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Human Capital Development in the Digital Era: Integrating Digital Competencies and Artificial Intelligence for Organizational Performance

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ABSTRACT

Digital transformation and artificial intelligence (AI) are reshaping how organizations develop human capital and achieve competitive performance. This study aims to examine how traditional human capital dimensions interact with digital competencies and AI-related capabilities in supporting organizational performance. Using a qualitative integrative literature review approach, the study synthesizes theoretical and empirical perspectives grounded in Human Capital Theory, the Resource-Based View, and Dynamic Capabilities Theory. The conceptual synthesis identifies five interconnected dimensions: education, training, work experience, professional skills, and entrepreneurship. Their contributions to organizational performance increasingly depend on digital literacy, AI literacy, technological adaptability, and human–AI collaboration. The study introduces Technology-Enabled Human Capital Development (TEHCD) as a conceptual framework linking workforce development, technological capabilities, organizational adaptation, and performance outcomes. The findings suggest that technological investment alone cannot ensure improved productivity or competitiveness without corresponding human capability development. This framework provides theoretical foundations for future empirical investigation.

ABSTRAK

Transformasi digital dan kecerdasan buatan (AI) telah mengubah cara organisasi mengembangkan modal manusia dan meningkatkan daya saing. Penelitian ini bertujuan menganalisis keterkaitan antara dimensi tradisional modal manusia, kompetensi digital, dan kemampuan berbasis AI dalam mendukung kinerja organisasi. Penelitian menggunakan pendekatan kualitatif melalui tinjauan literatur integratif dengan menggabungkan perspektif Teori Modal Manusia, Resource-Based View, dan Dynamic Capabilities. Hasil sintesis konseptual mengidentifikasi lima dimensi utama, yaitu pendidikan, pelatihan, pengalaman kerja, keterampilan profesional, dan kewirausahaan. Kontribusi kelima dimensi tersebut semakin dipengaruhi oleh literasi digital, literasi AI, kemampuan adaptasi teknologi, dan kolaborasi manusia dengan AI. Penelitian ini mengusulkan kerangka Technology-Enabled Human Capital Development (TEHCD) yang menghubungkan pengembangan tenaga kerja, kemampuan teknologi, adaptasi organisasi, dan kinerja. Temuan menunjukkan bahwa investasi teknologi saja belum menjamin peningkatan produktivitas dan daya saing tanpa pengembangan kemampuan manusia yang memadai. Kerangka ini memberikan landasan konseptual bagi penelitian empiris selanjutnya untuk menguji hubungan tersebut dalam berbagai konteks organisasi.

1. INTRODUCTION

Digital transformation has fundamentally changed how business organizations create value, manage resources, and compete in increasingly dynamic markets. Technologies such as artificial intelligence (AI), cloud computing, big data analytics, and digital platforms have expanded opportunities for improving operational efficiency, accelerating innovation, and reaching customers beyond geographical boundaries. However, the economic benefits of these technologies depend not only on their availability but also on the ability of organizations and their employees to use them effectively. The World Economic Forum (2025) reported that 86%

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of surveyed employers expect advances in AI and information processing to transform their businesses by 2030. Furthermore, approximately 39% of workers' existing skill sets are expected to change or become outdated during the 2025–2030 period. These developments indicate that technological transformation is simultaneously reshaping organizational operations and the competencies required to sustain business performance.

Human capital has long been recognized as a strategic resource that contributes to organizational productivity, innovation, and competitive advantage. From the perspective of Human Capital Theory, investments in education, training, and knowledge development enhance individuals' productive capabilities and their potential economic contributions (Becker, 1964). Similarly, the Resource-Based View emphasizes that valuable, rare, and difficult-to-imitate organizational resources can provide the foundation for sustained competitive advantage (Barney, 1991). Within this perspective, employees represent more than operational resources because their knowledge, experience, creativity, and problem-solving abilities contribute to organizational value creation. Previous studies have also highlighted the importance of education, training, work experience, professional skills, and entrepreneurial capabilities in strengthening business performance (Pennings et al., 1998; Soeharso, 2020; Škrinjarić, 2022). Nevertheless, the growing integration of digital technologies into organizational activities raises questions about whether these traditional dimensions of human capital development remain sufficient to address contemporary business challenges.

The relationship between human capital and organizational performance has become increasingly complex as digitalization changes the nature of work and the distribution of economic opportunities. Digital technologies can improve productivity by reducing repetitive tasks, facilitating information exchange, and supporting data-driven decision-making. However, these benefits are not automatically realized through technological investment. Organizations must also develop employees' ability to understand digital systems, interpret information, collaborate across technological environments, and adapt to changing work processes. The OECD (2024a) emphasizes that effective participation in the digital economy requires a combination of foundational skills, technological competencies, and complementary human capabilities, including communication, creativity, and problem-solving. Moreover, OECD (2024b) identifies a positive relationship between adult skills and labor productivity, suggesting that the quality and allocation of human capital remain important determinants of economic performance. Consequently, digital transformation should be understood not merely as technological modernization but also as a process of developing and reorganizing human capabilities.

The emergence of artificial intelligence has introduced additional challenges and opportunities for human capital development. Unlike earlier technologies primarily designed to automate routine physical or administrative activities, contemporary AI systems can support analytical tasks, information processing, content generation, and certain aspects of managerial decision-making. These capabilities may complement human expertise, although their effects differ across occupations and organizational contexts. The International Labour Organization (2025) estimates that approximately one in four workers worldwide are employed in occupations with some degree of exposure to generative AI, while emphasizing that many jobs are more likely to be transformed than entirely eliminated. Similarly, the OECD (2026) reports that shortages of relevant skills remain a significant barrier to AI adoption, particularly among small and medium-sized enterprises. These findings suggest that the organizational value of AI depends partly on employees' ability to understand its capabilities, evaluate its outputs, recognize its limitations, and integrate it responsibly into existing work processes.

These developments have important implications for the traditional components of human capital development. Education must increasingly prepare individuals for continuous learning rather than merely providing qualifications acquired before entering employment. Training should move beyond conventional technical instruction toward digital upskilling, reskilling, and the practical application of AI-supported technologies. Work experience also requires reconsideration because the duration of employment does not necessarily reflect an individual's ability to operate effectively in technologically changing environments. Similarly, professional skills now involve the integration of digital literacy, analytical reasoning, technological adaptability, and interpersonal competencies. Entrepreneurial capabilities are also evolving as digital platforms, AI-supported marketing, and data analytics create new opportunities for identifying markets, developing products, and engaging customers. Therefore, the five dimensions of human capital development identified in earlier organizational research remain relevant, but their contributions to business performance need to be reconsidered within the context of digital transformation.

From an economic perspective, the interaction between human capital and digital technologies is particularly important because productivity improvements depend on how effectively organizations combine labor, knowledge, and technological resources. Investments in digital infrastructure may reduce transaction costs and improve operational coordination, but insufficient employee competencies can limit their utilization. Conversely, employees with strong digital capabilities may identify opportunities to improve processes, develop innovative solutions, and enhance customer value. Nevertheless, technological transformation may also create unequal outcomes. Workers with limited access to digital training may face difficulties adapting to new job requirements, while organizations with inadequate resources may struggle to implement advanced technologies. The International Labour Organization (2024) highlights that differences in digital infrastructure and technological access can influence how the productivity benefits of AI are distributed across countries and socioeconomic groups. Thus, understanding human capital development in the digital era requires consideration of both organizational performance and the broader economic implications of technological change.

Theoretically, these relationships can be examined by integrating Human Capital Theory, the Resource-Based View, and Dynamic Capabilities Theory. Human Capital Theory explains why investments in education, training, and skills development can enhance employees' productive capacities (Becker, 1964). The Resource-Based View provides a foundation for understanding how knowledge and competencies contribute to competitive advantage when they are valuable and difficult for competitors to replicate (Barney, 1991). Meanwhile, Dynamic Capabilities Theory emphasizes the ability of organizations to identify opportunities, mobilize resources, and reconfigure competencies in response to technological and environmental changes (Teece, 2007, 2018). Although these perspectives offer complementary explanations, their integration is necessary to clarify how conventional human capital investments can be translated into digital competencies and subsequently contribute to organizational performance. In this context, technological capabilities should not be viewed simply as substitutes for human resources but as complementary capabilities whose value depends on organizational learning, managerial decisions, and the effective deployment of employee knowledge.

Despite growing academic interest in digital transformation, AI adoption, and workforce development, an important conceptual issue remains concerning how established dimensions of human capital development should be interpreted in technology-intensive organizational environments. Traditional discussions have generally emphasized education, training, work experience, skills, and entrepreneurship as contributors to business performance. Meanwhile, contemporary discussions of digital transformation increasingly highlight digital literacy, AI-related competencies, technological adaptability, and human–AI collaboration. Although these perspectives are closely related, their conceptual connections and implications for organizational performance require more explicit integration. In particular, it remains necessary to distinguish between the possession of human capital, the development of digital competencies, and the organizational processes through which these capabilities generate economic value. This study addresses that conceptual problem by bringing these perspectives together rather than treating human capital development and technological transformation as separate organizational concerns.

Accordingly, the novelty of this study lies in its proposed integration of five established dimensions of human capital development with digital competencies and AI-related capabilities to explain their potential contributions to organizational performance. Rather than assuming that education, training, experience, skills, and entrepreneurship independently produce superior business outcomes, this study considers how their effectiveness may depend on technological adaptation, organizational learning, and the productive application of digital resources. It also recognizes that digitalization may generate both performance opportunities and adjustment costs, making the relationship between human capital and organizational outcomes conditional rather than universally positive. This perspective provides a basis for developing an integrated conceptual understanding of technology-enabled human capital development.

Therefore, this study aims to critically examine how human capital development can be reconceptualized in the digital era by integrating digital competencies, artificial intelligence, and organizational performance. Specifically, it seeks to analyze the evolving roles of education, training, work experience, professional skills, and entrepreneurship; explain how digitalization and AI reshape their contributions to organizational productivity and competitiveness; and develop a conceptual framework connecting human capital development, technological capabilities, and organizational outcomes. Through an integrative literature review, the study is expected to contribute to the theoretical understanding of human capital development

while offering practical insights for organizations seeking to align workforce development strategies with digital transformation and long-term business competitiveness.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

2.1. Human Capital Theory and Organizational Performance

Human capital represents the knowledge, skills, competencies, experiences, and individual capabilities that contribute to productive activities and organizational value creation. Human Capital Theory, initially developed by Schultz (1961) and subsequently elaborated by Becker (1964), emphasizes that investments in education, training, and professional development can enhance individual productivity and generate economic returns. Unlike physical capital, which derives its value from tangible assets, human capital is embedded in individuals and develops through continuous learning, practical experience, and knowledge accumulation. From an organizational perspective, human capital is therefore not merely a component of labor input but a strategic resource that influences operational efficiency, innovation, and long-term competitiveness.

The relationship between human capital and organizational performance can also be explained through the Resource-Based View (RBV). Barney (1991) argues that sustainable competitive advantage emerges when organizations possess resources that are valuable, rare, imperfectly imitable, and difficult to substitute. Human capital can satisfy these conditions when employees possess specialized knowledge, distinctive competencies, and experience that competitors cannot easily replicate. However, the possession of qualified employees does not automatically translate into superior organizational performance. Organizations must establish appropriate management practices, learning environments, and resource allocation mechanisms that enable employees to apply their competencies productively. Crook et al. (2011), through a meta-analysis, identified a positive relationship between human capital and firm performance, while also highlighting the importance of contextual factors in explaining variations in organizational outcomes.

In the digital era, the economic value of human capital is increasingly influenced by technological change. Digital platforms, automation systems, and AI-supported applications are transforming how employees perform tasks, exchange information, and contribute to organizational objectives. Consequently, the productive value of education, training, and work experience increasingly depends on their relevance to changing technological requirements. Employees may possess extensive professional experience but encounter difficulties when organizational processes become dependent on unfamiliar digital systems. Conversely, employees who combine professional expertise with technological adaptability may contribute more effectively to innovation and productivity improvements. This development suggests that human capital should be understood as a dynamic resource whose economic value can change as technologies, organizational processes, and market conditions evolve.

2.2. Digital Transformation and the Changing Nature of Human Capital

Digital transformation refers to organizational changes associated with the integration of digital technologies into business processes, value creation mechanisms, and organizational structures. Vial (2019) conceptualizes digital transformation as a process in which digital technologies generate disruptions that encourage organizations to modify their strategic responses, organizational structures, and value creation activities. Similarly, Verhoef et al. (2021) distinguish between digitization, digitalization, and digital transformation, emphasizing that digital transformation extends beyond converting analog information into digital formats or improving existing processes through technological applications. It involves broader organizational changes that can reshape business models, customer relationships, and competitive environments.

These developments have significant implications for human capital development because technological transformation changes both the content of work and the competencies required to perform it. Digital systems increasingly support information processing, operational coordination, customer management, and organizational decision-making. However, technological investment alone does not guarantee performance improvements. Employees must possess the competencies necessary to operate digital tools, interpret information, evaluate technological outputs, and adapt existing practices to new working environments. The effectiveness of digital transformation therefore depends on the alignment between technological resources and human capabilities.

From an economic perspective, this relationship reflects the complementarity between human capital and technological investment. Technologies can improve organizational efficiency by reducing transaction

costs, facilitating information exchange, and accelerating routine activities. Nevertheless, these potential benefits may remain unrealized when employees lack appropriate skills or when organizational structures prevent effective technological integration. The concept of skill-biased technological change further suggests that technological advancement can alter the relative demand for different types of labor. Autor et al. (2003) demonstrate that computerization is associated with changes in the task composition of employment, particularly through the substitution of certain routine activities and the complementarity between technology and nonroutine analytical tasks. Although contemporary AI extends technological capabilities beyond earlier computerization, this perspective remains relevant for understanding how digital transformation changes the economic value of different human competencies.

Accordingly, digital transformation should not be interpreted as a purely technological process. It also represents a transformation of organizational knowledge, employee capabilities, and the relationship between human labor and technological systems. Organizations that fail to develop their workforce alongside technological investments may encounter implementation difficulties, inefficient resource utilization, and limited productivity improvements. Conversely, organizations that integrate technological adoption with continuous human capital development may be better positioned to convert digital investments into organizational value.

2.3. Digital Competencies and Artificial Intelligence Literacy

Digital competencies refer to the knowledge, skills, and attitudes required to use digital technologies effectively, critically, and responsibly. These competencies extend beyond basic computer literacy and include information management, digital communication, technological problem-solving, data interpretation, and the ability to adapt to emerging technological applications. The European Commission's DigComp 2.2 framework identifies five major areas of digital competence: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (Vuorikari et al., 2022). These dimensions demonstrate that digital competence involves both technical proficiency and the ability to make informed decisions within technology-mediated environments.

The growing adoption of artificial intelligence has further expanded the competencies required in contemporary organizations. AI literacy can be understood as the ability to comprehend fundamental AI concepts, recognize appropriate applications, evaluate AI-generated outputs, and understand the ethical and practical implications of AI-supported decisions. Long & Magerko (2020) conceptualize AI literacy as a set of competencies that enables individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI systems, and use AI as a tool in professional and everyday contexts. This perspective is particularly relevant to organizational environments because employees increasingly interact with AI-supported applications without necessarily possessing specialized expertise in computer science or algorithm development.

Digital competence and AI literacy are closely related but conceptually distinct. Digital competence encompasses a broad range of abilities associated with digital technologies, whereas AI literacy emphasizes the understanding, evaluation, and responsible application of systems that perform tasks involving prediction, classification, generation, or decision support. Employees may be proficient in using digital communication platforms and business software while lacking the ability to assess AI-generated recommendations or recognize algorithmic limitations. Conversely, understanding AI principles does not necessarily imply competence in managing organizational databases, cybersecurity practices, or digital collaboration systems. This distinction suggests that human capital development strategies should address both general digital capabilities and more specific AI-related competencies.

The relationship between these competencies and organizational performance is not necessarily direct. Digital competencies may contribute to performance by improving task execution, information accessibility, and coordination, while AI literacy may support the effective integration of intelligent systems into organizational activities. However, these contributions depend on the suitability of technological applications, the quality of organizational data, employee autonomy, and management support. Consequently, digital competencies and AI literacy should be viewed as complementary components of contemporary human capital rather than independent guarantees of organizational success.

2.4. Education, Digital Learning, and Organizational Performance

Education has traditionally been considered a fundamental component of human capital development because it contributes to knowledge acquisition, analytical capabilities, and individual productivity. Becker (1964) emphasizes that education represents an investment capable of generating future economic benefits through improved productive capacities. Within business organizations, educational attainment can support employees' ability to understand complex information, evaluate alternatives, and contribute to problem-solving activities. Pennings et al. (1998) also highlight the relevance of human capital in explaining organizational outcomes, demonstrating that the composition and quality of organizational resources can influence business sustainability. However, the relationship between formal education and organizational performance has become increasingly complex in technology-intensive environments. Formal qualifications may provide foundational knowledge, but technological developments can change the practical relevance of specific competencies. As organizations introduce digital platforms, automated systems, and AI-supported applications, employees must continuously update their knowledge to remain effective. This creates a distinction between educational attainment and continuous learning capability. Individuals with similar educational backgrounds may demonstrate different levels of productivity depending on their willingness and ability to acquire new technological competencies.

Digital learning environments provide opportunities to address these challenges by expanding access to educational resources and supporting more flexible knowledge development. Online learning platforms, virtual training environments, and AI-supported educational applications can facilitate learning beyond conventional classroom settings. Nevertheless, access to digital learning resources does not automatically ensure meaningful competence development. Learning outcomes depend on instructional quality, employee motivation, digital accessibility, and opportunities to apply newly acquired knowledge in actual organizational activities. Therefore, the contribution of education to organizational performance in the digital era should be examined through its capacity to support continuous learning and technological adaptability. Education remains an essential foundation of human capital, but its organizational value increasingly depends on how effectively individuals update and apply their knowledge in changing technological environments.

2.5. Training, Digital Upskilling, and Workforce Adaptability

Training represents a structured organizational effort to develop employees' knowledge, skills, and abilities in relation to specific job requirements. Unlike formal education, which often emphasizes broader knowledge acquisition, training generally focuses on competencies required to perform particular tasks or organizational functions. Salas et al. (2012) explain that effective training contributes to organizational outcomes when learning objectives, instructional methods, and workplace conditions are appropriately aligned. Training should therefore be understood as a process that connects employee development with organizational performance requirements. Digital transformation has introduced new demands for employee training, particularly through the growing importance of upskilling and reskilling. Upskilling refers to developing additional or more advanced competencies within an existing occupational role, whereas reskilling involves acquiring capabilities required to perform substantially different tasks or functions. Both approaches are increasingly relevant as automation, digital platforms, and AI-supported systems change the organization of work. The World Economic Forum (2025) identifies technological literacy, AI and big data, and cybersecurity-related capabilities among the skills expected to grow in importance. These developments indicate that employee training must increasingly address technological competencies alongside conventional professional and managerial skills.

AI-supported training systems may also change how organizations deliver employee development programs. Adaptive learning applications, automated feedback systems, and digital simulations can potentially support personalized learning experiences and improve access to training materials. However, their effectiveness depends on appropriate instructional design, data quality, technological accessibility, and human supervision. Organizations must also consider the possibility that excessive reliance on automated learning tools could reduce opportunities for critical reflection, interpersonal learning, or practical skill development. From an organizational performance perspective, training creates economic value when acquired competencies are transferred into workplace activities. Employees who complete digital training programs may not generate measurable productivity improvements if organizational processes remain unchanged or

if management does not provide opportunities to apply their new capabilities. Consequently, digital upskilling and reskilling should be integrated with organizational strategies, technological investments, and performance evaluation systems. This perspective positions training as a mechanism for workforce adaptability rather than merely a routine human resource management activity.

2.6. Work Experience, Digital Adaptability, and Human–AI Collaboration

Work experience contributes to human capital by allowing individuals to accumulate practical knowledge, develop professional judgment, and acquire competencies through repeated engagement with organizational activities. Experience can strengthen employees' understanding of operational processes, customer relationships, and organizational challenges. However, the economic value of experience depends not only on the duration of employment but also on the relevance, diversity, and applicability of accumulated knowledge. In rapidly changing technological environments, experience developed under previous operating conditions may not always translate into superior performance. Digitalization has altered the relationship between work experience and organizational effectiveness by introducing new tools, processes, and forms of collaboration. Employees increasingly interact with enterprise information systems, digital communication platforms, automated workflows, and AI-supported decision tools. These developments may enhance the productivity of experienced workers when technological systems complement their professional knowledge. At the same time, technological changes may reduce the relevance of certain established routines and require experienced employees to reconsider familiar working practices.

The emergence of generative AI has made human–AI collaboration particularly relevant to contemporary human capital development. AI systems can assist employees in preparing documents, analyzing information, generating alternatives, and supporting selected decision-making activities. However, these systems do not eliminate the importance of human judgment. Employees must assess the reliability, contextual appropriateness, and potential consequences of AI-generated outputs. Raisch and Krakowski (2021) discuss the automation–augmentation paradox, emphasizing that AI can simultaneously substitute for certain human activities and complement human capabilities. This perspective suggests that organizational performance depends partly on how responsibilities are distributed between employees and intelligent systems. Consequently, work experience in the digital era should be evaluated not only through occupational tenure but also through employees' ability to integrate accumulated knowledge with emerging technologies. Experienced workers may provide contextual understanding and professional judgment, while digital systems can support information processing and analytical activities. The effective combination of these capabilities may strengthen organizational learning, improve decision quality, and support technological adaptation.

2.7. Professional Skills, Technological Innovation, and Business Performance

Professional skills represent the practical competencies required to perform organizational activities effectively. These skills include technical knowledge, communication, problem-solving, collaboration, and managerial abilities. Previous discussions of human capital development have emphasized that employee skills contribute to business performance by supporting operational efficiency, innovation, and effective resource utilization (Soeharso, 2020; Škrinjarić, 2022). However, technological transformation has expanded the range of competencies required in contemporary workplaces. The growing integration of digital technologies has increased the importance of combining technical and nontechnical capabilities. Employees may require knowledge of digital platforms, data interpretation, information security, and AI-supported applications. Nevertheless, technological proficiency alone may be insufficient to generate superior organizational outcomes. Critical thinking, creativity, communication, and ethical judgment remain important because digital systems frequently produce information that requires contextual interpretation and human evaluation. This suggests that technological and interpersonal competencies should be treated as complementary rather than competing dimensions of human capital.

The relationship between professional skills and organizational performance can be understood through the capacity of employees to translate knowledge into productive activities. Digital competencies may improve information processing and operational coordination, while analytical and creative skills can support innovation and problem-solving. However, performance outcomes depend on the alignment between employee capabilities, organizational processes, and technological resources. Employees with advanced technological skills may contribute little to organizational performance when management structures discourage experimentation or when digital systems are poorly integrated into operational activities. From

the perspective of Dynamic Capabilities Theory, the development and reconfiguration of employee competencies can support organizational adaptation. Teece (2007) emphasizes the importance of sensing opportunities, seizing them, and transforming organizational resources in response to environmental change. Human capital development contributes to these processes when employees can recognize technological opportunities, apply new knowledge, and support changes in organizational routines. Thus, professional skills represent not only operational competencies but also potential foundations for innovation and organizational adaptability.

2.8. Digital Entrepreneurship, Marketing Innovation, and Organizational Competitiveness

Entrepreneurship represents the ability to identify opportunities, mobilize resources, manage uncertainty, and create economic value through innovative activities. Entrepreneurial orientation has traditionally been associated with innovativeness, proactiveness, and risk-taking (Lumpkin & Dess, 1996). Within human capital development, entrepreneurial competencies are relevant because they influence how individuals recognize market opportunities, develop business strategies, and respond to competitive pressures. Digitalization has transformed entrepreneurial activities by expanding access to information, reducing certain market entry barriers, and enabling new forms of value creation. Digital platforms allow businesses to communicate with customers, coordinate transactions, and access markets beyond conventional geographical boundaries. Nambisan (2017) argues that digital technologies reshape entrepreneurial processes by changing the boundaries, agency, and uncertainty associated with entrepreneurial activities. These developments suggest that entrepreneurial human capital increasingly includes the ability to identify and exploit opportunities emerging from digital technologies.

Artificial intelligence introduces additional possibilities for entrepreneurial decision-making and marketing innovation. AI-supported applications can assist businesses in analyzing customer preferences, developing marketing content, identifying market patterns, and supporting customer interactions. However, these capabilities do not automatically generate competitive advantage. Their economic value depends on the quality of available data, managerial interpretation, organizational resources, and the ability to translate technological insights into appropriate business decisions. Furthermore, digital entrepreneurship may create new competitive pressures as technological tools become increasingly accessible to competing firms. Consequently, entrepreneurial competencies in the digital era should extend beyond conventional opportunity recognition and risk-taking. They should also include digital opportunity identification, technological experimentation, data-informed decision-making, and the responsible application of AI-supported tools. The integration of these competencies may contribute to marketing effectiveness, business innovation, and organizational competitiveness, although the magnitude and direction of these relationships depend on organizational and environmental conditions.

3. RESEARCH METHOD

3.1. Research Design

This study adopts a qualitative research approach using an integrative literature review to examine the relationship between human capital development, digital competencies, artificial intelligence (AI), and organizational performance. An integrative literature review is appropriate because it allows researchers to critically examine, compare, and synthesize theoretical and empirical literature from different research traditions to develop a more comprehensive understanding of a particular phenomenon. Unlike a conventional descriptive literature review, which primarily summarizes existing knowledge, an integrative review emphasizes the identification of conceptual relationships, theoretical inconsistencies, emerging patterns, and opportunities for further theoretical development (Torraco, 2005; Snyder, 2019).

The selection of this approach is based on the multidimensional nature of human capital development in digitally transforming organizations. Existing studies have examined education, training, work experience, professional skills, and entrepreneurship as important contributors to organizational performance. However, the increasing integration of digital technologies and AI into organizational activities requires these dimensions to be reconsidered in relation to technological competencies, organizational adaptability, and changing patterns of value creation. Accordingly, this study employs an integrative review to connect established human capital perspectives with contemporary discussions of digital transformation and AI-supported organizational activities. The review is guided by three theoretical perspectives: Human Capital The-

ory, the Resource-Based View, and Dynamic Capabilities Theory. These perspectives provide complementary explanations of how employee knowledge and competencies are developed, how they contribute to organizational competitive advantage, and how organizations reconfigure their capabilities in response to technological change. Rather than statistically testing relationships between variables, the study seeks to develop a theoretically grounded conceptual synthesis based on relevant scholarly literature.

3.2. Literature Search Strategy

The literature search is designed to identify relevant scholarly publications addressing human capital development, digital transformation, digital competencies, artificial intelligence, and organizational performance. The search strategy prioritizes peer-reviewed journal articles, including theoretical contributions, empirical studies, and review papers. Seminal academic publications are also considered to establish the theoretical foundations of human capital development and organizational competitiveness. The proposed search sources include Scopus, Web of Science, ScienceDirect, SpringerLink, and Google Scholar. Scopus and Web of Science are prioritized for identifying peer-reviewed literature across management, economics, business, and technology-related disciplines. ScienceDirect and SpringerLink are used as supplementary publisher platforms, while Google Scholar supports the identification of additional relevant publications and foundational theoretical works. Because these sources have overlapping coverage, duplicate records will be identified and removed during the screening process. The search strategy combines keywords representing the central concepts of the study. These include "human capital development," "digital transformation," "digital competencies," "digital skills," "artificial intelligence," "AI literacy," "human–AI collaboration," "employee training," "organizational performance," and "business competitiveness." Boolean operators are used to identify studies examining the relationships between these concepts.

Table 1. Proposed Literature Search Strategy

No	Research focus	Search keywords
1	Human capital	"human capital" AND "organizational performance"
2	Digital transformation	"human capital development" AND "digital transformation"
3	Digital competencies	"digital skills" OR "digital competencies" AND "employee performance"
4	Artificial intelligence	"AI literacy" OR "artificial intelligence" AND "human capital"
5	Human–AI collaboration	"human-AI collaboration" AND "organizational performance"
6	Education and training	"digital learning" OR "digital upskilling" AND "workforce development"
7	Entrepreneurship	"digital entrepreneurship" AND "business performance"
8	Integrated perspective	"human capital" AND "digital transformation" AND "organizational performance"

The review prioritizes publications from 2015 to 2026 to capture developments in digital transformation and contemporary workforce capabilities. Earlier publications are included selectively when they provide foundational theoretical explanations, particularly those associated with Human Capital Theory, the Resource-Based View, technological change, and Dynamic Capabilities Theory. The search period therefore combines recent scholarly developments with seminal literature necessary for theoretical integration.

3.3. Inclusion and Exclusion Criteria

The selection of literature is guided by predefined inclusion and exclusion criteria to maintain conceptual relevance and analytical consistency. Studies are considered eligible when they examine human capital development, employee competencies, digital transformation, AI-related capabilities, or organizational performance within business and organizational contexts. Publications discussing the relationship between technological change and workforce productivity are also considered relevant. The review includes theoretical papers, empirical studies, and literature reviews that provide substantive contributions to the research objectives. Peer-reviewed journal articles are prioritized, while selected institutional publications from internationally recognized organizations may be used to contextualize technological and workforce developments.

Such institutional reports are treated as contextual evidence rather than substitutes for peer-reviewed academic research.

Table 2. Proposed Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Publication period	2015–2026; earlier seminal works	Older publications without foundational relevance
Publication type	Peer-reviewed articles and selected authoritative reports	Unverified websites, promotional material, and unsupported opinion pieces
Language	English	Publications outside the review's language scope
Research focus	Human capital, digitalization, AI, and organizational outcomes	Studies unrelated to workforce or organizational capabilities
Study design	Conceptual, qualitative, quantitative, mixed-methods, and review studies	Publications without sufficient methodological or conceptual information
Accessibility	Full text available for critical assessment	Records with insufficient accessible information

The eligibility criteria are intended to support the selection of literature that contributes directly to the study's theoretical and analytical objectives. Studies focusing exclusively on technological specifications without discussing human capabilities or organizational implications are excluded. Similarly, publications examining human resource practices without meaningful connections to the development, utilization, or performance implications of human capital are not prioritized.

3.4. Literature Selection and Data Extraction

The literature selection process is designed to proceed through identification, screening, eligibility assessment, and final inclusion. During identification, records retrieved from the selected databases are consolidated and checked for duplication. Titles and abstracts are subsequently screened to determine their relevance to the research objectives. Publications meeting the initial eligibility requirements are examined through full-text assessment to evaluate their theoretical contributions, methodological characteristics, and relevance to the relationship between human capital, technological capabilities, and organizational performance. Following the screening process, relevant information is extracted from each included publication using a structured literature matrix. The extraction categories include author and publication year, research context, theoretical foundation, research design, human capital dimensions, digital or AI-related constructs, organizational performance indicators, principal findings, and identified limitations. This structure enables comparisons across studies while preserving differences in their theoretical assumptions and methodological approaches. The extraction process also distinguishes between empirically supported findings and conceptual arguments. Empirical findings are evaluated according to their research design, measurement approach, and analytical limitations, whereas theoretical contributions are assessed based on conceptual clarity, explanatory relevance, and consistency with established literature. This distinction is necessary to avoid treating conceptual propositions as empirically verified relationships.

Table 3. Literature Extraction Framework

No	Extraction dimension	Information recorded
1	Bibliographic information	Author, year, journal, and title
2	Research characteristics	Objectives, context, and methodology
3	Theoretical foundation	Human Capital Theory, RBV, Dynamic Capabilities, or related perspectives
4	Human capital dimensions	Education, training, experience, skills, and entrepreneurship
5	Technological dimensions	Digital competencies, AI literacy, AI adoption, and human–AI collaboration
6	Organizational outcomes	Productivity, innovation, efficiency, performance, and competitiveness
7	Main findings	Relationships and mechanisms reported in the literature
8	Research limitations	Conceptual, methodological, and contextual limitations

The final number of included publications will be reported after the search and selection procedures have been completed. A selection summary will document the number of identified records, duplicates removed, records excluded during screening, full-text publications assessed, and studies included in the synthesis.

3.5. Data Analysis and Thematic Synthesis

The collected literature is analyzed using a qualitative thematic synthesis approach. This approach is appropriate for identifying recurring concepts, comparing theoretical explanations, and developing integrated interpretations across studies employing different research methodologies. The analysis is informed by the principles of thematic analysis described by Braun and Clarke (2006), while maintaining the critical and theory-building orientation of an integrative literature review. The analytical process consists of three interconnected stages. The first stage involves familiarization with the selected literature and the identification of relevant concepts related to human capital, technological capabilities, and organizational outcomes. The second stage involves coding and organizing these concepts into thematic categories. The third stage focuses on comparing findings across categories, identifying theoretical relationships, examining inconsistencies, and developing an integrated conceptual interpretation. Five initial themes are derived from the established dimensions of human capital development discussed in the original study: education, training, work experience, professional skills, and entrepreneurship. These themes serve as the organizing framework for examining how digitalization and AI influence the development and utilization of human capital. Additional concepts, including digital literacy, AI literacy, technological adaptability, human–AI collaboration, organizational learning, and productivity, are examined within and across these themes.

Table 4. Analytical Themes and Dimensions

Main theme	Digital and AI-related focus	Organizational implications
Education	Digital education and continuous learning	Knowledge development and learning adaptability
Training	Digital upskilling, reskilling, and AI-supported training	Workforce readiness and operational efficiency
Work experience	Digital work experience and human–AI collaboration	Knowledge integration and decision quality
Professional skills	Digital competencies, AI literacy, and analytical capabilities	Innovation and employee productivity
Entrepreneurship	Digital entrepreneurship and AI-supported marketing	Market opportunities and business competitiveness

The analysis follows an iterative process in which emerging interpretations are compared with the original publications and relevant theoretical perspectives. Particular attention is given to identifying conditions under which technological capabilities strengthen or constrain the relationship between human capital development and organizational performance. Contradictory findings are retained and examined rather than excluded merely because they do not support the emerging conceptual framework. The synthesis ultimately seeks to explain how traditional human capital dimensions interact with digital and AI-related capabilities, and how these interactions may contribute to organizational productivity, innovation, adaptability, and competitiveness.

3.6. Conceptual Framework Development

The conceptual framework is developed through the integration of findings from the thematic synthesis and the theoretical perspectives guiding the study. Human Capital Theory provides the foundation for understanding education, training, experience, and skills as investments in productive capabilities. The Resource-Based View explains how distinctive human competencies may contribute to organizational competitive advantage. Dynamic Capabilities Theory extends this explanation by emphasizing the organizational processes required to adapt, integrate, and reconfigure resources in response to technological and environmental changes. The framework is organized around three interconnected conceptual components. The first component comprises the five established dimensions of human capital development: education, training, work experience, professional skills, and entrepreneurship. The second component concerns digital and AI-related

capabilities, including digital literacy, AI literacy, technological adaptability, and human–AI collaboration. The third component represents organizational outcomes, particularly operational efficiency, innovation, productivity, adaptability, and competitive performance.

The framework does not assume that technological capabilities automatically mediate or moderate the relationship between human capital and organizational performance. Instead, the synthesis examines possible mechanisms through which these capabilities complement existing human resources and influence organizational outcomes. The proposed relationships are interpreted as conceptual propositions requiring subsequent empirical examination. By integrating these components, the study seeks to explain why similar investments in human capital may produce different organizational outcomes depending on technological readiness, managerial support, organizational learning, and the effectiveness of digital technology integration.

3.7. Research Rigor and Limitations

Several procedures are proposed to strengthen the transparency and credibility of the integrative review. First, the literature search strategy, eligibility criteria, and selection decisions will be documented to support the traceability of the review process. Second, the literature extraction matrix will provide a consistent basis for comparing studies across different theoretical and methodological traditions. Third, the synthesis will distinguish empirical evidence from theoretical interpretation and identify contradictory findings where relevant. The study also recognizes several methodological limitations. The restriction to English-language publications may exclude relevant research published in other languages. Differences in database coverage and access to full-text publications may influence the composition of the reviewed literature. Furthermore, the inclusion of studies employing different research designs, organizational contexts, and performance measures may limit the direct comparability of their findings. As a qualitative integrative review, the study does not estimate statistical relationships or establish causal effects between human capital development, technological capabilities, and organizational performance. Its primary contribution lies in developing a theoretically grounded synthesis that clarifies conceptual relationships, identifies relevant organizational mechanisms, and establishes directions for future empirical research.

4. DATA ANALYSIS AND DISCUSSION

4.1. Human Capital Development in the Context of Digital Transformation

The integration of digital technologies and artificial intelligence (AI) has introduced important changes in how organizations develop, utilize, and evaluate human capital. Based on the conceptual literature examined in this study, human capital remains a fundamental resource for organizational performance, but its contribution increasingly depends on the ability of employees and organizations to respond to technological change. Education, training, work experience, professional skills, and entrepreneurship continue to represent essential dimensions of human capital development. However, these dimensions can no longer be understood independently of digital competencies, technological adaptability, and the growing interaction between human expertise and intelligent systems. This interpretation is consistent with Human Capital Theory, which considers education, training, and knowledge acquisition as investments in productive capabilities (Becker, 1964). Nevertheless, technological transformation changes the conditions under which these investments generate economic value. In conventional organizational environments, human capital development primarily emphasizes improving employees' knowledge, experience, and occupational competencies. In digitally transforming organizations, the effectiveness of these capabilities also depends on their compatibility with technological systems and evolving business processes. Consequently, human capital development increasingly involves not only accumulating knowledge but also continuously renewing and applying that knowledge in technology-intensive environments.

The literature on digital transformation supports this broader interpretation. Vial (2019) explains that digital transformation involves organizational responses to technological disruptions that can alter value creation processes and organizational structures. Similarly, Verhoef et al. (2021) emphasize that digital transformation extends beyond technological implementation and requires changes in organizational capabilities and business models. These perspectives indicate that technological investment and human capital development should be considered complementary organizational activities. Organizations may possess advanced technological infrastructure but fail to achieve substantial performance improvements when employees lack the capabilities necessary to utilize these technologies effectively. From the Resource-Based View, human

capital can contribute to competitive advantage when employee knowledge and competencies are valuable, distinctive, and difficult to imitate (Barney, 1991). However, technological developments may alter the value of existing competencies. Skills that previously supported organizational efficiency may become less relevant when business processes are automated or redesigned. Conversely, employees who combine professional expertise with digital capabilities may contribute to new forms of innovation and value creation. This suggests that human capital should be understood as a resource whose strategic value depends partly on its capacity for continuous development and technological adaptation. The following discussion examines the five established dimensions of human capital development and considers how digitalization and AI may reshape their contributions to organizational performance. These discussions represent a theory-informed synthesis of the cited literature rather than findings from a completed systematic search or empirical dataset.

4.2. Education, Digital Learning, and Organizational Performance

Education represents one of the most fundamental investments in human capital because it contributes to knowledge acquisition, analytical reasoning, and the development of productive capabilities. Becker (1964) argues that education can generate economic returns by improving individuals' abilities to perform productive activities. Within organizations, educational attainment may support employees' capacity to understand complex information, solve problems, and participate in innovation. However, the increasing pace of technological change raises questions about whether formal educational qualifications remain sufficient to sustain employee productivity throughout their working lives. Digital transformation has expanded the meaning of education beyond formal qualifications toward continuous learning and technological adaptability. Employees are increasingly expected to understand digital platforms, interpret data, utilize technological applications, and adapt to new working procedures. These requirements suggest that the economic value of education depends not only on knowledge acquired through formal institutions but also on individuals' ability to update and apply that knowledge. The World Economic Forum (2025) estimates that approximately 39% of workers' existing skill sets will be transformed or become outdated between 2025 and 2030. Although this estimate represents employers' expectations rather than observed outcomes, it illustrates the growing importance of continuous competence development.

Digital learning technologies offer opportunities to address these changing requirements. Online educational platforms, virtual learning environments, and AI-supported learning applications can provide employees with access to learning materials beyond conventional classroom settings. Such technologies may support flexible learning arrangements, personalized instructional activities, and continuous professional development. However, the availability of digital educational resources does not necessarily guarantee improvements in employee competencies. Learning effectiveness depends on instructional quality, employee motivation, technological accessibility, and opportunities to apply acquired knowledge within organizational activities. An important distinction therefore exists between access to digital education and the productive utilization of digital knowledge. Organizations may invest in online learning subscriptions or digital training platforms without achieving meaningful improvements in employee performance. This situation can occur when educational content is not aligned with occupational requirements or when organizational structures provide limited opportunities for knowledge application. Conversely, employees who combine foundational education with continuous technological learning may be better prepared to identify operational problems, evaluate digital information, and contribute to organizational innovation.

From an economic perspective, digital education may improve organizational performance through the development of analytical capabilities, reduction of knowledge gaps, and more effective utilization of technological resources. However, these benefits should be interpreted as potential outcomes rather than automatic consequences of educational investment. The effectiveness of digital education depends on how knowledge is transferred into workplace activities and whether organizational processes enable employees to apply their newly developed competencies. Therefore, the contribution of education to organizational performance in the digital era should be evaluated through two complementary dimensions: the accumulation of foundational knowledge and the continuous development of digital learning capabilities. This interpretation extends conventional Human Capital Theory by emphasizing that the productive value of education may require ongoing renewal as technological conditions change.

4.3. Training, Digital Upskilling, and Organizational Efficiency

Training is an important mechanism through which organizations develop employee competencies in response to operational requirements and changing business environments. While education provides broader foundations for knowledge acquisition, training generally focuses on improving specific skills and work-related capabilities. Salas et al. (2012) emphasize that effective organizational training requires appropriate instructional design, opportunities for practical application, and supportive workplace conditions. These considerations remain relevant in digitally transforming organizations, although the content and delivery of training have become increasingly influenced by technological developments. The growing adoption of digital technologies and AI has increased the importance of digital upskilling and reskilling. Upskilling involves improving or expanding employees' existing competencies, whereas reskilling focuses on developing capabilities required for different occupational tasks or responsibilities. These processes are particularly important when organizations introduce automated systems, digital management platforms, or AI-supported applications that change how employees perform their work. The World Economic Forum (2025) identifies AI and big data, technological literacy, and cybersecurity-related capabilities among the skills expected to increase in importance.

However, the relationship between digital training and organizational performance is more complex than simply providing employees with technological instruction. Employees may learn to operate digital applications without understanding how these tools contribute to organizational objectives. For example, training employees to use data analytics software may improve technical proficiency, but its contribution to organizational efficiency depends on whether employees can interpret analytical outputs and apply them to operational decisions. Similarly, introducing AI-supported applications without adequate training may increase employee uncertainty, create inappropriate reliance on automated recommendations, or generate additional monitoring and verification costs. Digital training may also contribute to organizational efficiency by reducing the time required to complete certain tasks and improving coordination between employees and technological systems. Nevertheless, such improvements depend on the suitability of technological applications and the alignment between employee competencies and organizational processes. When digital training is disconnected from actual workplace requirements, organizations may incur additional costs without obtaining corresponding productivity benefits.

The effectiveness of training should therefore be assessed through its contribution to practical competence development and performance improvement rather than participation rates alone. Organizations need to evaluate whether employees can apply acquired digital skills, improve work processes, reduce errors, and support organizational objectives. This interpretation is consistent with the broader literature on training transfer, which emphasizes the importance of applying learning outcomes within actual work environments (Salas et al., 2012). From the perspective of Dynamic Capabilities Theory, digital upskilling and reskilling can also support organizational adaptation. Teece (2007) emphasizes that organizations must continuously identify opportunities, mobilize resources, and reconfigure capabilities to respond to environmental change. Employee training contributes to these processes when it enables organizations to renew their competencies and implement new technological practices. Accordingly, training should be considered not merely an operational human resource activity but a strategic investment in organizational adaptability and technological readiness.

4.4. Work Experience, Digital Adaptability, and Human–AI Collaboration

Work experience contributes to human capital by allowing individuals to accumulate practical knowledge, develop professional judgment, and understand organizational processes through repeated engagement with occupational activities. Experience can strengthen employees' abilities to identify operational problems, evaluate alternatives, and respond to situations requiring contextual understanding. However, technological transformation has changed the conditions under which accumulated experience contributes to organizational performance. In conventional working environments, extensive occupational experience is often associated with familiarity, efficiency, and professional expertise. Nevertheless, the duration of employment does not necessarily indicate an employee's readiness to adopt emerging technologies. Employees with substantial experience may possess valuable organizational knowledge but encounter difficulties when established work processes are replaced by digital systems. Conversely, employees with shorter occupational experience may demonstrate greater familiarity with certain digital applications while lacking the contextual judgment required for complex organizational decisions.

These differences suggest that experience and digital adaptability should be understood as complementary dimensions of human capital. Professional experience provides contextual knowledge, while digital adaptability enables employees to apply and renew that knowledge through emerging technologies. Neither capability necessarily guarantees superior performance independently. Their combined value depends on the extent to which organizations create opportunities for knowledge exchange, technological learning, and effective collaboration.

The increasing adoption of AI has made this relationship particularly important. AI-supported systems can assist employees with information processing, document preparation, data analysis, and selected decision-making activities. However, the reliability and organizational relevance of AI-generated outputs often require human evaluation. Raisch & Krakowski (2021) describe the automation–augmentation paradox, explaining that AI can simultaneously substitute for certain human activities and complement human expertise. This perspective highlights the importance of examining how organizations allocate tasks and responsibilities between employees and intelligent systems. Human–AI collaboration may generate productivity improvements when technological systems complement employees' knowledge and judgment. For example, AI-supported analytical tools may help experienced managers identify patterns in organizational information, while managerial experience remains important for interpreting these patterns within specific business contexts. Nevertheless, inappropriate reliance on AI may introduce risks associated with inaccurate outputs, insufficient contextual understanding, and reduced human oversight. These risks indicate that technological integration should involve clearly defined responsibilities and appropriate evaluation procedures.

From an organizational perspective, the productive value of work experience increasingly depends on employees' ability to combine accumulated knowledge with technological capabilities. Organizations should therefore avoid evaluating employee competence exclusively through occupational tenure or technological proficiency. Instead, human capital development should encourage the integration of professional judgment, continuous learning, and responsible technological application. This interpretation suggests that work experience remains valuable in digitally transforming organizations, but its contribution to performance increasingly depends on adaptability and the effective coordination of human and technological capabilities.

4.5. Professional Skills, Digital Competencies, and Business Performance

Professional skills constitute an essential component of human capital because they influence employees' ability to perform organizational tasks, solve problems, and contribute to business objectives. Traditional discussions of professional competence emphasize technical knowledge, communication, interpersonal relationships, initiative, and organizational problem-solving. These capabilities remain relevant, but digital transformation has expanded the competencies required for effective organizational participation. Digital competencies include the ability to access and evaluate digital information, communicate through technological platforms, create digital content, manage technological risks, and solve problems using digital tools. Vuorikari et al. (2022) identify these dimensions within the DigComp 2.2 framework, emphasizing that digital competence extends beyond the technical ability to operate electronic devices. It also involves critical evaluation, responsible technological behavior, and the ability to adapt digital tools to practical needs.

The increasing use of AI has introduced additional competency requirements. Long & Magerko (2020) explain that AI literacy involves the ability to understand, evaluate, communicate about, and interact effectively with AI technologies. Within organizations, these capabilities are particularly relevant because employees may use AI-supported systems to generate information, evaluate alternatives, or assist with decision-making. However, the ability to operate AI applications does not necessarily indicate an understanding of their limitations or the reliability of their outputs. This distinction is important when evaluating the relationship between digital competencies and organizational performance. Employees who possess basic digital skills may efficiently operate business applications but lack the analytical capabilities required to interpret complex information. Similarly, employees who frequently use AI tools may generate outputs quickly without adequately assessing their accuracy or suitability. Consequently, technological proficiency should be combined with critical thinking, analytical reasoning, communication, and ethical judgment.

The economic contribution of digital competencies can be understood through their potential effects on productivity and innovation. Employees who can effectively utilize technological tools may complete selected tasks more efficiently, improve information accessibility, and support organizational coordination.

Digital competencies may also facilitate innovation by enabling employees to identify technological opportunities and experiment with alternative working methods. However, these outcomes depend on organizational readiness, management support, and the availability of appropriate technological resources. The Resource-Based View provides a useful explanation for these relationships. Although basic digital tools are increasingly accessible to competing organizations, the ability to combine technological resources with distinctive employee knowledge may be more difficult to imitate. Competitive advantage may therefore emerge not simply from possessing advanced technologies but from developing organizationally embedded combinations of human expertise, digital competencies, and effective management practices. Accordingly, professional skills in the digital era should be understood as an integrated combination of technological and human capabilities. The development of digital competencies and AI literacy can strengthen the productive potential of human capital, but organizational performance depends on how these capabilities are applied within specific operational and strategic contexts.

4.6. Digital Entrepreneurship, AI Adoption, and Marketing Performance

Entrepreneurship represents an important dimension of human capital development because it involves identifying opportunities, mobilizing resources, managing uncertainty, and creating economic value. Lumpkin & Dess (1996) emphasize that entrepreneurial orientation encompasses innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness. These characteristics can support organizational competitiveness by encouraging businesses to identify new opportunities and respond to changing market conditions. Digital transformation has introduced new opportunities for entrepreneurial activities by changing how businesses access information, communicate with customers, and organize transactions. Digital platforms enable organizations to reach customers beyond traditional geographical boundaries, while technological applications can support market analysis, customer engagement, and operational coordination. Nambisan (2017) argues that digital technologies reshape entrepreneurial processes by altering the boundaries and dynamics of entrepreneurial opportunities.

However, digital entrepreneurship requires more than the adoption of online business platforms. Entrepreneurs must possess the competencies necessary to identify appropriate technological opportunities, evaluate market information, manage digital customer relationships, and adapt business strategies. The availability of digital technologies may reduce certain barriers to market participation, but it can also intensify competition by enabling more businesses to enter similar markets. AI-supported technologies further expand the possibilities for entrepreneurial innovation and marketing activities. Businesses can use AI applications to assist with customer segmentation, marketing content development, demand analysis, and customer communication. Nevertheless, these applications do not automatically improve marketing performance. Their effectiveness depends on data quality, technological suitability, managerial interpretation, and the organization's ability to translate technological outputs into relevant marketing decisions. An important consideration is that technological accessibility does not necessarily create sustainable competitive advantage. When competing firms can access similar digital platforms and AI applications, the technologies themselves may provide limited differentiation. Competitive advantage may instead depend on entrepreneurs' abilities to combine technological resources with distinctive market knowledge, customer understanding, creativity, and strategic decision-making.

From an economic perspective, digital entrepreneurship can contribute to organizational performance through market expansion, improved customer engagement, and the development of new products or business processes. However, digitalization may also introduce additional costs associated with technological investment, employee training, cybersecurity, and platform dependence. These considerations indicate that the relationship between digital entrepreneurship and business performance is conditional rather than universally positive. Therefore, entrepreneurial human capital in the digital era should incorporate digital opportunity recognition, technological adaptability, data-informed decision-making, and responsible AI utilization. These capabilities may strengthen marketing innovation and business competitiveness when they are supported by appropriate organizational resources and strategic management practices.

4.7. Theoretical Integration: Human Capital, Digitalization, and Organizational Performance

The preceding discussion indicates that the relationship between human capital development and organizational performance is increasingly shaped by technological transformation. Education, training, work experience, professional skills, and entrepreneurship remain important organizational resources. However, their

contributions to performance may depend on employees' digital competencies, AI-related capabilities, and the organization's ability to integrate technological resources into productive activities. Human Capital Theory explains the importance of investing in employee knowledge and competencies (Becker, 1964). The Resource-Based View extends this explanation by emphasizing that distinctive organizational resources can contribute to competitive advantage (Barney, 1991). Dynamic Capabilities Theory further highlights the importance of renewing and reconfiguring organizational resources in response to environmental and technological change (Teece, 2007). Integrating these perspectives provides a broader explanation of how human capital may contribute to organizational performance under changing technological conditions.

The conceptual contribution of this study lies in distinguishing three interconnected processes. The first involves developing human capital through education, training, experience, professional skills, and entrepreneurship. The second concerns the integration of digital competencies and AI-related capabilities into these established dimensions. The third involves translating these combined capabilities into organizational outcomes through improved productivity, innovation, knowledge integration, and technological adaptability. These processes should not be interpreted as a deterministic sequence in which investment in human capital automatically generates technological capabilities and superior organizational performance. Instead, their relationships may be influenced by technological infrastructure, managerial support, organizational learning, employee motivation, and the suitability of digital applications. Organizations with similar human capital resources may therefore achieve different performance outcomes depending on their ability to integrate technological and human capabilities.

The proposed perspective can be described as Technology-Enabled Human Capital Development (TEHCD). In this study, TEHCD refers to the continuous development, renewal, and application of employee knowledge, experience, skills, and entrepreneurial capabilities through the effective integration of digital technologies and AI-supported systems. The term is introduced as a conceptual organizing framework rather than an established theory or empirically validated construct. This framework extends conventional discussions of human capital by emphasizing that technological competencies should not be treated as isolated additions to employee qualifications. Instead, they interact with existing human capabilities and influence how knowledge is translated into organizational value. The framework also recognizes that technological integration may create adjustment costs, unequal learning opportunities, and organizational risks that constrain expected performance improvements.

Table 5. Integration of Human Capital Dimensions, Digital Capabilities, and Organizational Outcomes

Human capital dimension	Digital and AI integration	Potential organizational outcomes
Education	Digital learning and continuous knowledge renewal	Learning adaptability and knowledge utilization
Training	Digital upskilling, reskilling, and AI-supported training	Workforce readiness and operational efficiency
Work experience	Digital adaptability and human–AI collaboration	Improved knowledge integration and decision quality
Professional skills	Digital competencies, AI literacy, and analytical capabilities	Employee productivity and innovation
Entrepreneurship	Digital opportunity recognition and AI-supported marketing	Market expansion and business competitiveness

The integration presented in Table 5 demonstrates that the established dimensions of human capital development remain conceptually relevant but require reinterpretation in relation to technological capabilities. Importantly, the organizational outcomes identified in the table represent theoretically plausible contributions rather than effects established by the present study.

4.8. Proposed Conceptual Framework and Research Propositions

Based on the theoretical integration, this study proposes a conceptual framework connecting human capital development, digital and AI-related capabilities, organizational adaptation, and performance outcomes.

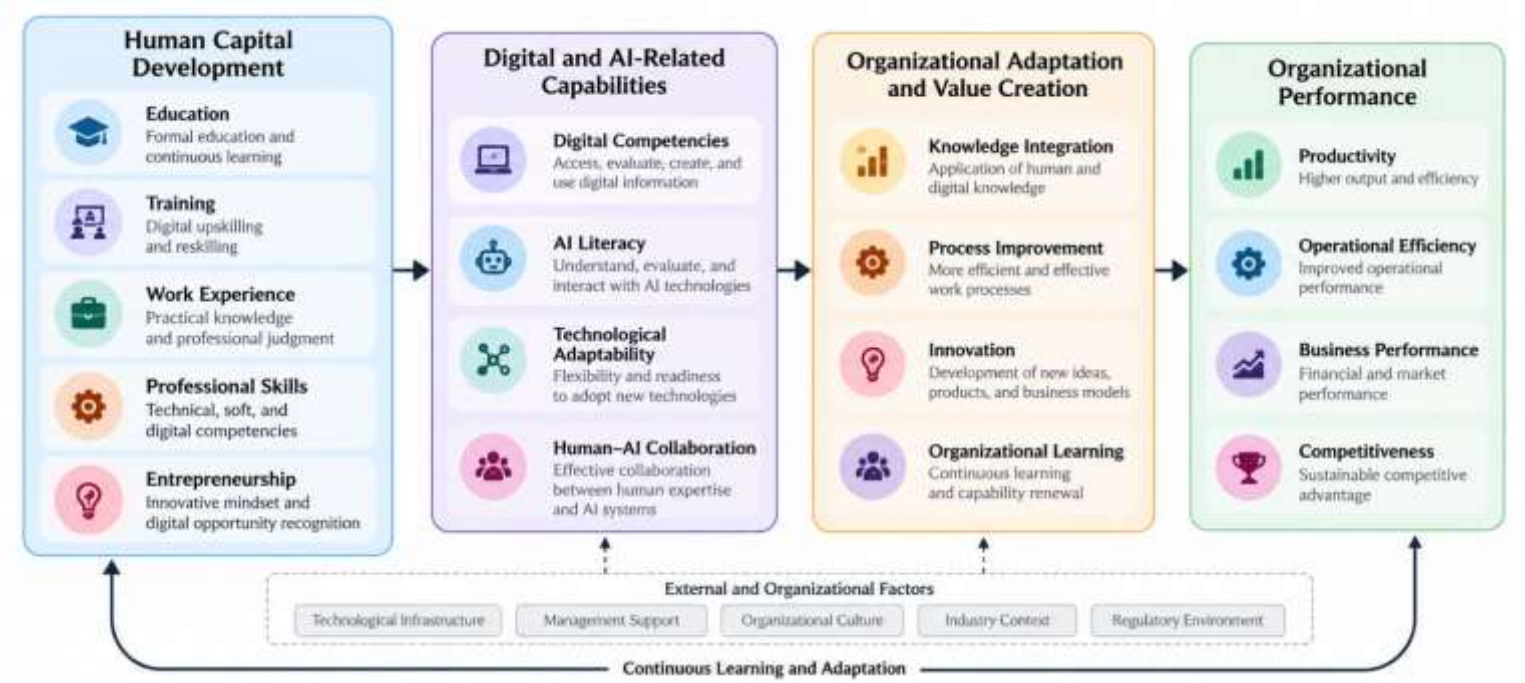


Figure 1. Proposed conceptual framework

The framework suggests that human capital development provides foundational capabilities, while digital competencies and AI-related skills support their application in technologically changing organizational environments. Organizational learning, knowledge integration, and process improvement represent potential mechanisms through which these combined capabilities may contribute to performance. Based on this interpretation, five research propositions are proposed.

- Proposition 1 (P1): The contribution of education to organizational performance is likely to be stronger when employees possess continuous digital learning capabilities and opportunities to apply technological knowledge.
- Proposition 2 (P2): Digital upskilling and reskilling may strengthen the contribution of employee training to organizational efficiency when acquired competencies are effectively transferred into workplace activities.
- Proposition 3 (P3): The integration of professional experience with technological adaptability and human–AI collaboration may improve organizational knowledge utilization and decision quality.
- Proposition 4 (P4): Digital competencies and AI literacy may strengthen the relationship between professional skills and organizational performance through improved productivity, innovation, and technological problem-solving.
- Proposition 5 (P5): Digital entrepreneurial capabilities and the effective utilization of AI-supported marketing technologies may contribute to business competitiveness through improved opportunity recognition, marketing innovation, and customer engagement.

These propositions provide directions for future empirical research. They should not be interpreted as hypotheses tested or confirmed by the present literature-based study.

4.9. Implications for Theory and Organizational Practice

The theoretical implications of this study concern the changing interpretation of human capital as a productive organizational resource. Conventional Human Capital Theory emphasizes the economic value of education, training, and knowledge accumulation. The present conceptual synthesis extends this discussion by

emphasizing that technological transformation may influence how these investments are utilized and translated into organizational outcomes. The Resource-Based View further suggests that competitive advantage may depend on the combination of employee expertise and organizationally embedded technological capabilities rather than the mere possession of digital tools. Meanwhile, Dynamic Capabilities Theory explains why organizations must continuously renew and reconfigure employee competencies to respond to technological change. The integration of these perspectives provides a foundation for understanding human capital development as an ongoing process of learning, adaptation, and organizational value creation.

From a practical perspective, organizations should align human capital development strategies with technological investments and business objectives. Education and training programs should address both digital competencies and complementary human capabilities, including critical thinking, communication, creativity, and ethical judgment. Organizations should also provide opportunities for employees to apply newly acquired skills, evaluate the outcomes of technological training, and encourage collaboration between experienced workers and employees with advanced digital capabilities. The findings also suggest that organizations should avoid assuming that AI adoption automatically improves employee productivity. Effective implementation requires attention to technological suitability, data quality, employee readiness, human oversight, and organizational learning. In particular, managers should evaluate whether AI-supported systems complement existing human expertise or create additional operational and coordination challenges. For small and medium-sized enterprises, the integration of digital competencies and entrepreneurial capabilities may support market access and innovation. However, limited financial resources, technological infrastructure, and training opportunities may constrain implementation. These conditions highlight the importance of developing human capital strategies that are appropriate to organizational size, resource availability, and technological readiness.

4.10. Research Limitations and Future Research Directions

The conceptual synthesis presented in this study provides an integrated interpretation of human capital development in the digital era. Nevertheless, several limitations should be acknowledged. First, the discussion is based on theoretical and selected scholarly literature rather than primary organizational data. Consequently, the proposed relationships cannot establish causal effects or determine the magnitude of the contribution of digital competencies and AI-related capabilities to organizational performance. Second, the relationships discussed may vary across industries, organizational sizes, technological environments, and labor market conditions. Digital competencies that contribute to productivity in technology-intensive service organizations may differ from those required in manufacturing, agriculture, or small entrepreneurial businesses. Similarly, the organizational implications of AI adoption may depend on the complexity of occupational tasks, employee qualifications, and the extent of technological integration.

Third, the proposed Technology-Enabled Human Capital Development framework requires further conceptual refinement and empirical validation. Future studies could develop operational measures for digital learning capability, AI literacy, technological adaptability, and human–AI collaboration. Quantitative research could examine whether these capabilities mediate or moderate relationships between traditional human capital dimensions and organizational performance. Longitudinal research would also be valuable for understanding how the economic contribution of human capital changes as organizations adopt and integrate new technologies. Future research should additionally consider the potential negative consequences of technological transformation, including skill obsolescence, unequal access to training, employee resistance, algorithmic dependence, and changes in employment opportunities. Examining these issues would provide a more balanced understanding of the relationship between human capital development, technological transformation, and organizational performance.

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This study concludes that human capital development remains a fundamental determinant of organizational performance, although its contribution is increasingly influenced by digital transformation and artificial intelligence (AI). The five established dimensions of human capital development—education, training, work experience, professional skills, and entrepreneurship—continue to provide essential foundations for productivity, innovation, and organizational competitiveness. However, their potential value increasingly depends on the integration of digital competencies, AI literacy, technological adaptability, and human–AI collaboration. Drawing on Human Capital Theory, the Resource-Based View, and Dynamic Capabilities Theory, this

study proposes the concept of Technology-Enabled Human Capital Development (TEHCD) to explain how traditional human capabilities can be renewed and applied in technology-intensive organizational environments. The central conclusion is that technology does not automatically improve organizational performance; its potential benefits depend on how effectively organizations develop, integrate, and utilize human capabilities alongside technological resources. These conclusions represent a conceptual synthesis rather than empirically established causal relationships.

The findings offer theoretical and practical implications for understanding human capital development in the digital era. Theoretically, this study extends conventional human capital perspectives by positioning digital competencies and AI-related capabilities as complementary elements that may influence how employee knowledge and experience contribute to organizational value creation. The proposed TEHCD framework also connects Human Capital Theory with the Resource-Based View and Dynamic Capabilities Theory, providing an integrated explanation of workforce development, technological adaptation, and organizational performance. Practically, organizations should reconsider human resource development strategies by integrating continuous digital learning, AI literacy, upskilling, and reskilling into employee development programs. Managers should also recognize that investing in advanced technologies without strengthening employee capabilities may result in inefficient implementation and limited organizational benefits. Therefore, human capital development and technological investment should be managed as complementary strategic priorities rather than separate organizational activities.

This study has several limitations that should be considered when interpreting its conclusions. First, the research adopts a conceptual integrative literature review approach and does not collect primary data or conduct statistical testing; consequently, the proposed relationships between human capital development, digital competencies, AI capabilities, and organizational performance cannot be interpreted as empirically confirmed causal effects. Second, the conceptual synthesis draws on literature from different organizational and technological contexts, which may limit the applicability of its interpretations across industries, organizational sizes, and economic environments. Third, the proposed TEHCD framework has not been operationalized or empirically validated, leaving uncertainty regarding the relative contributions of its components. Furthermore, the literature selection and synthesis procedures require complete documentation before the review can be considered methodologically finalized. These limitations indicate that the framework should be understood as a theoretical contribution requiring further empirical examination rather than a universally applicable explanation of organizational performance.

Future research should empirically examine the proposed TEHCD framework to determine how traditional human capital dimensions interact with digital competencies, AI literacy, and technological adaptability in influencing organizational performance. Quantitative studies using structural equation modeling could investigate the direct and indirect relationships among these constructs, while longitudinal research could explore how technological change influences the productive value of human capital over time. Comparative studies involving small and medium-sized enterprises, large corporations, and organizations operating in different industries would also help identify contextual differences in technological readiness and workforce development. In addition, future research should consider potential challenges associated with AI adoption, including skill obsolescence, unequal access to digital training, technological dependence, and employee resistance. From a managerial perspective, organizations are encouraged to establish continuous learning programs, evaluate the effectiveness of digital training, and maintain appropriate human oversight in AI-supported activities. Ultimately, the priority should not be technological adoption alone, but the development of human capabilities that enable technology to generate meaningful and sustainable organizational value.

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