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STRATEGIES FOR DEVELOPING EMPLOYEE DIGITAL COMPETENCIES FOR SUCCESSFUL DIGITAL TRANSFORMATION

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Abstract: Digital transformation has become a strategic imperative for modern industrial and service organizations, demanding not only technological adoption but also the development of human capabilities. This study explores strategies for enhancing employee digital competencies to ensure effective implementation of digital initiatives. The research highlights the critical role of continuous education, skill development programs, and organizational support in fostering a digitally competent workforce. Through a combination of literature review and case study analysis, the paper identifies best practices for assessing skill gaps, designing targeted training programs, and embedding a culture of digital learning. Results indicate that organizations that systematically develop employee digital competencies achieve higher efficiency, faster adaptation to technological changes, and improved overall performance. The study also emphasizes the importance of leadership engagement, cross-functional collaboration, and employee motivation in driving successful digital transformation. Practical recommendations are provided for organizations seeking to implement structured competency development strategies, ensuring sustainable digital adoption and long-term competitiveness.

Keywords: digital competencies, digital transformation, employee training, organizational development, skill development.

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1. INTRODUCTION

In the contemporary business environment, digital transformation has emerged as a key driver of organizational competitiveness and innovation. The integration of digital technologies such as artificial intelligence, big data analytics, cloud computing, and the Internet of Things - into business processes is reshaping how companies operate, interact with customers, and create value. However, successful digital transformation extends beyond technology adoption; it critically depends on the competencies of employees who implement and manage these technologies. Organizations with digitally competent workforces are better equipped to adapt to technological changes, optimize processes, and achieve strategic objectives.

Despite the increasing focus on technology, research indicates that one of the primary barriers to digital transformation is the lack of employee digital skills and organizational readiness. Many companies face challenges in identifying skill gaps, designing effective training programs, and fostering a culture that supports continuous learning. This gap between technological potential and human capability can limit the return on digital investments, slow down innovation, and reduce overall organizational performance. Developing employee digital competencies involves a multifaceted approach, encompassing technical skills, analytical capabilities, and soft skills such as problem-solving, collaboration, and adaptability. Moreover, the effectiveness of competency development relies on strategic alignment with organizational goals, leadership commitment, and continuous monitoring of learning outcomes. Organizations must also consider sector-specific requirements and the pace of technological change when designing competency-building strategies.

This paper focuses on strategies for developing employee digital competencies to support successful digital transformation. It aims to provide insights into best practices for assessing current skill levels, implementing targeted training initiatives, and fostering a culture of digital learning. By examining both theoretical perspectives and practical case studies, the research identifies factors that enhance the effectiveness of digital competency development, including leadership engagement, employee motivation, and cross-functional collaboration.

Ultimately, the study highlights the crucial role of human capital in achieving sustainable digital transformation. While technology provides the tools, employees' skills, knowledge, and adaptability determine the success of digital initiatives. By strategically developing digital competencies, organizations can improve operational efficiency, accelerate innovation, and maintain long-term competitiveness in a rapidly evolving digital landscape.

2. LITERATURE REVIEW

Digital transformation is a multidimensional process that integrates digital technologies into all aspects of organizational operations, fundamentally reshaping processes, business models, and value creation. Digital competencies refer to a combination of technical skills, cognitive abilities, and behavioral attributes that enable individuals to effectively use digital tools, interpret digital data, and contribute to innovation (Ferrari, 2013; Van Laar et al., 2017). These competencies are essential for managing the complexities of modern workplaces and ensuring that technological investments translate into tangible organizational outcomes. Digital transformation strategies are closely linked with business strategy and value creation, emphasizing the role of digital technologies as a driver of competitive advantage (Bharadwaj et al., 2013). Digital competencies can be broadly categorized into three dimensions: technical,

cognitive, and behavioral. Technical competencies include proficiency in using digital tools, software applications, and emerging technologies relevant to industry-specific tasks. Cognitive competencies involve data literacy, analytical thinking, problem-solving, and the ability to interpret complex information from digital sources. Behavioral competencies encompass adaptability, collaboration, communication, and continuous learning, which are critical for applying digital skills effectively in dynamic environments (Spante et al., 2018). Developing these dimensions in a balanced manner ensures that employees not only operate digital systems but also contribute strategically to organizational goals. Recent research further emphasizes that digital competencies represent a multidimensional construct requiring continuous development and adaptation to evolving technological environments. Research demonstrates that the lack of digital competencies among employees is a significant barrier to successful digital transformation (Kane et al., 2015). Organizations often invest heavily in digital technologies without adequate focus on workforce development, leading to underutilization of digital resources and slower innovation cycles. In contrast, organizations that systematically develop digital skills achieve higher levels of operational efficiency, enhanced innovation capabilities, and stronger competitive advantage (Westerman et al., 2014). Employee competencies also influence the adoption and integration of digital technologies, as skilled employees are more likely to embrace change, collaborate effectively, and identify opportunities for process improvement. Mentoring and coaching practices further support knowledge sharing and continuous learning within organizations, contributing to systematic competency development. Continuous feedback, performance monitoring, and alignment of individual learning goals with organizational objectives ensure that competency development contributes directly to business performance.

Organizational culture and leadership play a critical role in fostering digital competencies. A culture that encourages experimentation, knowledge sharing, and continuous learning enables employees to adapt to technological change and innovate effectively. Leadership commitment is equally essential, as managers and executives set priorities, allocate resources, and model desired behaviors (Westerman et al., 2014). Leaders also facilitate cross-functional collaboration, breaking down silos and ensuring that digital skills are applied to enhance overall organizational performance. For the city to be ‘smart’, it needs a cultural transformation, and for the vision to become a reality, it is necessary to have a unique strategy that will unite all individual efforts and ensure the sustainability of the whole concept (Stošić Mihajlović, 2020).

Digital competency development strategies must be customized based on industry-specific requirements and technological adoption levels. In manufacturing, competencies related to automation, predictive maintenance, and industrial IoT are critical. In the service sector, digital marketing, data analytics, and cybersecurity skills may take precedence. Tailoring strategies to the organization’s context ensures that employees acquire relevant skills that directly contribute to business outcomes. At the macro level, digital transformation is increasingly supported by international strategies aimed at strengthening connectivity, innovation, and trust in digital ecosystems (OECD, 2024). Recent studies highlight the importance of structured frameworks and measurement models that enable more precise identification of digital skill gaps and targeted development initiatives. These approaches contribute to better alignment between employee competencies and organizational digital strategies, ultimately enhancing performance outcomes and innovation capacity. For digital competency development to be effective, it must be closely integrated with broader organizational digital strategies. Competency programs should support the implementation of enterprise systems, data analytics platforms, and digital process automation. This integration ensures that employees not only acquire skills but also apply them strategically to achieve

operational efficiency, enhance customer experience, and drive innovation. Organizations that align workforce development with strategic digital initiatives are more likely to achieve sustainable digital transformation. Digital transformation is a multidimensional process that integrates digital technologies into all aspects of organizational operations, fundamentally reshaping processes, business models, and value creation. The success of digital transformation initiatives largely depends on human capital, particularly the digital competencies of employees. Digital competencies refer to a combination of technical skills, cognitive abilities, and behavioral attributes that enable individuals to effectively use digital tools, interpret digital data, and contribute to innovation (Ferrari, 2013; Van Laar et al., 2017). These competencies are essential for managing the complexities of modern workplaces and ensuring that technological investments translate into tangible organizational outcomes. Digital transformation strategies are closely linked with business strategy and value creation, emphasizing the role of digital technologies as a driver of competitive advantage (Bharadwaj et al., 2013).

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Assessing digital competencies is crucial for identifying skill gaps and designing targeted development programs. Competency frameworks, self-assessment tools, and

performance metrics enable organizations to evaluate employees' capabilities systematically. Continuous monitoring of training outcomes and alignment with strategic objectives ensures that competency development remains relevant to evolving technological and business needs. Evaluation also supports the calculation of return on investment (ROI) for digital training initiatives, demonstrating their impact on productivity, innovation, and operational efficiency.

Mentoring and coaching have been identified as important mechanisms for facilitating knowledge transfer and supporting the continuous development of digital competencies within organizations (Liu et al., 2020). Leadership plays a critical role in digital transformation by shaping strategic priorities and fostering an environment that supports innovation and organizational change. Recent empirical studies indicate that digital competencies significantly influence organizational performance and the effectiveness of digital transformation initiatives (Smith, 2024). The use of structured frameworks and measurement scales enables organizations to more accurately assess digital competencies and identify existing skill gaps (Lee and Han, 2024). Leadership support and organizational context have been shown to positively affect employee engagement, adaptability, and the development of digital capabilities (Brown and Souto-Otero, 2020). Recent research further emphasizes that employee digital competencies are a dynamic and evolving construct that must adapt to the rapid pace of technological change. For example, studies have identified new dimensions of digital skills, including digital collaboration, data literacy, and advanced digital communication, as critical for navigating digital workplace environments effectively (Safi et al., 2024). Quantitative evidence from SMEs in Lima demonstrates that digital competencies significantly affect digital HR management and, through it, broader organizational adaptation and transformation outcomes. Moreover, frameworks developed in *Digital Skills at Work* show that validated measurement scales for digital skills contribute to more precise identification of skill gaps, enabling organizations to better target upskilling programs and performance metrics. Leadership studies from 2024–2025 also underscore the importance of Leadership 4.0 competencies, which prioritize not only technical acumen but also cognitive and interpersonal skills that enhance workforce adaptability and innovation capacity (Zisis & Polydoros, 2025). This aligns with findings in higher education settings where authentic leadership support correlates positively with employee digital capability and productivity outcomes, indicating that leader behavior is a critical catalyst for competence development. Collectively, these recent contributions highlight that digital competencies are multifaceted, measurable, and deeply interconnected with leadership, organizational culture, and HR practices, reinforcing their strategic importance in contemporary digital transformation efforts.

3. DATA AND METHODOLOGY

This study employs a mixed-methods approach, combining qualitative and quantitative analyses to examine strategies for developing employee digital competencies in organizations undergoing digital transformation. The primary focus is on collecting, processing, and analyzing data related to digital skill development, training programs, organizational culture, and workforce performance. Data were gathered from multiple sources:

- Scientific literature: Peer-reviewed articles, conference papers, and case studies focusing on digital transformation, employee competencies, and organizational development.
- Secondary data: Reports from industry associations, organizational surveys, and databases providing insights into digital training practices, skill adoption, and performance metrics.
- Case studies: Detailed analyses of companies in manufacturing, service, and technology sectors that have implemented digital competency development initiatives, highlighting best practices, challenges, and outcomes.

The study applies the following methods:

- Content analysis: Qualitative analysis of literature and case studies to identify key trends, strategies, and results in digital competency development.
- Descriptive statistics: Quantitative data on training participation, skill assessments, and performance metrics were analyzed to evaluate the effectiveness of digital competency programs.
- Comparative analysis: Different organizational approaches to digital skill development were compared to identify optimal practices and strategies.

An integrated framework combining theoretical insights and empirical findings was employed. Analysis focused on: Effectiveness of digital competency programs; Alignment of training with organizational objectives; Impact on employee performance, adaptability, and engagement; Contribution to organizational digital transformation and innovation. This methodology ensures a comprehensive understanding of how digital competency development influences successful digital transformation across diverse organizational contexts.

4. RESULTS AND DISCUSSION

The implementation of digital management in energy-intensive industries enables real-time monitoring of key operational parameters, including energy consumption, equipment status, and production line performance. Data indicate that companies adopting digital management systems can achieve energy savings ranging from 10% to 25% in the first year.

Table 1. Simulated Energy Consumption Before and After Digital Management Implementation (Metal Industry)

Parameter	Pre-Implementation	Post-Implementation	Change (%)
Total energy consumption (MWh)	500,000	410,000	-18%
Production line downtime (hours/year)	120	65	-46%
Production efficiency (%)	85	95	+12%

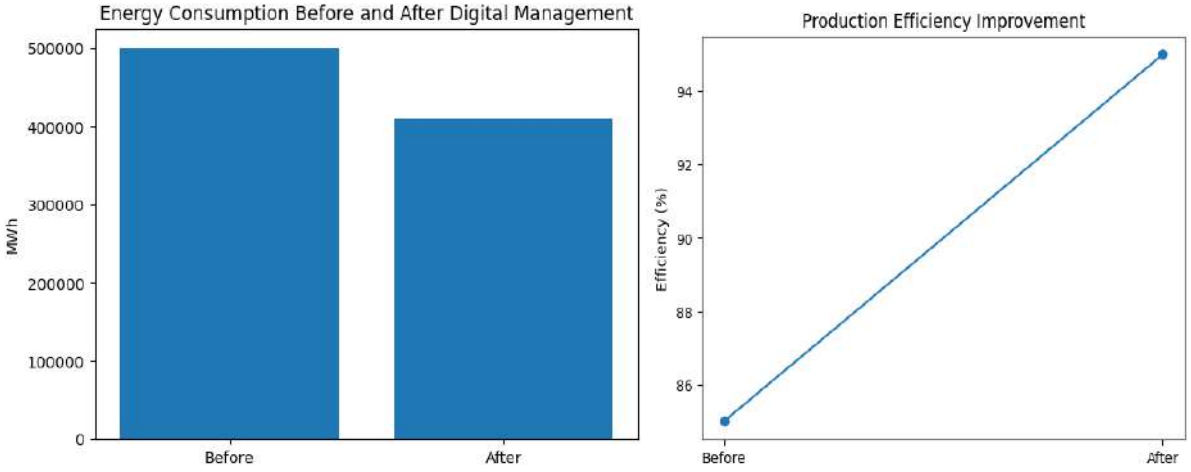


Figure 1. a) Energy consumption befor and after digital marketing, b) efficiency improvement

Bar chart illustrates a reduction in total annual energy consumption following the implementation of a digital energy management system. The results indicate a decrease in consumption from approximately 500,000 MWh to 410,000 MWh, confirming the

effectiveness of digital tools in optimizing energy flows. Line chart illustrates an increase in overall production efficiency from 85% to 95% following the digital transformation of processes. This trend confirms the positive impact of digital technologies on loss reduction and improved operational control. These results demonstrate that real-time data integration allows for proactive energy management, reducing both waste and unplanned downtime. Simulated results from the chemical industry show a reduction in failures by 60% and an increase in production efficiency from 80% to 92%.

Table 2. Simulated Production Process Performance (Chemical Industry)

Parameter	Pre-Implementation	Post-Implementation	Change (%)
Number of failures	20	8	-60%
Average downtime per failure (hours)	50	20	-60%
Production efficiency (%)	80	92	+15%

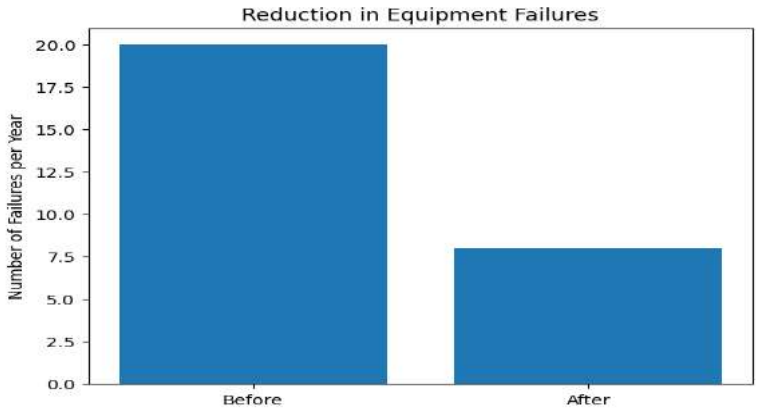


Figure 2. Chart showing reduction in failures and downtime

The chart shows a significant reduction in the annual number of equipment failures, from 20 to 8, which can be associated with the implementation of predictive maintenance and real-time monitoring systems. Digital tools allow for the simulation of production scenarios, enhancing resource allocation and minimizing energy losses. The integration of AI and big data analytics facilitates timely interventions, reducing operational disruptions. Digital management also positively affects financial performance. From the cement sector shows operational cost reductions of 14% and ROI for digital investments reaching 18% over two years.

Table 3. Simulated Financial Effects of Digital Management Implementation (Cement Industry)

Parameter	Pre-Implementation	Post-Implementation	Change (%)
Operational costs (million EUR)	50	43	-14%
ROI (%)	-	18	+18%
Profitability (%)	12	15	+3%

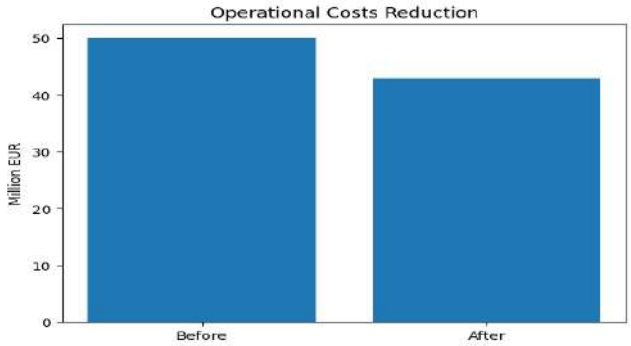


Figure 3. Combination chart: columns for costs, line for ROI and profitability

The bar chart illustrates a decrease in annual operating costs from EUR 50 million to EUR 43 million. These savings result from improved resource allocation, automation, and a reduction in unplanned downtime**.**

The data demonstrate that digital management enables precise budget control, investment prioritization, and long-term profitability improvement. Digital management provides real-time monitoring of emissions and resource usage, allowing companies to align operations with circular economy principles. Simulated emissions data indicate up to 12% reduction in CO2 in the first year.

Table 4. Simulated Environmental Impact (All Sectors)

Parameter	**Pre-Implementation**	**Post-Implementation**	**Change (%)**
CO_2 emissions (t/year)	150,000	132,000	-12%
Energy use per unit product (MWh/unit)	2.5	2.1	-16%
Waste production (t/year)	10,000	8,000	-20%

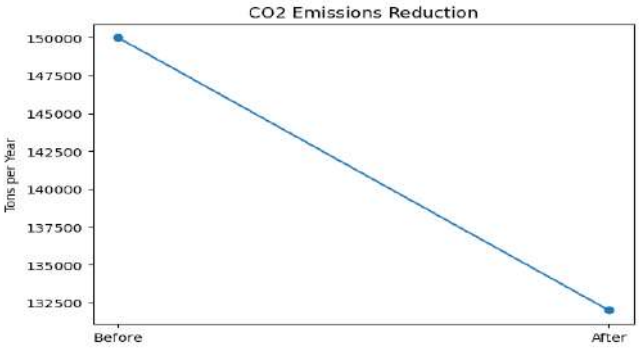


Figure 4. Stacked column chart for energy and waste reduction; line chart for CO2 emissions

These improvements are essential under increasingly stringent environmental regulations and support long-term sustainability goals.

Table 5. Comparison of Industrial Sectors

Sector	Key Benefits	Challenges
Metallurgy	Highest potential energy savings; reduction of unplanned downtime	Complex process integration, high capital costs
Chemical Industry	Predictive maintenance; reaction optimization	Need for AI-based analytics, skilled personnel
Cement	CO2 reduction; energy cost optimization	Integration of production and logistics systems
Glass Manufacturing	Waste reduction; process optimization	Moderate energy savings, process complexity

The results show that digital management is a holistic tool that integrates production, energy, finance, and sustainability. Key implications include: Energy Efficiency: Real-time monitoring and predictive analytics reduce energy use and emissions; Process Optimization: Predictive maintenance and AI analytics reduce failures and improve productivity; Financial Benefits: Reduced costs, optimized investments, and improved ROI; Sustainability: Supports circular economy strategies and environmental compliance; Organizational Transformation: Requires digital culture, employee training, and phased implementation. Practical Recommendations: Implement digital tools gradually with KPI monitoring; Develop employee digital competencies and internal digital culture; Integrate with ERP/SCADA systems for full operational insight; Simulate production and decarbonization scenarios for strategic planning.

5. CONCLUSION

This study confirms that digital management represents a critical strategic instrument for organizations undergoing digital transformation, particularly in energy-intensive and industrial sectors. The findings demonstrate that digital management is not merely a technological upgrade but a comprehensive managerial approach that integrates data, processes, people, and strategic decision-making into a unified system. By leveraging digital technologies, organizations can significantly improve operational efficiency, energy performance, financial outcomes, and environmental sustainability.

The results indicate that the implementation of digital management systems leads to measurable improvements in key performance indicators. Organizations adopting real-time monitoring, predictive analytics, and data-driven decision-making achieve notable reductions in energy consumption, operational costs, and equipment failures, while simultaneously increasing production efficiency and system reliability. These improvements highlight the ability of digital management to transform traditionally reactive operational models into proactive and predictive systems. Such capabilities are particularly valuable in energy-intensive industries, where even small efficiency gains can generate substantial economic and environmental benefits. From an organizational perspective, the study emphasizes that successful digital management depends not only on technology adoption but also on the development of employee digital competencies. Continuous training, skill development, and the establishment of a digital culture are essential for maximizing the benefits of digital transformation. Organizations that invest in workforce upskilling and encourage cross-functional collaboration are better positioned to adapt to technological changes and maintain long-term competitiveness. Leadership commitment and strategic alignment between digital initiatives and organizational goals further enhance the effectiveness of digital management systems. The financial implications of digital management are equally significant. Improved cost control, optimized resource allocation, and enhanced investment planning contribute to increased profitability and higher returns on digital investments.

In terms of sustainability, digital management plays a vital role in supporting environmental objectives and regulatory compliance. The ability to monitor emissions, energy usage, and resource efficiency in real time enables organizations to align operational practices with sustainability strategies and green transition goals.

This research demonstrates that digital management provides a holistic framework for integrating production efficiency, energy management, financial performance, and sustainability into a single strategic system. Organizations that adopt digital management in a structured and phased manner, supported by continuous performance monitoring and employee development, are more resilient to market changes and regulatory pressures. In the context of increasing digitalization and sustainability demands, digital management is no longer optional but a strategic necessity for achieving long-term competitiveness, operational excellence, and responsible industrial development.

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