and deployment & monitoring) as a further result. This results in four overarching observations that serve as recommendations for successfully planning and executing AI projects. First, incumbent firms must strike a balance between success factors relating to desirability, feasibility, and viability in AI projects, and must not neglect or focus only on one of them, as this may result in project failure. Second, incumbent firms must increase the prioritization of success factors relating to datability in AI projects, because data represents the foundation for project success. Third, incumbent firms must focus on success factors relating to datability and desirability throughout AI projects, while feasibility and viability are particularly relevant at the start (i.e., demand specification) and at the end (i.e., deployment & monitoring). Fourth, incumbent firms must rethink established definitions of 'done' in AI projects, as there is a need for continuous adaptation.

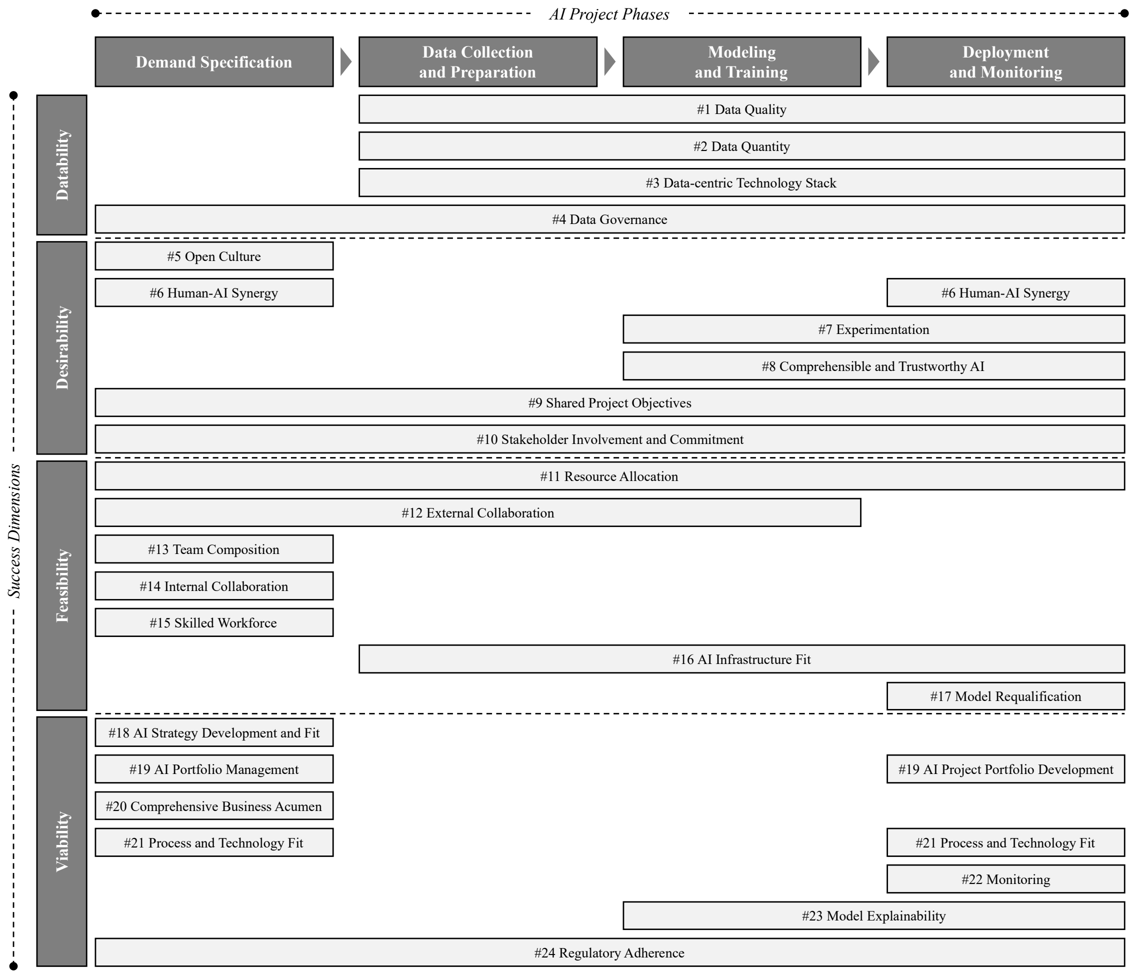

Figure 6 Contextualization of success factors for artificial intelligence projects

The results of Research Paper P5 are novel, because they are the first to systematically explore the success factors for AI projects by synthesizing extant knowledge from a systematic literature review with emergent insights from an interview study. While the scientific literature here mentions relevant aspects to consider when planning and executing AI projects, they do not provide a coherent and conclusive list of success factors that are subject to contemporary AI.

In this way, Research Paper P5 provides researchers and practitioners with valuable implications. From a theoretical perspective, the results complement the existing body of knowledge on the success factors for IT projects (Duan et al. 2019; Dwivedi et al. 2021). With the unique set of success factors for AI projects, this study specifies established knowledge about the antecedents for successfully planning and executing AI projects to account for the inherent characteristics and specific requirements of AI (Ågerfalk et al. 2022; Benbya et al. 2020; Berente et al. 2021). This study further supplements previous work that has already thematized the logic of value creation and delivery of AI projects against the background of concepts such as AI adoption in general or AI readiness in particular (Jöhnk et al. 2021; Merhi and Harfouche 2024). Accordingly, the results even serve as a starting point for community-wide discussions on the settings, conditions, and events that matter in AI projects. Further, from a practical perspective, the results help managers in assessing and actively monitoring the extent to which their current AI projects cover relevant success factors. In this context, the framework of success factors for AI projects serves as a foundation for a self-assessment or a fit-gap analysis. In turn, the resulting insights allow them to capitalize on strengths and opportunities, while concurrently eliminating threats and weaknesses. In the latter case, managers can then even take immediate action in current AI projects to address success factors that are inadequately covered. Further, the coherent and conclusive list of success factors for AI projects serves as a starting point for a systematic understanding of the antecedents for successfully planning and executing AI projects. Thus, managers can utilize the unique set of success factors to structure strategic discussions on what is necessary to turn conceptual use cases into productive systems.

In sum, the primary contribution of Research Paper P5 to the research objectives of this doctoral thesis is to provide theoretical guidance on how incumbent firms can successfully plan and execute AI projects. Thus, it builds on overarching success dimensions and subordinate success manifestations to obtain a holistic and integrative view of what is necessary to turn conceptual use cases into productive systems.

IV.2 Architectural Model for Artificial Intelligence Innovations

While knowledge of how to turn conceptual use cases into productive systems forms the foundation for successfully planning and executing AI projects, the business value of AI is simultaneously closely linked to the ability to generate AI innovations (Trocin et al. 2021; Truong and Papagiannidis 2022). It is therefore essential for incumbent firms to be able to leverage the ever-increasing number and variety of AI applications (Berente et al. 2021). In this context, GenAI in general and LLMs in particular have recently drawn considerable attention from incumbent firms (Griebel et al. 2020; Kanbach et al. 2024). Recent work has emphasized the contribution of LLMs to substantially enhance human creativity (Griebel et al. 2020; Kanbach et al. 2024). This amplifies the transformative potential of LLMs and renders them interesting for knowledge-intensive endeavors such as the generation of innovative ideas (Bouschery et al. 2023; Nah et al. 2023).

Against this backdrop, Research Paper P6 seeks to investigate the transformative potential of LLMs for the generation of innovative ideas. In general, idea generation is based on two approaches: divergent thinking (i.e., the generation of potential ideas) and convergent thinking (i.e., the further development and evaluation of generated ideas) (Banathy 1996). The double diamond visualizes the interplay between divergent and convergent thinking. While the first diamond focuses on the problem space, facilitating the discovery and definition of a relevant problem, the second diamond centers on the solution space, involving the development and delivery of viable solutions (British Design Council 2004). Accordingly, LLMs allow to increase the output of potential ideas in the divergent phase and to consider a broader spectrum of aspects for problem concretization in the convergent phase (Bouschery et al. 2023; Nah et al. 2023). As a result, Figure 7 visualizes a single diamond that illustrates the impact of LLMs on divergent and convergent thinking with reference to the original double diamond.

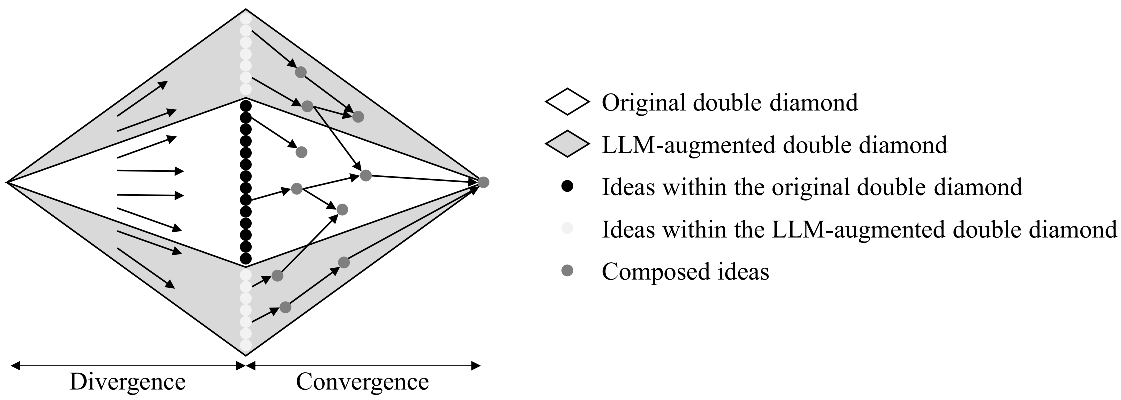

Figure 7 Single diamond of divergent and convergent thinking

While this single diamond illustrates the impact of LLMs on divergent and convergent thinking in a theoretical way, it remains unclear how to instantiate the theorized potential of LLMs for the generation of innovative ideas in a practical way. In fact, the scientific literature already discusses the use of digital technologies in general and AI in particular as a way to augment human creativity in idea generation (Müller-Wienbergen et al. 2011; Siemon et al. 2022). There is also evidence of the generation of innovative ideas with the help of LLMs (Griebel et al. 2020; Kanbach et al. 2024). In contrast, little is known about how to channel the inherent capabilities of LLMs to augment divergent and convergent thinking in the ideation process through a real-world instantiation in a meaningful and efficacious way. Accordingly, Research Paper P6 poses the following research question: *How to design an LLM-based agent system that augments the ideation process?*

To address this research question, Research Paper P6 embraces the DSR paradigm (Gregor and Hevner 2013; Peffers et al. 2007). Specifically, it follows the well-established six-phase process, synthesizing current academic research and frontline industrial insights. After the problem identification, this study derives design objectives from a structured literature review, which serve as the basis for the subsequent design and development of an artifact. It further instantiates the resulting artifact in the form of an architectural model of an LLM-based agent system through a software prototype on a local server to demonstrate the design specification. Finally, this study discusses the software prototype for its performance and impact through ten interviews with subject matter experts to ensure rigorous evaluation as a basis for scientific communication.

Figure 8 presents the main results of Research Paper P6. The architectural model of an LLM-based agent system visualizes which components are necessary, which tasks they fulfill, and how they interplay across layers and interfaces to augment divergent and convergent thinking in the ideation process with the help of LLMs. Overall, the architectural model has two layers: the user agent layer and the AI agent layer. The user agent layer contains the user agent, which serves as the interface for human interaction, while the AI agent layer includes various specialized agents based on LLMs. First, the chat manager agent initiates and oversees the overall process by receiving prompts from the user agent and delegating tasks to the other agents. Second, the planner agent generates plans, encompassing problem definition, brainstorming, idea development, evaluation, and reporting, as well as assigning them to the corresponding agent. Third, the problem definer agent formulates a problem statement and defines the solution requirements. Fourth, the brainstormer agent uses the problem statement and external data to brainstorm ideas. Fifth, the idea developer agent refines the generated ideas by incorporating the feedback from the user agent. Sixth, the evaluator agent assesses the detailed ideas against the predefined requirements and reports on their performance. Seventh, the reporter agent concludes the process by creating a summary of the group conversation. Eighth, the retrieval augmented generation agent retrieves specific information from external data.

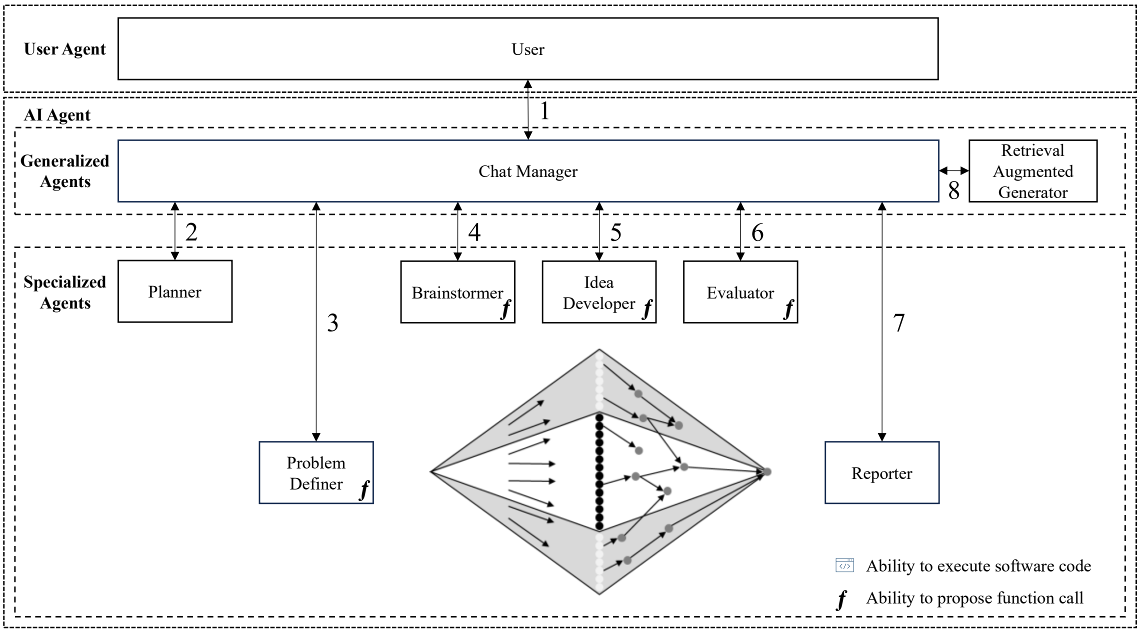

Figure 8 Architectural model of a large language model-based agent system

The results of Research Paper P6 offer valuable implications for research in terms of understanding how to leverage the transformative potential of LLMs for the generation of innovative ideas. While the scientific literature has highlighted the use of AI as a way to augment human creativity in idea generation (Müller-Wienbergen et al. 2011; Siemon et al. 2022), this study complements and advances the existing body of knowledge on the interplay between human and computational creativity to maximize the value of augmenting human creativity through LLMs. In this way, it also responds to recent suggestions to turn the theorized potential of LLMs for the generation of innovative ideas through a real-world instantiation into action. In addition, this study provides valuable implications for practice. Specifically, managers can use the results to get a more structured understanding of the impact of LLMs. Thereby, the LLM-based agent system serves as a support in innovation activities to generate potential ideas in the divergent thinking phase or further develop and evaluate generated ideas in the convergent phase. Further, the results serve managers as a blueprint to build their own LLM-based agent system or to experiment with LLMs in a meaningful and efficacious way.

Overall, the primary contribution of Research Paper P6 to the research objectives of this cumulative dissertation is to provide actionable insights into how incumbent firms can embrace AI innovations. To do so, it draws on the example of LLMs as technological manifestations of AI and idea generation as the core of the innovation process to study the leverage effect of AI in innovation management.

V. Conclusion

V.1 Summary

Over the past few years, the strategic use of AI has moved to the center of research agendas and corporate roadmaps (Borges et al. 2021; Li et al. 2021). Today, after a period of experimentation and testing, the surge in interest in AI is at its peak (Oehmichen et al. 2023; Sagodi et al. 2024; van Giffen and Ludwig 2023). Appropriately, market studies and industry reports indicate that incumbent firms have meanwhile acknowledged the strategic use of AI as a way to achieve cost reductions and revenue leaps, and are now seeking to achieve sustainable performance gains (Boston Consulting Group 2024; McKinsey & Company 2024). Despite these formidable projections, for incumbent firms, the disparity between the business potential of AI and its de facto business value remains one of the most critical challenges faced by researchers and practitioners in various facets (Lee et al. 2023; Merhi 2023).

Against this backdrop, this doctoral thesis proposes an end-to-end perspective on the exploration of AI. Specifically, it provides theoretical guidance on and actionable insights into how to navigate the strategic use of AI in incumbent firms. This ranges from aspects relating to understanding the business potential of AI (i.e., *scoping*) over preparing the business use of AI (i.e., *strategizing*) to realizing the business value of AI (i.e., *scaling*). On the foundation of six research papers, this cumulative dissertation offers theoretically grounded and practically relevant conceptual and empirical work that serves as a way for incumbent firms to bridge the gap between the business potential of AI and its de facto business value. Thereby, it seeks to give researchers and practitioners a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms, in three ways.

Section II, which includes *Research Papers P1 and P2*, provides two notable contributions that advance the knowledge on how incumbent firms can move from an interest in AI to an intention with AI by means of *scoping*. First, an overview over how the action potentials of individual cognitive functions of AI vary across different contextual factors of business processes that serves as a foundation to support the state-of-the-art analysis of potential AI applications is outlined. Second, a conceptual framework of affordance layers that serves as a way to facilitate the identification, assessment, and selection of potential AI use cases is introduced. Together, the results of these two research papers enhance theoretical guidance on and actionable insights into how to align the technological opportunities of AI with business problems under consideration of the domain-specific environment. In this way, this doctoral thesis provides researchers and practitioners with insights into the technical and organizational intricacies associated with understanding the business potential of AI.

Section III, which includes *Research Papers P3 and P4*, presents two significant contributions that expand the knowledge on how incumbent firms can move from an intention with AI to an implementation of AI by means of *strategizing*. First, a taxonomy and corresponding clusters that conceptualize the design space of an AI strategy are provided. Second, pathways that describe the process of AI capability development along six core capability areas are offered. Together, the results of these two research papers advance the scientific knowledge on how to set a strategic frame for AI. Specifically, they provide theoretical guidance on and actionable insights into how incumbent firms can approach the strategic use of AI in line with firm-specific goals as well as internal and external constraints. In this way, this doctoral thesis equips researchers and practitioners with insights into the technical and organizational intricacies associated with preparing the business use of AI.

Section IV, which includes *Research Papers P5 and P6*, provides two notable contributions that advance the knowledge on how incumbent firms can move from an implementation of AI to an impact from AI by means of *scaling*. First, a framework of success factors for AI projects that serves as a foundation for the transition of conceptual use cases into productive systems is outlined. Second, an architectural model for AI innovations that serves as a way to facilitate the generation of innovative ideas is introduced. Together, the results of these two research papers enhance theoretical guidance on and actionable insights into how to transform the technological affordances of AI into specific actions toward achieving sustainable performance gains. In this way, this doctoral thesis provides researchers and practitioners with insights into the technical and organizational intricacies associated with realizing the business value of AI.

Motivated by the need to navigate the strategic use of AI in incumbent firms, the overall purpose of this cumulative dissertation is to provide researchers (e.g., IS scholars) and practitioners (e.g., high- and mid-level decision-makers) with a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms. It contributes to this research area by taking an end-to-end perspective on the exploration of AI as a way to move from an initial interest in AI, to a sound intention with AI, to a targeted implementation of AI, to an actual impact from AI.

V.2 Limitations and Future Research

The results of this doctoral thesis need to be reflected against the backdrop of limitations that also provide an impetus for future research. While the limitations of the embedded research papers are discussed in detail in the Appendix (*Sections VII.3 to VII.8*), this section provides an aggregated overview over the limitations of this cumulative dissertation. Thus, the following presents three overarching limitations that stimulate avenues for future research on the strategic use of AI in incumbent firms.

First, this cumulative dissertation seeks to bridge the gap between the business potential of AI and its de facto business value through six research papers in three phases. This end-to-end perspective has been stimulated by previous research and is confirmed by the results of this doctoral thesis. In this sense, this cumulative dissertation complements extant work on the strategic use of AI in incumbent firms, as presented in contributions dealing with technical intricacies (e.g., AI lifecycle models or AI project workflows) and organizational imperatives (e.g., AI adoption or AI readiness). However, the six research papers represent only individual and selected contributions that are dedicated to isolated topics and specific issues relating to understanding the business potential of AI, preparing the business use of AI, and realizing the business value of AI. The six research papers are also self-contained, so that connections and dependencies are neither considered between the contributions within nor across the three phases. Although it is good practice in the scientific literature to focus on isolated and specific research questions, the six research papers are not comprehensive and complete in their entirety, as there may be further aspects in the three phases that need to be considered. Accordingly, future research may investigate, for instance, the assessment and selection of potential AI use cases in the scoping phase, the implementation of mechanisms of an AI governance in the strategizing phase, or the integration of monitoring tools and control systems in the scaling phase. In this context, fellow researchers may also advance the synthesis of knowledge within and across the three phases to account for connections and dependencies between research papers when referring to an end-to-end perspective on the exploration of AI.

Second, this doctoral thesis seeks to navigate the strategic use of AI in incumbent firms through the provision of artifacts. Therefore, the six research papers primarily involve systematic literature reviews and qualitative interview studies to infer results. Thus, there are limitations that are inherent in the nature and type of these research methods. To counteract potential methodological shortcomings such as an imperfect compilation of scientific literature or a biased selection of interview partners, the six research papers augment the development of the artifacts with extensive evaluation rounds to ensure the applicability and usefulness of the artifacts. Nonetheless, future research may conduct confirmatory and explanatory studies to expand the breadth and depth of data collection and to assess the reliability and validity of the results in a more comprehensive context. The results are also limited regarding an evaluation of the benefits of the artifacts in the real world. Although the six research papers consider researchers and practitioners as prospective users in the extensive evaluation rounds, the artifacts are not instantiated in the real world. Thus, fellow researchers are encouraged to demonstrate the applicability and usefulness of the artifacts in the real world through practitioner interventions (e.g., through case studies). In addition, the results reflect the current status quo of the strategic use of AI in incumbent firms. Although the six research papers are regarded as a reliable framework that researchers and practitioners can build on in the future to bridge the gap between the business potential of AI and its de facto business value, novel perspectives may emerge in line with the nature of AI as the ever-evolving frontier of computational advancement. Thus, future research may review and update the results in regular intervals and repeated cycles to reflect the latest technological progress in AI.

Third, this cumulative dissertation seeks to provide an end-to-end perspective on the exploration of AI. Thereby, it focuses on incumbent firms that were founded before the emergence of digital technologies as the subject of investigation. However, the research papers relating to understanding the business potential of AI and realizing the business value of AI contain research questions that are relevant but not limited to incumbent firms. Fellow researchers are encouraged to narrow the focus of these research papers down to incumbent firms and study whether and how the results may differ from alternative organization types (e.g., startups and new ventures). In this sense, future research may harmonize research angles by tailoring the technological focus of Research Paper P2 from digital technologies in general to the specifics of contemporary AI. Conversely, it may broaden the technological focus of Research Paper P6 from the example of LLMs as technological manifestations of AI to AI in general. In contrast, the two research papers relating to preparing the business use of AI refer to incumbent firms as the subject of investigation. However, as there is by definition no information on the size or industry affiliation of incumbent firms, they take different perspectives on incumbent firms. As a result, Research Paper P3 examines the design space of an AI strategy across all sectors in the context of corporations from the largest economies worldwide, while Research Paper P4 investigates the pathways for AI capability development in the context of SMEs in the manufacturing sector. Fellow researchers are encouraged to continue studying the strategic use of AI in incumbent firms through different research angles and thereby expand the scope of interest to a broader spectrum of leading-edge IS application domains to account for potential contextual constraints.

Notwithstanding these limitations, this cumulative dissertation contributes to the current body of knowledge on how to navigate the strategic use of AI in incumbent firms. It paves the way for researchers (e.g., IS scholars) and practitioners (e.g., high- and mid-level decision-makers) to gain a better understanding of the technical and organizational intricacies associated with the strategic use of AI in incumbent firms.

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VII. Appendix

IX.1 Index of the Research Papers

This cumulative dissertation includes six research papers, which have been published in or submitted to renowned peer-reviewed scientific journals or conference proceedings. This section lists the respective authors of the individual research papers, together with the publication medium and its scientific quality.

Research Paper P1: Through the Lens of Cognitive Functions and Contextual Factors: A Study of the Action Potentials of Artificial Intelligence in Business Process Management

Meierhöfer, Simon; Dorner, Claudius-Merlin (2023). Through the Lens of Cognitive Functions and Contextual Factors: A Study of the Action Potentials of Artificial Intelligence in Business Process Management. In: Proceedings of the 18th International Conference on Wirtschaftsinformatik, Paderborn, Germany.

(VHB-Jourqual 3: C | VHB-Jourqual 4: B | Impact Factor: n.a.)

Research Paper P2: Leveraging Digital Technologies in Logistics 4.0: Insights on Affordances from Intralogistics Processes

Albrecht, Tobias; Baier, Marie-Sophie; Gimpel, Henner; Meierhöfer, Simon; Röglinger, Maximilian; Schlüchtermann, Jörg; Will, Lisanne (2023). Leveraging Digital Technologies in Logistics 4.0: Insights on Affordances from Intralogistics Processes. In: Information Systems Frontiers. DOI: 10.1007/s10796-023-10394-6.

(VHB-Jourqual 3: B | VHB-Jourqual 4: B | Impact Factor: 6.9)

Research Paper P3: Conceptualizing the Design Space of Artificial Intelligence Strategy: A Taxonomy and Corresponding Clusters

Hofmann, Peter; Meierhöfer, Simon; Müller, Leon; Oberländer, Anna Maria; Protschky, Dominik (2025). Conceptualizing the Design Space of Artificial Intelligence Strategy: A Taxonomy and Corresponding Clusters. In: Business & Information Systems Engineering. DOI: 10.1007/s12599-025-00941-7.

(VHB-Jourqual 3: B | VHB-Jourqual 4: B | Impact Factor: 7.4)

Research Paper P4: Pathways to Developing Artificial Intelligence Capabilities: Insights from Small and Medium-sized Enterprises in the Manufacturing Sector

Meierhöfer, Simon; Oberländer, Anna Maria; Weidlich, Robin (2025). Pathways to Developing Artificial Intelligence Capabilities: Insights from Small and Medium-sized Enterprises in the Manufacturing Sector. Under Review in: Information & Management.

(VHB-Jourqual 3: B | VHB-Jourqual 4: B | Impact Factor: 8.2)

Research Paper P5: Uncovering the Sweet Spot of Artificial Intelligence Projects: An Exploration of Success Factors

Leuthe, Daniel; Meierhöfer, Simon; Häckel, Björn; Kolbeck, Thomas (2025). Uncovering the Sweet Spot of Artificial Intelligence Projects: An Exploration of Success Factors. In Revision in: International Journal of Innovation and Technology Management.

(VHB-Jourqual 3: C | VHB-Jourqual 4: C | Impact Factor: 1.6)

Research Paper P6: Augmenting Divergent and Convergent Thinking in the Ideation Process: An LLM-Based Agent System

Fischer-Brandies, Leopold; Meierhöfer, Simon; Protschky, Dominik (2024). Augmenting Divergent and Convergent Thinking in the Ideation Process: An LLM-Based Agent System. In: Proceedings of the 32nd European Conference on Information Systems, Paphos, Cyprus.

(VHB-Jourqual 3: B | VHB-Jourqual 4: A | Impact Factor: n.a.)

Throughout the course of this doctoral thesis, I have also co-authored further book chapters, research papers, and white papers that are not part of this cumulative dissertation.

- Grüneke, Timo; Guggenberger, Tobias; Hall, Kristina; Langer, Tiana; Meierhöfer, Simon; Oberländer, Anna Maria; Röglinger, Maximilian; Stramm, Jan; Urbach, Nils; Wozar, Jana (2025). Einsatz- und Akzeptanzanalyse von KI-basierten Wissenszugängen in KMU am Beispiel einer semantischen Suche. In: University of Bayreuth & Frankfurt University of Applied Sciences.

- Häckel, Björn; Meierhöfer, Simon; Müller, Melina; Oberländer, Anna Maria Süzeroğlu, Selina; Werner, Tim; Wiedemann, Stefanie (2025). Erschließung von Nachhaltigkeitspotenzialen mittels Künstlicher Intelligenz: Einblicke aus einem Konsortialforschungsprojekt in der Druckindustrie. In: HMD Praxis der Wirtschaftsinformatik. DOI: 10.1365/s40702-025-01176-6.

- Mayer, Valentin; Prediger, Loreen; Urbach, Nils; Meierhöfer, Simon (2025). The Evolution of the Organizational Decision Making Process: A Predictive Analysis of the Impact of Artificial Intelligence. In: Proceedings of the 46th International Conference on Information Systems, Nashville, Tennessee, USA.

- Meierhöfer, Simon; Schüll, Moritz; Buck, Christoph (2024). Etablierung von Enterprise Architecture Management in kleinen und mittleren Unternehmen: Erkenntnisse aus einer Fallstudie. In: Wirtschaftsinformatik & Management. DOI: 10.1365/s35764-024-00530-5.

- Urbach, Nils; Feulner, Daniel; Mayer, Valentin; Meierhöfer, Simon (2025). AI Strategizing and Readiness. In: Managing Artificial Intelligence – How Organizations Succeed with AI. Springer Fachmedien Wiesbaden.

IX.2 Individual Contributions to the Research Papers

This doctoral thesis comprises six research papers. All research papers were developed in collaboration with one or more co-authors. This section details the various research settings and highlights my individual contributions to the research papers. The descriptions follow the Contributor Roles Taxonomy (CRediT) by Allen et al. (2019).

Research Paper P1, entitled *Through the Lens of Cognitive Functions and Contextual Factors: A Study of the Action Potentials of Artificial Intelligence in Business Process Management*, was written with one co-author. As the lead author, I had the key role in all parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. While the co-author was responsible for writing the original draft, I had a key role in reviewing and editing the entire paper up to a conference proceedings publication. I also substantially revised and further developed individual sections. Finally, I presented this research paper at the 18th International Conference on Wirtschaftsinformatik in Paderborn, Germany. The research team agreed that I should act as the lead author, while the co-author acts as subordinate author.

Research Paper P2, entitled *Leveraging Digital Technologies in Logistics 4.0: Insights on Affordances from Intralogistics Processes*, was written by seven authors. I had a crucial role in most parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. While one co-author was responsible for writing the original drafts of individual sections, I had a key role in reviewing and editing the entire paper up to publication in a scientific journal. I also substantially revised and further developed individual sections. The research team agreed that all co-authors had contributed in equal parts.

Research Paper P3, entitled *Conceptualizing the Design Space of Artificial Intelligence Strategy: A Taxonomy and Corresponding Clusters*, was written with four co-authors. I had a crucial role in all parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. In close collaboration with one of the co-authors, I was responsible for writing the original drafts of individual sections and was involved in reviewing and editing the entire paper up to publication in a scientific journal. I also took over the project administration of the entire research process. The research team agreed that all co-authors had contributed in equal parts.

Research Paper P4, entitled *Pathways to Developing Artificial Intelligence Capabilities: Insights from Small and Medium-sized Enterprises in the Manufacturing Sector*, was written by three authors. As the lead author, I had the key role in all parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. In close collaboration with one of the co-authors, I was responsible for writing the original drafts of individual sections and was involved in reviewing and editing the entire paper. I also took over the project administration of the entire research process. The research team agreed that I should act as the lead author, while the other co-authors act as subordinate authors.

Research Paper P5, entitled *Uncovering the Sweet Spot of Artificial Intelligence Projects: An Exploration of Success Factors*, was written with three co-authors. I had a crucial role in all parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. In close collaboration with one of the co-authors, I was responsible for writing the original drafts of individual sections and was involved in reviewing and editing the entire paper. I also took over the project administration of the entire research process. The research team agreed that one co-author and I should act as equal lead authors, while the other co-authors as subordinate authors.

Research Paper P6, entitled *Augmenting Divergent and Convergent Thinking in the Ideation Process: An LLM-Based Agent System*, was written by three authors. I had a crucial role in all parts of the project. I contributed significantly to the conceptualization, methodology, investigation, and data curation. While one co-author was responsible for writing the original draft, I had a key role in reviewing and editing the entire paper up to a conference proceedings publication. I also substantially revised and further developed individual sections. Finally, I presented this research paper at the 32nd European Conference on Information Systems in Paphos, Cyprus. The research team agreed that all co-authors had contributed in equal parts.

IX.3 Research Paper P1: Through the Lens of Cognitive Functions and Contextual Factors: A Study of the Action Potentials of Artificial Intelligence in Business Process Management

Authors:

Meierhöfer, Simon; Dorner, Claudius-Merlin

Published in:

Proceedings of the 18th International Conference on Wirtschaftsinformatik, Paderborn, Germany (2023)

Abstract:

Artificial intelligence (AI) is currently one of the most prevalent technological breakthroughs. The nature of AI provides a multitude of action potentials in business process management (BPM). However, the diversity and complexity of underlying tools and methods of AI make it difficult for organizations to determine appropriate use cases in business processes, the central unit of BPM. At this point, organizations lack knowledge on how to conceptualize the use of AI in BPM. Against this background, we investigate the action potentials of individual cognitive functions of AI across different contextual factors of business processes by combining an online survey with an interview study by means of a mixed-methods approach. The results provide researchers and practitioners with a comprehensive overview of the action potentials of AI in BPM.

Keywords:

Artificial Intelligence; Business Process Management; Cognitive Functions; Contextual Factors

IX.4 Research Paper P2: Leveraging Digital Technologies in Logistics 4.0: Insights on Affordances from Intralogistics Processes

Authors:

Albrecht, Tobias; Baier, Marie-Sophie; Gimpel, Henner; Meierhöfer, Simon; Röglinger, Maximilian; Schlüchtermann, Jörg; Will, Lisanne

Published in:

Information Systems Frontiers (2023)

Abstract:

Emerging digital technologies are transforming logistics processes on a large scale. Despite a growing body of knowledge on individual use cases ranging from collaborative robots to platform-based planning systems in the frontline industrial development of Logistics 4.0, organizations lack a systematic understanding of the opportunities digital technologies afford for logistics processes. To foster such understanding, this study takes an intra-organizational perspective as a central starting point for digitalization initiatives toward Logistics 4.0. It synthesizes current academic research and industrial insights from a systematic literature review and an expert interview study through an affordance lens. The result is a catalog and conceptual framework of ten digital technology affordances in intralogistics (DTAILs) and 46 practical manifestations. Thereby, this study contributes to understanding and leveraging the opportunities digital technologies afford in a leading-edge information systems application domain. It serves as a foundation for further theorizing on Logistics 4.0 and for structuring strategic discussions among organizational stakeholders.

Keywords:

Affordance Theory; Digital Technology; Industry 4.0; Logistics 4.0; Logistics Process; Supply Chain Management

IX.5 Research Paper P3: Conceptualizing the Design Space of Artificial Intelligence Strategy: A Taxonomy and Corresponding Clusters

Authors:

Hofmann, Peter; Meierhöfer, Simon; Müller, Leon; Oberländer, Anna Maria; Protschky, Dominik

Published in:

Business & Information Systems Engineering (2025)

Abstract:

As the real-world use of artificial intelligence (AI) becomes increasingly pervasive, the interest of organizations in the nascent technology is currently at its peak. Although the scientific literature points out that a strategy is key to responding to technological breakthroughs, the three facets of autonomy, learning, and inscrutability that distinguish contemporary AI from previous generations of IT give rise to a novel and distinctive perspective on strategy. Particularly, the facets of contemporary AI lead to AI-induced market and resource shifts and, thus, to AI-related strategic challenges regarding the scope, scale, speed, and source from which organizations make strategic deliberations. This ultimately requires a strategic response from organizations in the form of an AI strategy. Against this backdrop, this study proposes a multi-layer taxonomy with 15 dimensions and 45 characteristics that unveils how organizations currently structure and organize an AI strategy. Conducting a cluster analysis on this foundation, this study further provides four clusters that delineate predominant design options for developing a new AI strategy or evaluating an existing one. In this way, the results contribute to a fundamental understanding of the design space of an AI strategy and enrich recent discussions among researchers and practitioners on how to advance the real-world use of AI.

Keywords:

Artificial Intelligence; Strategy; Taxonomy; Clusters

IX.6 Research Paper P4: Pathways to Developing Artificial Intelligence Capabilities: Insights from Small and Medium-sized Enterprises in the Manufacturing Sector

Authors:

Meierhöfer, Simon; Oberländer, Anna Maria; Weidlich, Robin

Under Review:

Information & Management

Extended Abstract:

Although the business potential of Artificial intelligence (AI) is undisputed among researchers and practitioners, most organizations still struggle to leverage this nascent technology in key operations and generate business value (Åström et al. 2022; Berg et al. 2023; Enholm et al. 2022). Specifically, small and medium-sized enterprises (SMEs), which make up approximately 95% of organizations worldwide and operate predominantly in the manufacturing sector, are reluctant to initiate their digital journey with AI (Oldemeyer et al. 2024; Schwaeke et al. 2025). Accordingly, to date, SMEs have only launched AI initiatives to a limited extent, despite their ambition and willingness to do so. In contrast to large corporations, SMEs face resource constraints such as the presence of financial means, or the engagement of qualified personnel, which prevent the use of digital technologies such as AI at speed and scale (Oldemeyer et al. 2024; Schwaeke et al. 2025). However, to keep pace with large corporations in a competitive environment, SMEs must find strategic actions to develop relevant capabilities that enable them to leverage the business potential of AI for designing novel products, devising smart services, or inventing disruptive business models (Hansen et al. 2024; Sjödin et al. 2021; Weber et al. 2023).

Despite the extensive research into the antecedents for AI adoption in organizations, into relevant capabilities for the strategic use of AI, and into digital transformation initiatives in SMEs, there has been very little attention on the pathways to develop relevant AI capabilities in SMEs. This poses a twofold challenge: On the one hand, it poses issues for researchers seeking to understand how SMEs can develop relevant capabilities for the strategic use of AI and what motives and rationalities are behind distinct pathways. On

the other hand, it poses issues for practitioners seeking to understand how to disseminate AI initiatives in SMEs across application areas and functional domains in line with the firm-specific objectives and the specific organizational context. Accordingly, this study poses the following research question: *What pathways can SMEs in the manufacturing sector take to develop relevant AI capabilities?*

To answer this research question, this study conducts a multiple case study and synthesizes qualitative data from eight cases (Mills et al. 2010; Yin 2018). These cases involve SMEs in the manufacturing sector that are undergoing digital transformation by means of the strategic use of AI. Building on 22 semi-structured interviews with subject matter experts as well as insights from secondary data, the result is four pathways (i.e., AI Ambassador Group, AI Ecosystem Alliance, AI Innovation Hub, AI Venture Spin-off) that demonstrate how SMEs can proceed to develop relevant AI capabilities. The pathways represent unique approaches for AI capability development in line with the firm-specific objectives and the specific organizational context. On this foundation, this study describes, for each pathway, in detail, the process of AI capability development along six core capability areas (i.e., processual and structural alignment, use case management, data and infrastructure setup, strategy and leadership prioritization, knowledge and skill building, network and partnership engagement). Thus, this study is a first step toward a better understanding of which pathways SMEs can take to develop relevant AI capabilities.

Keywords:

Artificial Intelligence; Capability Development; Manufacturing; Pathways; Small and Medium-sized Enterprises

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IX.7 Research Paper P5: Uncovering the Sweet Spot of Artificial Intelligence Projects: An Exploration of Success Factors

Authors:

Leuthe, Daniel; Meierhöfer, Simon; Häckel, Björn; Kolbeck, Thomas

In Revision:

International Journal of Innovation and Technology Management

Extended Abstract:

The gaining momentum of artificial intelligence (AI) for designing novel products, devising smart services, or inventing disruptive business models evokes an inarguable wave of excitement among both researchers and practitioners (Burström et al. 2021; Sjödin et al. 2021). In search of a strategic response, organizations across industries have started to initiate AI projects that seek to unlock the underlying business value (Vial et al. 2023; Wamba-Taguimdje et al. 2020). However, organizations encounter significant pitfalls when planning and executing AI projects (Lee et al. 2023; Merhi 2023). This encompasses – including technical (e.g., ensuring explainability of AI algorithms) and business challenges (e.g., identifying valuable AI use cases), but also legal (e.g., creating suitable AI governance practices) and ethical issues (e.g., promoting responsible AI use), among others. As a result, AI projects often fail to live up to the intended outcomes or are even terminated before completion (Vial et al. 2023; Wamba-Taguimdje et al. 2020).

Recent work attributes this dilemma to the lack of a systematic understanding of the success factors for AI projects (Duan et al. 2019; Dwivedi et al. 2021). While the study of the determinants that influence the success and failure of IT projects is a very prominent research stream in the scientific literature (Dwivedi et al. 2015; Xu et al. 2010), researchers and practitioners seeking a systematic understanding of the success factors for AI projects can draw only on a few studies (Duan et al. 2019; Dwivedi et al. 2021). However, to turn conceptual use cases into productive systems, there is a need for a systematic understanding of the antecedents for successfully planning and executing AI projects. Accordingly, this study states the following research question: *What are the success factors for AI projects?*

To answer this research question, this study follows a three-stage research approach. First, it conducts a systematic literature review to develop an initial set of success factors (Webster and Watson 2002; Wolfswinkel et al. 2013). Second, it performs an interview study with 20 subject matter experts from academia and industry to validate, refine, and extend the initial set of success factors toward a final set of success factors (Bettis et al. 2015; Goldkuhl 2012). Third, it conducts a focus group discussion with 18 researchers to situate the success factors in a broader context and determine how they manifest in the AI project workflow (Nyumba et al. 2018; Tremblay et al. 2010). The result is a framework of 24 success factors for AI projects, structured along four overarching success dimensions (i.e., datability, desirability, feasibility, and viability) and specified by 93 subordinate success manifestations. This study is the first to systematically explore the success factors for AI projects. In this way, it lays the foundation for researchers to advance knowledge on how to manage AI projects. It also provides organizational stakeholders with a foundation to structure strategic discussions on how to successfully plan and execute AI projects.

Keywords:

Artificial Intelligence; Artificial Intelligence Project; Artificial Intelligence Project Workflow; Project Management; Project Success; Success Factors

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IX.8 Research Paper P6: Augmenting Divergent and Convergent Thinking in the Ideation Process: An LLM-Based Agent System

Authors:

Fischer-Brandies, Leopold; Meierhöfer, Simon; Protschky, Dominik

Published in:

Proceedings of the 32nd European Conference on Information Systems, Paphos, Cyprus (2024)

Abstract:

Generative artificial intelligence (GenAI) in general and large language models (LLMs) in particular have recently gained considerable attention in innovation management as a means to augment the generation of innovative ideas. While this trend seems to grow at an astonishing pace, knowledge of how to leverage the transformative potential of LLMs for the generation of new ideas remains scarce in the scientific literature. This poses a major challenge for organizations striving to channel the inherent capabilities of LLMs for idea generation in a meaningful and efficacious manner. Against this backdrop, we design and instantiate an artifact that augments divergent and convergent thinking in the ideation process with the help of LLMs (i.e., LLM-based agent systems) following the design science research paradigm. Based on the insights from ten evaluation interviews with subject matter experts, we conclude that the integration of our artifact into existing ideation processes is useful and applicable.

Keywords:

Generative Artificial Intelligence; Ideation Process; Innovation; Large Language Models