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## Implementing AI Applications in Retail – Ex-ante and Ex-post Evaluation

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**Abstract:** This study examines how Austrian retail companies systematically implement Artificial Intelligence to enhance efficiency, customer interaction, and competitiveness along the value chain. It adopts a multi-stage, peer dialogue-oriented research design that combines an ex-ante conceptualization with company-specific recommendations and an ex-post analysis based on eight expert interviews conducted after one year.

The findings indicate that companies are still at an early stage of implementation and that organizational and cultural factors - such as management commitment, clear use cases, governance structures, and capability development - are more critical than purely technological issues.

The study contributes a context-sensitive ex-ante and ex-post implementation perspective and provides evidence-based recommendations, emphasizing top management involvement, transparent data management, pilot projects, key-user concepts, and cross-functional learning processes to achieve sustainable value creation through Artificial Intelligence in retail.

**Keywords:** AI in retail, innovation evaluation, ex-ante assessment, ex-post evaluation, retail innovation

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### 1 Introduction and Background

The ongoing digitalization of markets and intensifying competitive pressure compel retail firms to fundamentally reassess their business models and operations. In this context, Artificial Intelligence (AI) has emerged as a key driver of digital transformation

and an increasingly important source of competitive advantage (Zerine et al., 2025). By enabling advanced analytics, predictive modeling, and process automation, AI reshapes both internal operations and customer-facing activities, enhancing efficiency, decision quality, and customer experience.

This development is particularly evident in the Austrian retail sector, where AI adoption has accelerated significantly. Approximately 40 % of retailers have already implemented AI solutions at scale, reflecting a broader “AI boom” and underscoring its strategic relevance for productivity, resilience, and customer-centric value creation (Handelsverband, 2025). Empirical evidence further shows that AI applications are concentrated in areas such as marketing, customer service, supply chain management, and knowledge management (Deloitte, 2026; GDI, 2025), with use cases including demand forecasting, dynamic pricing, recommendation systems, automated content generation, customer analytics, chatbots, and predictive logistics.

Against this backdrop, proactive engagement with future developments and trends becomes increasingly critical for retail firms to remain competitive in the face of disruptive change, external pressures, and dynamic market conditions. The SCORE initiative (Scouting the Future of Retail) is a platform at the University of Applied Sciences Upper Austria designed to promote innovation in the retail sector. The SCORE initiative comprises workshops with retail companies across the entire value chain, the development of sector-specific trend radars, and strategic recommendations at company level. Findings from these activities show that AI is one of the key trends shaping the retail sector. In particular, the “Retail Trend Radar 2025,” which was developed through a co-creative process within the SCORE initiative involving academia, practitioners, and application experts and highlights that the strategic management of artificial intelligence and its effective implementation will be decisive for the future competitiveness of retail companies. Based on these insights, concrete, firm-specific recommendations for the organizational implementation of AI for the SCORE partner companies have been derived.

Despite its substantial potential, the implementation of AI remains challenging. Existing research highlights a lack of integrated approaches that align technological capabilities with organizational requirements. Key barriers include insufficient data quality, weak strategic alignment, underdeveloped innovation cultures, unclear responsibilities, and increasing concerns regarding data protection and cybersecurity (Handelsverband, 2025; Kalpana et al., 2025). Beyond these structural constraints, human and organizational factors are critical. Limited AI-related competencies, integration challenges with legacy IT systems, and consumer concerns regarding transparency, fairness, and data privacy influence both adoption and effectiveness. In this context, trust in AI emerges as a central prerequisite, shaped not only by technical performance but also by transparent communication and responsible data governance (Hofmann & Schumacher, 2021). Against this backdrop, this study examines how retail firms across the entire value chain can systematically integrate AI into organizational structures and processes. It adopts a holistic perspective, emphasizing the alignment of technological capabilities with organizational processes, human resources, and innovation-oriented management systems to leverage AI as both an efficiency driver and a catalyst for organizational renewal and sustainable competitive advantage.

Building on the insights outlined above, it becomes evident that while AI holds significant potential for enhancing efficiency, decision-making, and customer engagement in retail, its successful organizational implementation remains complex and multifaceted. Although prior initiatives and studies have generated company-specific recommendations for AI adoption, the extent to which these recommendations are implemented and the organizational consequences that follow remain largely unexplored (Haefner et al., 2024; Dignum, 2019; Oliveira and Martins, 2011). Addressing this gap, the present study focuses on evaluating both ex-ante and ex-post perspectives to generate actionable insights.

### *Research questions*

Against this background, the present study examines the extent to which the ex-ante developed recommendations have been implemented ex-post and analyses the resulting organizational implications, leading to the formulation of the following main research question:

*To what extent are ex-ante developed recommendations for AI implementation realized ex-post, and which organizational, data-related and strategic factors influence their successful adoption in retail companies?*

The remainder of the paper is organized as follows: Section 2 outlines the research design. Section 3 presents the ex-ante analysis while section 4 reports the ex-post evaluation results and implementation insights. Section 5 discusses the findings. Section 6 presents practical implications and theoretical contributions. Finally, Sections 7 and 8 outline the study's limitations and provide directions for future research.

## **2 Research design**

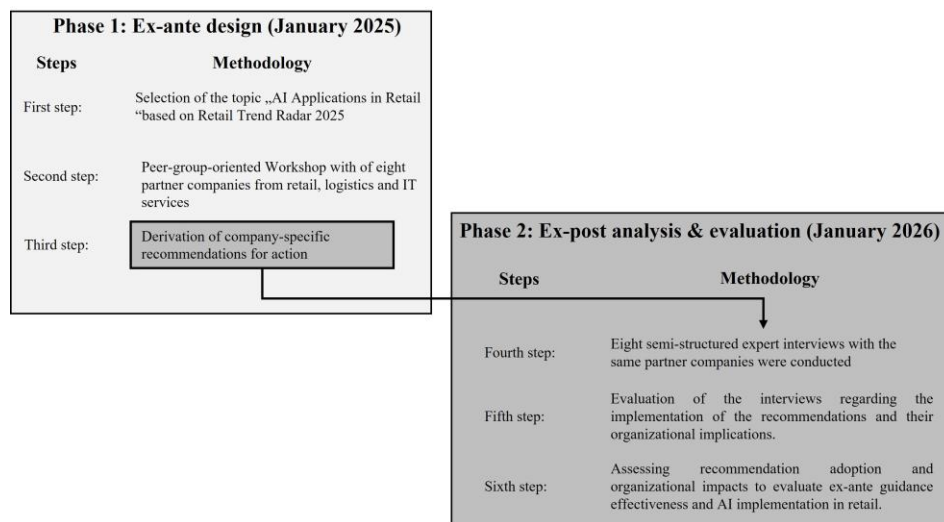
The research design of this study was structured in two sequential phases, comprising an ex-ante phase focused on developing company-specific practical AI implementation recommendations and an ex-post phase aiming at evaluating their actual practical adoption and organizational impact.

In the first phase, conducted in January 2025, the research topic was selected based on the 2025 Retail Trend Radar, with AI applications in retail identified as the focal area due to their strategic relevance and transformative potential. Subsequently, a peer-group-oriented workshop was conducted with eight partner companies from the retail sector along the entire value chain. The participating companies represented the sectors of manufacturing and industrial technology, (intra-) logistics and transportation, retail and consumer goods, as well as information technology and services. During the workshop, company-specific challenges related to the adoption and integration of AI were identified, serving as the basis for the development of tailored, company-specific recommendations to guide the implementation of AI applications.

In the second phase, conducted one year later in January 2026, the study aimed to evaluate the extent to which the previously developed company-specific recommendations had been implemented in practice by the participating partner companies. Following this one-year implementation period, an ex-post analysis was

carried out to assess both the degree of adoption and the resulting organizational implications, particularly their impact on internal processes.

To this end, a systematic evaluation approach was applied, including eight expert interviews with representatives of the same organizations that had participated in the initial workshop series. This longitudinal design ensures consistency and enables a direct comparison between intended and realized outcomes. The interview data were analyzed using qualitative methods, focusing not only on the extent of implementation but also on identifying enabling and inhibiting factors, as well as evaluating their effects on internal processes, practical feasibility, and the overall effectiveness of the ex-ante recommendations.



**Figure 1: Research design**

To address the main research question, a multi-stage research design was developed that combines ex-ante and ex-post analyses. This approach enables both the conceptual exploration of AI applications in retail and the empirical evaluation of their practical implementation over time.

The company-specific recommendations presented in the following chapter form the foundation of this study and serve as the basis for the ex-post analysis. This evaluation is conducted in January 2026 through guideline-based, semi-structured interviews with the eight corporate partners. The interview guideline can be found in the annex of this paper.

The overall research approach is guided by the dialogue-based strategic trend management model proposed by Massimiani et al. (2022), which emphasizes structured exchange between academia, practitioners, and application experts. The iterative nature of the design facilitates a comprehensive understanding of both anticipated potentials and actual implementation challenges. By combining ex-ante conceptualization of recommendations with ex-post evaluation, the study adopts a practice-oriented perspective on AI adoption in retail and provides a robust foundation for deriving actionable and strategically relevant recommendations.

### **3 Ex-ante analysis and derivation of recommendations**

#### *Company-specific recommendations*

The analysis of the participating companies across the sectors of manufacturing and industrial technology, (intra-) logistics and transportation, retail and consumer goods, and information technology and services reveals substantial heterogeneity in AI maturity. Smaller or niche service providers remain at early stages, typically limited to isolated pilot applications, whereas larger retail and manufacturing firms have progressed further, integrating AI into selected operational and strategic processes. Despite these differences, a common pattern emerges: most companies are in a transitional phase, where AI is applied selectively rather than embedded as a company-wide capability.

A key similarity across all cases is the use-case-driven adoption of AI. Companies in information technology and services as well as retail and consumer goods apply AI in areas such as marketing, intralogistics, and product development, with a strong focus on customer experience and efficiency. In contrast, firms in manufacturing and industrial technology and (intra-) logistics and transportation emphasize operational applications, including predictive maintenance, routing optimization, and automated reporting. Across all sectors, significant untapped potential is identified in inventory management, forecasting, process automation, and end-to-end supply chain optimization, although implementation is often constrained by technical, organizational, and cultural barriers.

Organizational and cultural factors represent another key point of convergence. Successful AI implementation depends strongly on leadership commitment, employee engagement, and continuous capability development. Less mature companies emphasize the need for structured training, clear responsibilities, and long-term workforce development, while more advanced organizations focus on scaling, cross-functional integration, and alignment with strategic objectives. This suggests that, beyond technological sophistication, organizational readiness is a decisive factor for successful AI adoption.

Resources and governance structures further shape AI adoption. All companies highlight the importance of dedicated budgets, transparent decision-making processes, and clearly defined responsibilities. At the same time, demonstrating a measurable return on investment (ROI) remains a central challenge and often limits the scaling of AI initiatives.

Data-related issues constitute an additional shared challenge. All companies emphasize that data quality, governance, and security are critical prerequisites for effective AI implementation. Fragmented system landscapes, inconsistent datasets, and siloed information structures significantly hinder both deployment and scaling. These findings underline that organizational data maturity is a key enabler of successful AI adoption.

Differences between companies primarily relate to strategic focus and the depth of AI integration. While some organizations prioritize customer-facing innovations, such as personalized marketing or autonomous services, others focus on internal efficiency and process optimization. More advanced firms increasingly pursue integrated, end-to-end systems and autonomous operations, whereas less mature companies remain focused on isolated pilots and incremental experimentation.

### *Summary of key insights*

The analysis of the participating companies shows strong alignment regarding the critical success factors for AI implementation. Across the peer group - spanning retail, consumer goods, industrial manufacturing and technology, (intra-) logistics and transportation, and information technology and services - and independent of AI maturity levels, it becomes evident that technological sophistication alone is not the primary determinant of success. Instead, organizational readiness, strategic alignment, and cultural acceptance are the key drivers shaping the trajectory and impact of AI initiatives. Even companies with advanced technological capabilities often fail to realize tangible business value when organizational and cultural foundations are insufficient.

Successful AI adoption therefore requires a holistic, multi-dimensional approach that integrates technical and non-technical elements. Strong top management commitment is essential, as leadership provides strategic direction, allocates resources, and signals organizational prioritization. Equally important is the selection of value-driven use cases that address concrete business problems and generate measurable outcomes. Clear definition of objectives and success metrics further strengthens organizational buy-in and accelerates adoption.

Robust data governance and high data quality represent additional foundational requirements. Fragmented system landscapes, inconsistent or siloed data, and weak data management practices remain persistent barriers to both implementation and scaling. Consequently, effective AI adoption requires not only technological infrastructure but also standardized processes and clear accountability structures ensuring data integrity and accessibility across organizational boundaries.

Organizational capacity and workforce readiness are equally critical. Continuous training, structured knowledge transfer, and active end-user engagement help bridge the gap between technological potential and practical application. Mechanisms such as key-user networks, pilot projects, and iterative learning cycles enable experimentation in low-risk environments, foster competence development, and enhance cultural acceptance while reducing resistance.

AI implementation is further characterized as a gradual capability-building process. Companies typically evolve along a continuum from isolated pilot applications toward integrated, strategically embedded AI systems across functions. While advanced organizations focus on scaling and automation of complex processes, less mature firms remain in exploratory phases. This progression highlights that AI adoption is not a discrete project but a long-term transformation requiring iterative learning and cross-functional collaboration.

Overall, organizational, cultural, and strategic factors outweigh purely technical considerations in determining AI success. Firms that systematically address leadership engagement, workforce readiness, data governance, and strategic alignment are more likely to achieve sustainable value creation and competitive advantage. In contrast, neglecting these dimensions - despite technological investment - often leads to underutilized systems and limited impact.

In conclusion, AI adoption in sectors such as retail, consumer goods, industrial manufacturing, and logistics should be understood as a holistic transformation process. Success depends on iterative capability development, strategic coherence, and organizational as well as cultural readiness. Firms that integrate these dimensions are

better positioned to scale AI applications, realize measurable benefits, and establish AI as a long-term value driver.

#### **4 Ex-post evaluation results and implementation insights**

The combined use of ex-ante and ex-post evaluations (Rossi et al., 2019; Naundorf and Radaelli, 2017) provides significant value for understanding and managing AI adoption in organizations. Ex-ante evaluations enable forward-looking planning by identifying opportunities, prioritizing use cases, and clarifying key requirements such as data quality, resource allocation, and organizational readiness. They support the definition of a clear strategic framework for pilot implementation and realistic expectation setting. In contrast, ex-post evaluations provide a retrospective assessment of implementation outcomes, highlighting deviations between planned and actual execution as well as key success factors and barriers. Integrating both perspectives reveals systematic gaps that would remain hidden in isolated analyses, enabling continuous organizational learning and the refinement of strategies, processes, and governance structures. Overall, this dual approach links strategic intent with operational reality and supports scalable, sustainable AI value creation.

The analysis of the eight companies shows a heterogeneous landscape of AI maturity and strategic orientation, yet also reveals consistent patterns in challenges and success factors. Organizations are at different stages of an ongoing transformation but face largely similar structural and organizational constraints.

AI maturity levels range from early experimentation to more advanced strategic integration. While some firms already embed AI into core processes such as marketing and product development, others still treat it as an experimental tool. Across all companies, the most established applications are low-complexity, high-impact use cases such as administrative support, marketing content generation, and selected process optimization (e.g., predictive maintenance). These often serve as entry points for broader adoption and organizational learning.

Despite differences in maturity, strong commonalities emerge. The human factor is consistently identified as a key bottleneck, particularly regarding employee and customer acceptance and the need for structured change management. Data-related issues represent another fundamental constraint, including poor data quality, lack of standardization, and data silos, which significantly hinder scaling. This highlights that technological capability alone is insufficient without a robust data foundation.

A further shared pattern is the pragmatic, incremental implementation approach. Rather than pursuing large-scale transformation, companies prioritize small, value-driven use cases that deliver quick wins, build trust, and justify further investment. At the same time, resource constraints are common, as AI initiatives compete with other strategic priorities. Consequently, strong top management commitment is essential to secure resources and ensure strategic alignment.

Key differences between companies relate to AI maturity, strategic focus, and integration depth. Some organizations have established AI roadmaps and governance structures, while others are still defining their strategic direction and responsibilities. Application focuses also varies: logistics- and operations-oriented firms emphasize intralogistics optimization, plant planning, and predictive maintenance, whereas customer-centric companies prioritize personalized marketing, automated service, and

content generation. Some firms further focus on specialized technologies such as computer vision.

Finally, perceptions of AI value differ across contexts. In craft-oriented environments, AI is often viewed with skepticism due to perceived limitations in replacing human creativity and manual work, whereas digitally mature organizations increasingly consider AI a core element of value creation.

## 5 Discussions

The analysis of the eight companies reveals a pronounced discrepancy between the original strategic objectives for adoption of AI and the operational reality. While initial successes have been achieved in marketing and administrative support, substantial gaps remain in terms of deep process integration and cultural transformation.

### *Implemented Recommendations and Current Applications*

A majority of the organizations have realized tangible “quick wins” in communication and specialized technical domains. In marketing and content creation, AI-supported generation of text, images, and social media content has already become standard practice in digitally oriented firms, leading to measurable improvements in efficiency and quality. Similarly, smaller organizations employ AI primarily for these purposes.

In operational and technical processes, specific AI applications have been successfully implemented. Predictive maintenance is utilized to optimize maintenance planning in manufacturing and logistics operations, while AI supports the optimization of intralogistics processes, such as truck unloading. Advanced visual recognition systems (computer vision) are also in operation in selected companies.

Administrative support is another area where AI adoption has shown clear benefits. AI agents and co-pilots are used for tasks such as research, summarization, and office organization, providing tangible relief for employees and streamlining routine work. Furthermore, several companies have already established dedicated AI task forces or initiated structured training programs to systematically build internal knowledge and capabilities.

### *Identified Gaps and Implementation Challenges*

Despite these advances, similar barriers persist across almost all organizations, limiting the broader scaling of AI initiatives. Data quality and infrastructure issues are among the most frequently cited challenges, including inconsistent datasets, fragmented system landscapes, and data silos.

Cultural acceptance and workforce capabilities present additional constraints. Heterogeneous employee readiness, limited expertise among middle management, and general skepticism impede wider rollout.

### *Planned Future Implementations*

Looking ahead, companies are planning to professionalize their AI efforts further and expand technical applications in line with their roadmaps for the next few years. Technical use cases will be deepened, including camera-based inventory management

and improved forecasting models, automation of sales processes, and optimization of plant planning. Long-term ambitions include fully autonomous warehouse systems and the integration of AI modules into e-commerce platforms.

In parallel, customer service applications are expected to expand. Initiatives include autonomous, voice-based customer service centers and more advanced personalization in online retail environments. Organizational enablement is also a key focus, with nearly all companies planning the establishment of key-user networks, structured training paths, and closer involvement of end-users in development processes.

## **6 Practical implications and theoretical contribution**

For practitioners, the study provides evidence-based recommendations for successful AI implementation in retail. The findings emphasize the importance of early and visible top management engagement, clear data and governance structures, a strong focus on concrete use cases, and the active involvement of employees through key-user concepts, pilot projects, and targeted capability development. Moreover, the results demonstrate that iterative learning processes and cross-functional knowledge transfer are critical for reducing implementation risks and enabling sustainable value creation through AI.

Overall, the findings indicate that implementation failures are less the result of technological shortcomings and instead primarily stem from organizational and cultural factors (Hofmann & Schumacher, 2021). Retail companies along the value chain must therefore invest consistently not only in technical solutions, but also in change management initiatives, governance structures, and a realistic selection of use cases (Gläß, 2018). Sustainable success emerges when identified success factors are operationalized at an early stage, continuously reflected upon, and adaptively refined within dialogue-oriented processes.

The findings give rise to several important practical implications for organizations seeking to advance their AI adoption. First, a “think big, start small” strategy emerges as a critical success factor. Rather than pursuing large-scale, organization-wide transformations from the outset, companies should initiate clearly defined pilot projects that allow for experimentation, learning, and the demonstration of tangible value. Such incremental approaches help to build organizational trust in AI technologies, reduce perceived risks, and create a foundation for subsequent scaling efforts.

Second, the results underline the necessity of establishing robust data governance structures prior to any extensive AI rollout. A well-structured and consistent data architecture, along with the systematic reduction of data silos, should be considered a prerequisite for meaningful AI investments. Since the performance and reliability of AI systems are inherently dependent on the quality of the underlying data, deficiencies in data management directly limit the achievable outcomes. Consequently, organizations must prioritize data quality, accessibility, and integration as part of their AI readiness efforts.

Third, leadership plays a pivotal role as an enabler of AI adoption. Managers are not only responsible for allocating resources and defining strategic priorities, but also for acting as role models who actively promote the use of AI within the organization. By fostering a supportive environment, communicating a clear vision, and reducing uncertainty, leadership can contribute significantly to the cultural legitimization of AI initiatives and encourage broader acceptance among employees.

Finally, the involvement of end users is identified as a key determinant of successful implementation. Early integration of employees into the development and deployment process, combined with targeted onboarding and training programs, is essential to bridge the gap between technical feasibility and actual usage. By ensuring that AI solutions are aligned with user needs and capabilities, organizations can enhance adoption rates, increase perceived usefulness, and ultimately realize greater value from their AI initiatives.

This study contributes to research on AI implementation in retail by conceptualizing implementation as a context-dependent, organization-centered process rather than a purely technology-driven activity. By integrating an ex-ante and ex-post perspective, the study extends existing implementation concepts with a processual and context-sensitive dimension and highlights the central role of managerial commitment, organizational structures, clearly defined use cases, and organizational learning mechanisms across the value chain. The methodological approach of the integrated ex-ante and ex-post perspective links theoretical requirements with empirical insights from expert interviews, thereby enabling a robust understanding of implementation processes (Kalpana et al., 2025).

The study provides several notable contributions to the academic discourse on AI adoption. It advances existing research by systematically contrasting ex-ante strategic recommendations with ex-post operational realities. This comparative perspective enables the identification of persistent gaps between intended AI strategies and their actual implementation in practice. By uncovering these discrepancies, the study contributes to a more nuanced understanding of the challenges associated with translating strategic ambitions into effective operational outcomes.

Moreover, the results contribute to the development of industry-specific AI maturity models. By identifying common trajectories, challenges, and enabling factors, the study outlines differentiated pathways for AI maturity in sectors such as commerce, logistics, and manufacturing. This sector-sensitive perspective enriches existing maturity frameworks by emphasizing that AI adoption is not a uniform process, but rather evolves along distinct, context-dependent paths shaped by industry-specific characteristics and requirements.

## **7 Limitations**

Several limitations should be acknowledged. First, the study focuses on the retail sector along the value chain, which may limit the generalizability of the findings. Retail organizations are characterized by relatively customer-centric processes and specific operational structures; therefore, the identified success factors for AI implementation may not fully transfer to other industries such as manufacturing, healthcare, or financial services. Second, the findings primarily emphasize organizational and managerial perspectives on AI adoption. While this provides important insights into strategic, governance-related, and cultural factors, it may underrepresent technical aspects of AI implementation as well as the perspectives of operational employees or end users beyond selected key informants. Third, the study highlights several critical success factors - such as top management support, data governance, and employee involvement - but does not empirically test causal relationships between these factors and AI performance outcomes. As a result, the identified mechanisms should be interpreted as indicative rather than

strictly causal. Fourth, the emphasis on best practices such as pilot projects, iterative learning, and “think big, start small” approaches reflect a relatively normative interpretation of the findings; however, the study does not systematically examine under which contextual conditions these approaches may fail or require adaptation. Finally, although the study captures a range of organizational experiences with AI implementation, it provides a cross-sectional rather than longitudinal perspective. Consequently, dynamic developments in AI maturity, learning effects over time, and long-term transformation outcomes cannot be fully assessed.

## 8 Outlook and future research

The findings point to several promising avenues for future research. In particular, the continued advancement of autonomous systems - such as automated warehouse solutions in the retail and logistics sectors and voice-based customer service centers in service-oriented industries - opens up substantial opportunities for further investigation into human-machine interaction. A deeper understanding is required of how such systems can be designed to foster effective collaboration, ensure user acceptance, and build trust between human actors and AI-driven technologies.

At the same time, the results highlight a growing need for research on domain-specific AI models (Cao, 2021; Fu et al., 2023). While general-purpose models provide a valuable starting point, their application in highly specialized fields remains limited without significant adaptation. This underscores the importance of developing approaches for the fine-tuning and contextualization of AI systems to meet the specific technical, regulatory, and knowledge-based requirements of these domains.

Another critical area for future inquiry concerns the measurement of return on investment (ROI) in AI initiatives. Despite increasing levels of investment, organizations continue to face challenges in systematically assessing the actual value generated by AI applications. This points to the need for more robust and standardized evaluation frameworks that capture both tangible and intangible benefits, thereby enabling more informed decision-making and resource allocation.

Finally, the findings emphasize the importance of rethinking qualifications and capability-building strategies in the context of rapid technological change. Rather than relying on one-off training initiatives, organizations must develop continuous and adaptive learning pathways that allow employees to keep pace with evolving AI technologies (Fu et al., 2023). Investigating how such long-term qualification strategies can be effectively designed and implemented represents a key area for future research, particularly with regard to sustaining organizational competitiveness and ensuring successful AI adoption over time.

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### **Structured interview guideline for ex-post evaluation**

The following questions were included in the expert interview questionnaire for the eight corporate partners:

*Questionnaire on the Implementation of Recommendations for AI Applications in Retail*

1. To what extent did your organization follow the ex-ante recommendations?
2. To what extent did these ex-ante recommendations help your organizations in implementing AI initiatives?
3. Are ex-ante and ex-post evaluations integrated within your organization?
4. To what extent do these evaluations help identify deviations between planning and implementation as well as key success factors?
5. To what extent do these evaluations contribute to continuous organizational learning and the improvement of strategies and processes?
6. To what extent does your organization have a clearly defined AI strategy and roadmap?
7. To what extent is AI already integrated into core business processes?
8. How would you assess the current level of AI maturity in your organization?
9. To what extent are AI applications initially implemented as “quick wins” (small, short-term value-generating use cases)?
10. To what extent do the following factors influence the success of AI initiatives:
  - Employee and customer acceptance
  - Data quality and availability
  - Resources (budget, personnel)
  - Top management support
11. In which areas does your organization primarily apply AI (e.g., marketing, administration, production, customer service)?