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**DEVELOPMENT OF AN IMPLEMENTATION
FRAMEWORK FOR THE COMPANY-WIDE USE
OF GENERATIVE ARTIFICIAL INTELLIGENCE
IN GERMAN SMALL AND MEDIUM-SIZED
ENTERPRISES**

Theses of the doctoral (PhD) dissertation

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1 INTRODUCTION

1.1 Background and relevance

In recent years, generative artificial intelligence (AI) has evolved from an experimental field of research into a practical technology that is transforming business processes (Al Naqbi et al., 2024; Feuerriegel et al., 2023). The ability of these systems to independently generate complex content such as text, images, video, or audio marks a paradigm shift in the way companies interact with AI technology (Cao et al., 2023; Zhao et al., 2025). For the German economy, this presents both opportunities to increase competitiveness and an urgent need for action in the context of digital transformation (Gualandri & Kuzior, 2024; Peres et al., 2020).

Recent studies have indicated a marked increase in the adoption of artificial intelligence (AI) within German small and medium-sized enterprises (SMEs). While the Statistisches Bundesamt (2024b) reported that 20% of companies utilised AI technologies in 2024, this figure rose to approximately 40% in 2025, according to the ifo Institut (2025), Bitkom e. V. (2025) and the Institut der deutschen Wirtschaft (2025). This tendency is particularly pronounced among large companies (48%), as opposed to medium-sized (28%) and small companies (17%) (Statistisches Bundesamt, 2024a). The situation is particularly critical for SMEs, which traditionally form the backbone of the German economy. These companies face specific challenges: scarcity of

financial and human resources, lack of technical expertise and qualified IT specialists, and deficits in change management (Mesloh, 2021; Rajaram & Tinguely, 2024). Added to this are digital skills gaps in the workforce, legal uncertainties regarding data protection and compliance, and the complexity of integration into existing system landscapes (Oldemeyer et al., 2024; Schwaeke et al., 2024).

While large companies have dedicated IT departments and extensive budgets, SMEs often lack the structural prerequisites for successful technology adoption (Gupta, 2024). This discrepancy between technological potential and practical implementation capability poses not only a business challenge but also an economic one (Bettoni et al., 2021; Szedlak et al., 2021). Specialist departments such as marketing can benefit particularly from generative AI by creating personalized content and making data-driven campaign decisions with minimal resource expenditure (Davenport et al., 2020; Mikalef et al., 2021). At the same time, integration requires organizational adjustments, new skill profiles, and changed workflows (Kumar & Ratten, 2024).

Despite its practical relevance, there are gaps in the research (Oldemeyer et al., 2024; Sadiq et al., 2021). Five key research gaps can be identified: First, there is a lack of systematic studies on the implementation process of generative AI in medium-sized companies that map phases, milestones, and stakeholder constellations (Campbell et al., 2020; Chen et al., 2023). Second, there is a lack of analysis of strategic approaches and decision-making frameworks that SMEs use to plan and manage their implementation projects (Kanbach et al.,

2023). Third, there is hardly any research on specific basic technologies – such as model architectures, data pipelines, and integration interfaces – for practical implementation. Fourth, there is a lack of case studies documenting successful and failed implementation projects and deriving success and risk factors from them. Fifth, there is insufficient knowledge about evaluation criteria and impacts that arise specifically for departments such as marketing (Schönberger, 2023). These research gaps illustrate that, despite considerable potential, there are significant knowledge deficits regarding practical implementation and organizational design.

1.2 Objectives

The primary objective is to develop an empirically based framework that structures the process-oriented implementation of generative AI in medium-sized companies and makes it practical to apply. This framework is intended to serve as a guide that takes into account the specific conditions and resource constraints of SMEs while also being scientifically sound.

To achieve this primary objective, four secondary objectives are pursued: First, the analysis and derivation of strategic planning approaches that support SMEs in designing and managing their AI initiatives. Second, the identification and description of the basic technologies used in practice in order to provide decision-makers with concrete guidance in selecting technologies. Third, the derivation and description of criteria and metrics for evaluating implementation success

in order to enable evidence-based assessment. Fourth, the development of well-founded recommendations for the formulation and further development of an AI roadmap that ensures a strategic long-term perspective.

The dissertation thus aims to make two significant contributions: For science, it closes a central research gap by developing a systematic, empirically validated framework for the first time. For practice, it provides a directly applicable guide that supports decision-makers in the planning, implementation, and evaluation of AI projects.

1.3 Research questions

To address the identified research gaps, a leading research question (LRQ) was formulated, which is specified by five supplementary research questions (SRQs). The leading research question is:

(LRQ): How can the implementation process of generative AI be designed for German SMEs, and which strategic approaches and underlying basic technologies can be applied in this context?

This overarching question examines the entire implementation process from initiation to practical integration and addresses both strategic and technological dimensions. The five supplementary research questions delve deeper into specific aspects:

(EF1): How can German SMEs proceed with the implementation of generative AI, and what steps characterize this process?

(EF2): What strategic approaches can German SMEs pursue to implement generative AI?

(EF3): What basic technologies can German SMEs use to implement generative AI?

(EF4): What evaluation criteria can German SMEs use to assess the success of the implementation?

(EF5): How can German SMEs formulate their AI roadmap, and what ongoing implementation measures can they derive from it?

The research questions are systematically derived from the identified research gaps and form the basis for the investigation and development of the framework.

2 METHODOLOGY

The methodological approach is guided by pragmatist epistemology, in which the research questions serve as the primary determinant of the methodological orientation (Feilzer, 2010). This ensures that the choice of research methods is primarily determined by the questions to be answered. Such an approach allows for the combination of different methodologies to comprehensively analyze the subject of investigation (Maarouf, 2019). Specifically, a qualitative-exploratory approach was chosen. The acquisition of knowledge is based on empirical observations and theoretical considerations, employing inductive, deductive, and abductive methods. The research process can be seen in Figure 1.

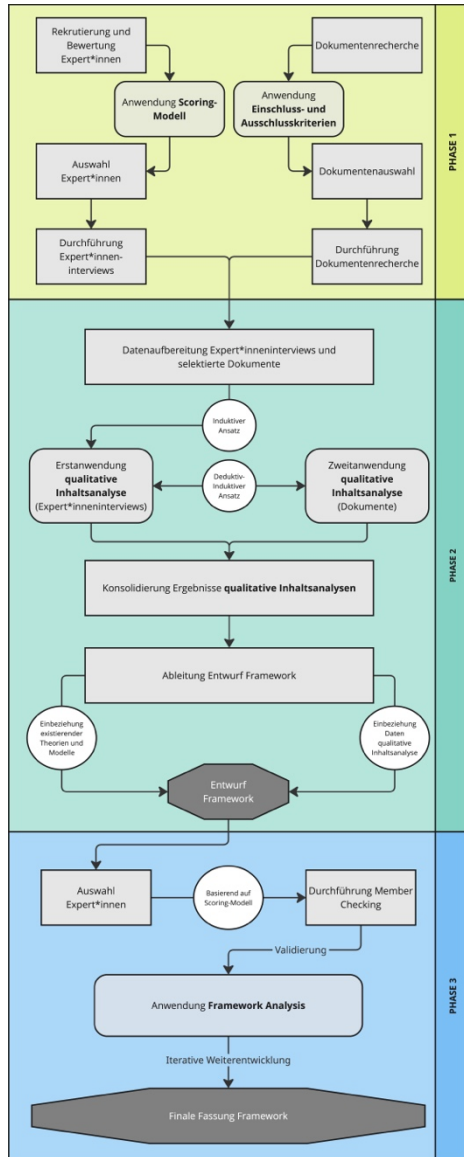


Figure 1: Research Design Scheme

Source: Own presentation

The research process is divided into three consecutive phases: The first phase is dedicated to the systematic recruitment of experts with the aid of a scoring model, as well as the execution of a documentary search. The second phase, through qualitative content analysis, facilitates both data-driven category formation and theory-guided contextualization of the collected data, which subsequently served for the initial derivation of the framework. The third phase is for the systematic validation and finalization of the initial draft of the framework, based on expert feedback and employing a framework analysis. As a central principle of quality assurance, methodological triangulation is applied, which enhances validity through the convergence of diverse data sources and analytical procedures (Valencia, 2022).

3 RESULTS

The central result of this research is a process-oriented implementation framework (Figure 2), which is based on the systematic analysis of expert interviews, podcast episodes, and validation discussions. It divides the introduction of generative AI into five main phases: (1) Identification of problems and opportunities, (2) Conceptualization and planning, (3) Prototyping or piloting, (4) Integration and rollout, and (5) Evaluation and further development.

The framework extends beyond a purely technical guide, pursuing a holistic, strategically anchored approach. This is substantiated by three overarching strategic success factors: a hybrid governance architecture that connects central and decentralized initiatives, a solid technology and data strategy, and continuous employee enablement. Furthermore, the process is intentionally designed to be iterative and adaptive in order to accommodate the high dynamics of innovation and the heterogeneity of medium-sized organizations through feedback loops and continuous learning.

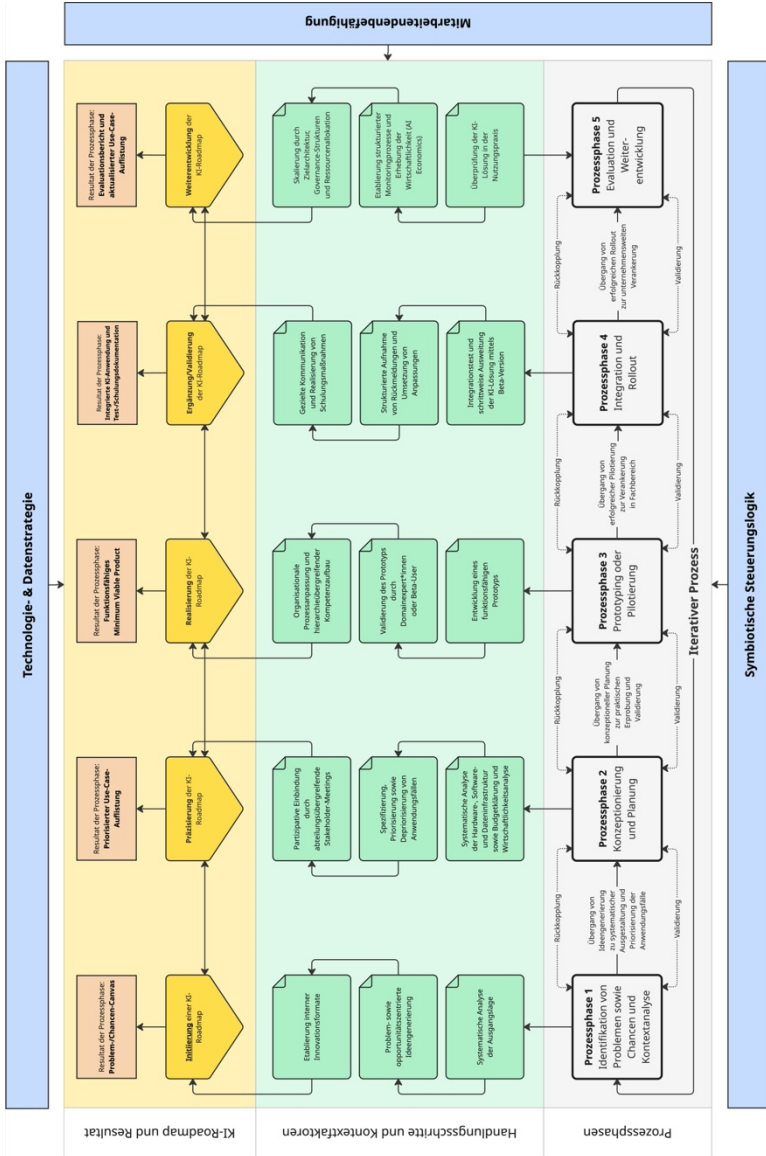


Figure 2: Implementation framework

Source: Own presentation

The initial phase focuses on the systematic analysis of the specific corporate context and the identification of concrete problems and opportunities. This involves assessing technical infrastructures, organizational frameworks, existing competencies, and strategic objectives. The second phase entails the conceptual development and strategic planning of the implementation, including the precise definition of goals, the allocation of necessary resources, and the establishment of responsibilities and governance structures. The third phase comprises the prototypical testing or pilot implementation of selected use cases in a controlled environment with a limited user group. This enables early organizational learning and the identification of potential technical or organizational challenges. Phase four is dedicated to the company-wide integration and systematic rollout of the technology, explicitly considering the insights gained and optimization needs identified during the pilot phase. The final phase includes the continuous evaluation of the implementation and its ongoing optimization based on systematically collected user feedback and defined key performance indicators.

The final validation through expert interviews confirmed the high practical relevance of the framework. In particular, the interplay of structured phase logic and procedural flexibility, as well as the integration of strategic success factors, were highlighted as key conceptual strengths.

4 NEW SCIENTIFIC RESULTS AND CONTRIBUTIONS

This research study makes a significant scientific contribution, arising from the combination of theoretical foundations, empirical knowledge acquisition and methodological consistency. At its core is an implementation framework that, for the first time, enables the process of introducing generative AI in German SMEs to be described and managed systematically. This contribution is novel not only because of the existence of the framework, but also because of what it achieves conceptually, which existing models are structurally unable to do.

Existing approaches, such as the plan-driven waterfall model, agile methods like Scrum and Kanban, and the data-oriented CRISP-DM framework, were developed for contexts in which target states can be defined and processes can be technically controlled. They neither address the specific resource constraints of SMEs nor the cultural, organisational and strategic dimensions that constitute successful AI implementation. This explains why approaches that are structurally unsuitable for the context at hand are often used in practice, and why a specific framework for this context did not exist until now.

The core of this work's scientific contribution lies in the fact that the introduction of generative AI differs fundamentally from classic IT implementation projects. While the introduction of a CRM system, cloud infrastructure or computer-controlled processes has a defined target state and can be completed technically, generative AI is a dy-

dynamic system that requires continuous learning, adaptation and organisational reflexivity, rather than a static tool. This technology changes not only processes, but also role models, decision-making logic and employees' relationships with their work. This cultural and organisational dimension is not secondary — it is essential for the successful implementation of generative AI. The empirical results of this study, obtained through 39 expert interviews and the analysis of 32 podcast episodes, consistently demonstrate that AI initiatives in small and medium-sized enterprises fail less due to technical deficits than structural, communicative and cultural deficits. This finding is novel and informs action.

The developed framework takes this finding into account by combining iterative-cyclical process logic with symbiotic control architecture. It divides the implementation process into successive, feedback-enabled phases, anchoring employee empowerment, change management and strategic leadership responsibility as integral components, rather than optional additions. This architecture's scientific added value lies not only in its completeness, but also in the conceptual decision to systematically separate process-descriptive and process-accompanying dimensions while simultaneously bringing them together in an integrated framework. This creates a frame of reference for the first time that understands and describes the implementation process of generative AI in SMEs as an organisational transformation process rather

than a linear project. Table 1 below summarises the scientific contributions of this work in terms of dimensions and explicitly contrasts them with the existing state of research.

Table 1: Overview of scientific contributions and new scientific findings

| No. | Contribution dimension | Scientific contribution | Novelty of the results |
|-----|------------------------|--|---|
| 1 | Conceptual | Initial conceptualization of the introduction of generative AI in SMEs as an organizational transformation process – not as a completed IT project with a definable end state | Existing models conceive implementation as a technically linear process; this work fundamentally overcomes this conception and thus creates a new conceptual frame of reference for the SME context |
| 2 | Conceptual | Development of a framework architecture: systematic separation and simultaneous integration of process-describing (5 phases) and process-accompanying dimensions (4 control dimensions) | No existing methodology combines both levels for the SME context with generative AI; the control architecture thus closes a structural gap that has been consistently identified as a factor for failure in practice |
| 3 | Empirical | Evidence that the failure of AI initiatives in SMEs is primarily due to structural, communicative, and cultural deficits – substantiated by 39 expert interviews and the analysis of 32 podcast episodes | Previous research has focused primarily on technical and financial barriers; for the first time, the cultural and organizational dimension has been empirically proven to be a constitutive – not downstream – success factor |
| 4 | Practical | Context-specific implementation framework with phase-related artifacts (including problem & opportunity canvas, MVP metrics, evaluation reports) as well as structurally anchored change management and employee empowerment | For the first time, there is an empirically based orientation model that is fully geared toward German SMEs – one that views organizational and regulatory dimensions not as supplements, but as integral components |
| 5 | Transferable | Theory-based transferability to SMEs with comparable structural characteristics (limited resources, flat hierarchies, high owner influence, early stage of digitalization maturity) | The framework does not claim universal validity, but it does lay an empirically saturated foundation for quantitative follow-up studies, international comparisons, and industry-specific adaptations |

Source: Own representation

The framework is geared towards German SMEs and is anchored in a specific context. It does not claim to be universally valid, as this would not be methodologically sound in the context of qualitative exploratory research. Nevertheless, the conceptual logic can be transferred to SMEs with comparable structural characteristics, such as limited resources, flat hierarchies, significant owner influence and an early stage of digital maturity. Companies that do not share these characteristics will have to make situational adjustments, which should be seen as an expression of the framework's adaptability rather than as a limitation. This paper therefore establishes an initial, empirically saturated foundation on which quantitative follow-up studies, international comparisons and context-specific adaptations can build.

5 CONCLUSION

5.1 Recommendations for business practice

The implementation of generative AI technologies in medium-sized companies requires a systematic approach that combines strategic foresight with operational implementation competence. To this end, the following recommendations address both the strategic and the operational level, offering a practice-oriented framework for decision-makers, managers, and project leaders.

At the strategic level, the creation of a conducive framework is of central importance. The establishment of a hybrid governance logic proves to be a critical success factor: While management assumes responsibility for the strategic vision, legitimation, and budget, employees should be actively enabled to identify concrete use cases from their operational perspective. This bidirectional approach avoids the limitations of purely hierarchical or exclusively decentralized methods and fosters organizational acceptance at all company levels. Employee enablement must be understood as a continuous strategic process, supported by low-threshold formats such as prompt guides or the appointment of "AI champions" who systematically disseminate their knowledge within the company and act as multipliers. Additionally, the development of a pragmatic technology and data strategy is necessary. This strategy should provide orientation through clear guardrails without inhibiting the dynamics of innovation through excessive regulation or slowing down decision-making processes.

On the operational level, the recommendations are oriented towards the phases of the implementation process. In the identification phase, the focus should be extended beyond reactive problem-solving to proactive opportunity recognition. Formalization through structured instruments, such as a Problem-Opportunity Canvas, creates commitment and transparently documents the basis for decisions. To substantiate investment decisions, the conceptualization phase requires a pragmatic economic viability analysis. The systematic prioritization and deprioritization of use cases in cross-departmental stakeholder meetings proves to be a critical success factor. In the prototyping phase, the development of scalable Minimum Viable Products should be preferred over isolated proof-of-concepts, as they combine early learning effects with realistic scaling perspectives. In this process, iterative feedback loops ensure consistent alignment with the real requirements of users and enable continuous optimization of the solution. The rollout phase benefits from formal testing phases with selected beta users, which minimize technical risks and prevent negative initial experiences. A transparent communication strategy that highlights the concrete benefits of the AI application and addresses concerns accompanies this process and sustainably promotes organizational acceptance. The evaluation phase requires continuous monitoring of defined key performance indicators and deliberate decisions regarding the scaling, functional enhancement, or decommissioning of applications to ensure a learning, cyclical process.

5.2 Future research directions

For future research, diverse perspectives emerge. These may include the development of SME-specific change management strategies to promote employee acceptance and overcome cultural barriers. Likewise, the analysis of new roles and qualification requirements in human-AI collaboration, as well as the conception of data governance frameworks suitable for medium-sized businesses, are possible perspectives. Furthermore, the development of a maturity model for generative AI in medium-sized companies would enable the systematic assessment of development stages and create benchmarking opportunities. Industry-specific use-case analyses could also identify promising applications in core sectors such as manufacturing, trade, and services, and derive best practices. Technologically, research perspectives open up in the optimization of personalization and customer experience, as well as in the development of architectures for agentic AI systems that autonomously orchestrate tasks. Beyond these research perspectives, the following hypotheses for examining effectiveness, influence, and efficiency can be found in Table 2:

Table 2: Hypothesis

| Hypothese Nr. | Formulierung der Hypothesen |
|---------------|--|
| 1 | Medium-sized companies that follow the five-phase implementation framework exhibit a higher success rate in the introduction of generative AI than companies that choose an ad-hoc approach. |
| 2 | The establishment of a symbiotic governance logic (top-down & bottom-up) correlates positively with the acceptance of AI applications by employees. |
| 3 | A higher degree of continuous employee enablement leads to a faster and broader adoption of generative AI tools within the company. |
| 4 | The application of iterative feedback loops between the implementation phases reduces the project duration and increases user satisfaction compared to a strictly linear approach. |

Source: Own representation

Ultimately, this work closes a central research gap by developing an empirically validated framework for AI implementation in medium-sized companies. It translates the qualitative findings into a practice-oriented framework for action and, through the formulated hypotheses, simultaneously lays the foundation for subsequent research. Thus, the dissertation makes a decisive contribution to the structured shaping of technological change within the corporate practice of the German Mittelstand.

6 AUTHORS SCIENTIFIC PUBLICATIONS

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- (4) Bartelt, C., & Röser, A. M. (2024). *Artificial Intelligence as a Catalyst for Sustainable Business Innovation: Perspectives from Finance and Marketing*. *Gazdaság & Társadalom / Journal of Economy & Society*, 17(35) (2), 37–65. <https://doi.org/10.21637/GT.2024.2.02>

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