

Intralogistics in the Age of Digital Transformation, Automation and Artificial Intelligence: Germany's Long Road to Greater Use of AI and Automation in Intralogistics - Strategic Ambition versus Operational Reality

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Abstract

Artificial intelligence (AI) offers considerable potential to improve efficiency, flexibility, and decision quality in intralogistics by optimising increasingly complex material flows. While research on Industry 4.0 has predominantly examined technological implementation and operational applications, the strategic and operational role of middle management in AI adoption remains underexplored. This omission is significant because middle managers translate strategic objectives into operational practice. Despite Germany's position as Europe's largest logistics market and a benchmark for industrial excellence, empirical evidence reveals a pronounced innovation–adoption gap: almost half of industry stakeholders remain unfamiliar with AI applications, and only one quarter possess the innovation capabilities required for large-scale implementation. This study presents a narrative literature review synthesising 34 academic and practitioner publications published between 2019 and 2026. The review addresses three research questions: (1) Which opportunities and barriers influence AI adoption in intralogistics? (2) Which managerial capabilities facilitate successful implementation? (3) Which organisational factors continue to constrain AI diffusion in German companies? The findings reveal a consistent imbalance within the existing literature. Technological challenges are extensively addressed, whereas the managerial capabilities required to integrate technology, organisational change, and workforce development receive comparatively little attention. This indicates a structural gap in current implementation approaches. To address this gap, the paper introduces the People & Technology Management (PTM) Framework, an interdisciplinary management concept integrating technological innovation absorption, operational excellence, and organisational transformation into a single bridging function. Positioned at the middle-management level, the framework connects strategic decision-making with operational execution and supports sustainable AI implementation. The study contributes to digital transformation and AI adoption research by conceptualising the PTM Framework as a management capability for operations. Practically, it demonstrates that successful AI implementation requires an integrated governance approach combining innovation management, SMART objective setting, and the Value Creation–Capture Circle. Future research should further develop socio-technical design principles for process-oriented intralogistics under conditions of digital transformation.

Keywords: intralogistics, artificial intelligence, innovation management, knowledge management, digital transformation

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