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Advanced Technologies and Firm Performance: The Mediating Role of Employee Digital Competency: A Conceptual Framework

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Abstract

Putting the Investments in advanced technologies such as artificial intelligence (AI), big data analytics, cloud computing, the Internet of Things (IoT), and robotics by organizations from several industries have not yet run to stable and foreseeable performance effects. However, current research reveals that there is further to the technology value creation than just technology. There is a human factor in a first. Moreover, to create value by means of advanced technology, employees must acquire the necessary digital competencies. This paper explains a conceptual model where advanced technology is the independent variable, employee digital competency is the mediating variable, and firm performance is the dependent variable. For five (5) classifications of advanced technologies, specifically AI, big data, cloud computing, IoT, and robotics, the link with employee digital competency and the resulting firm performance is discussed. There are three underlying theoretical frameworks are the Resource-Based View, Dynamic Capabilities Theory, and the Technology Organization Environment (TOE) framework. The paper consists of a synthesis of empirical and conceptual studies published between 2023 and 2026. It argues the literature gaps, the research objectives, and questions, and presents a set of testable hypotheses. The findings and implications for management and research are presented as well. Limitations and directions for future research are also discussed.

Keywords: Advanced Technology, Employee Digital Competency, Digital Skills, Digital Transformation, Firm Performance

Introduction

Over the past three years, many firms have increased their implementation of new advanced digital technologies (e.g., AI, big data analytics, cloud computing, robotics, IoT) to remain competitive in a greatly digitized marketplace (Zhao et al., 2024). Findings from current national surveys of how industries use different technologies, to encourage their operations, highlight that numerous of advanced technologies and platforms are now broadly used by businesses of all dimensions from all sectors with some notifying changes to the skills required by employees and how they achieve their tasks (Massini et al., 2025). However, the anticipation that advanced technologies automatically translate into better performance by firms has not been proved empirically. There is growing in number of evidence that human factors, mainly the employees' competency, verify the success or failure of a firm's digital transformation (Mhaske et al., 2025). The huge gap between a business's technological endowments and its capability to generate value from these technologies is a vital issue that needs to be tackled from a conceptual perspective in this paper.

Background of the Study

The implementation of advanced digital technologies, including artificial intelligence (AI), big data analytics, cloud computing, Internet of Things (IoT) sensors, and industrial robotics, has increased meaningfully across different organizations in current years (Islam et al., 2025; Massini et al., 2025; Zhao et al., 2024). However, the adoption of these technologies does not necessarily lead to increased organizational performance. Their efficient use depends considerably on employees' capability to understand, function, and integrate digital technologies into their daily tasks. Current survey-based findings show that employees vary considerably in how they react to new integration of digital technologies. These variances are associated with workers' digital skills, existing competencies, and previous experience with digital technologies, which can impact their ability to use new systems efficiently and their insights of technology implementation (Piotrowski & Revtiuk, 2026; Oostveen et al., 2025). Consequently, the successful implementation of advanced technologies needs more than investing in technological infrastructure; it also expects employees who own the applicable digital competencies to employ these technologies in efficient manner. This highlights the significance of studying employee digital competency as a essential mechanism via which organizational investment in advanced technologies may aid to improved firm performance.
Furthermore, at the firm level, the link between exact technologies such as, big data analytics capability, cloud computing, IoT enabled operations and industrial robotics and firm performance is not only constantly positive but also consistently assign to human factors such as the attendance of analytics talent, employee competency to create meaning of data, information-sharing within labor units and workforce willingness for automation (Korherr & Kanbach, 2023; Pea-Assounga & Bindel Sibassaha, 2024). The strong evidence from employee level and firm level is thus the preliminary point for this paper, as it points to a sole fundamental mechanism: employees' digital competency and how it effects the performance variance that comparable technology investments create between firms.

Problem Statement

Even though there is a growing amount of money being paid on advanced technology, there is still insufficient knowledge of the causes for companies that do not recognize corresponding growths in performance. According to Vărzaru et al., (2024) there are three main concerns need to be focus on. The first matter relates to technology implementation research, where

the performance of firms is frequently considered to be a immediate result of technology adoption. Though, small attention is given to the importance of workforce competencies that need to employ technology in work Procedures' (Ojong, 2025). The second matter concerns human factor difficulties in technology implementation that have been studied, but within a single type of technology, for example digital literacy for the recognition of AI (Piotrowski & Revtiuk, 2026; Schiavo et al. 2024), human factors for big data analytics as studied by (Bi et al., 2025; Korherr & Kanbach, 2023), or employee competencies and related HR practices for IoT as tested by (Díaz-Martínez et al., 2026; Pea-Assounga & Bindel Sibassaha, 2024). The doubt remains if, whether employee digital competencies form a mediating influence that can be used to all technologies or whether they form a group of technology with specific effects. Third, practically, there is a huge gap among the money consumed on technology and the revenues on investment, since numerous digital conversion initiatives are obstructed by employee resistance and skills gaps, which cannot be reduced by insufficient investment in training (Hansen et al. 2025; Seppänen 2025). In this paper, we introduce and justify a unified conceptual model for different types of technologies. In the framework, the relationship between advanced technology and firm performance is mediated by employee digital competency.

Literature Review

Advanced Technology (Independent Variable)

Advanced technology (AT) states for a group of digital technologies for example Artificial Intelligence, Big Data Analytics, Cloud Computing, Internet of Things, 3D Printing, and Robotics that organizations utilize to collect, process, and act on data in a huge volume and at a quicker speed than what is possible with outdated information technologies (Massini et al., 2025). The implementation of AT is impacted by a combination of aspects, including technology, organization, and environment, and its influence on the performance of high-tech firms contingent on various factors within the organization, specifically the digital literacy of its employees (Bilal et al., 2026; Zhao et al., 2024). Many studies have recognized the promises as well as expenditures and barriers to the acquiring of advanced digital technologies by organization, with non-uniform innovation the advantages arising from such adoption (Nafizah, 2023; Siminică et al. 2025). Furthermore, while IT capabilities and digital orientation have been acquired to significantly impact firm performance, this influence is greatest when these are embedded within a wider digital transformation process (Barba-Sánchez et al., 2024; Weritz et al. 2025).

Employee Digital Competency (Mediating Variable)

Employee competency refers to the combination of employees' skills, knowledge, expertise, training, and qualifications that allow them to perform their tasks effectively and efficiently, particularly within involvement of digital technologies within workplace. Employee digital competency can be seen at work as a multi-dimensional organizational affordance that extends beyond the employee technical skill. The employee capability to use, evaluate and adapt digital tools in the work environment is key to innovative work behavior and employability. Research shows that employees who are digitally capable can translate advance technology into innovative outcomes for their organization (Caroline et al., 2025; Meena & Santhanalakshmi, 2025). However, no general measure for digital literacy has been developed and implemented in business research, which restricts the comparison of results

from past studies and even more from different industries (Bouwmans et al., 2024; Caroline et al., 2025).

From literature synthesis on business and workforce studies discovered that there is a need to support both parties' organizations and mainly from top management to target the training to enhance employee digital competencies (Mhaske et al., 2025; Poulose et al.,2025). On the other hand, there is study conducted by (Cao et al.,2026) focusing on investment-orientation have found that investment on digital human capital has a positive effect on firm performance indirectly through mediating role of organizational-technological resources, relatively to the effect of human capital on firm performance.

Firm Performance (Dependent Variable)

According to (Bilal et al., 2026) firm performance is defined as a multidimensional concept consisting of both financial and non-financial components. Earlier research on digital technology has typically studied the effect of such technologies on three ranks of firm performance: financial, operational, and innovative. Using Structural Equation Modeling of a sample of ICT firms, the authors discover that digital capability, digital orientation, and digital transformation all have a positive and significant influence on firm performance. The relationship is partly mediated by digital innovation (Sánchez et al., 2024; Shah et al., 2024). Studies using panel data from Chinese recorded companies also found a positive correlation among digital transformation and company performance (Chen et al., 2023; Zhao et al. 2024). Human capital also played a mediating role between digital transformation and company performance in manufacturing companies (Fan & He, 2025; Shen et al. 2025).

Linking Specific Advanced Technologies to Employee Digital Competency and Firm Performance

The designation of advanced technology involves various tools and technologies. Therefore, it is importance to prove a relationship between each of these technologies and employee digital competency and, in turn, firm performance, rather than examining advanced technology in general. Newly the existing evidence for five different categories of technology is outlined in the following subdivisions.

Artificial Intelligence (AI) and Employee Digital Competency

New large-scale European survey evidence from a sample of employees from Eurobarometer 101.4, conducted in 2026, reveals that employees' self-assessed digital competencies meaningfully increase the likelihood of them having a positive view of AI and of workplace robots. Particularly, a one-element increase in employees reported digital skills is related with greater odds of their positive view of AI (Piotrowski & Revtiuk, 2026). (Ali et al. 2024) stated that, an applicable understanding of AI is critical for its sustained and effective implementation within organizations. Recognizing the possibility benefits of AI requires not only its adoption but also its experienced and constant use by employees, which can contribute to enhancement in organizations operational efficiency in innovative manner. In this context, employees' digital competency represents a vital organizational capability that shapes the boundary to which investments in AI are translated into practical workplace applications and earned tangible organizational value. Without appropriate digital competency, AI technologies may continue underutilized, restricting the organization's capability to recognize the anticipated returns on technological investments.

Big Data Analytics and Employee Digital Competency

Classifications of human factors in big data analytics have recognized that there are specific employee-level in competences of skills such as analytical skills, data interpretation skills and cross-functional data literacy as situations that allow big data analytics capability to translate into better company performance rather than solely depend on technology (Garmaki et al. 2023; Korherr & Kanbach, 2023).There is other research that has been examining big data embedded in marketing sector, adding to this by proving that firms with a strong data-driven culture and suitable analytics talent are capable to achieve better financial and marketing performance from their big data investments than others companies that use the same technology but with shortage of human capabilities (Santana & Díaz-Fernández, 2023).

Cloud Computing and Employee Digital Competency

Perceived and used cloud computing services by users influencing by their competency, have significantly affected the implementation of cloud computing by SMEs and lead to firm performance (Abdalla et al., 2024).This also corresponds with the greater body of research on cloud computing implementation that depends on the TOE-framework and classifies organizational preparedness (including staff skills) as a technological-context aspect and thus control whether the desired efficiency and cost savings are truly created through cloud investment (Hsu et al, 2024).

Internet of Things (IoT) and Employee Digital Competency

Pea-Assounga (2024) stated that, there is a study conducted in the telecom sector found that there are three key components of technological change, employee digital competency and acquiescence with regulatory necessities interchange to enable the efficient use of digital in human resource practices. Especially, employee digital competency is key in elements the scope to which HR technologies provide promised performance enhancements (Bindel Sibassaha, 2024). For IoT systems that constantly create data associated with organization operational processes and need to be monitored and countered to by top level employees. Therefore, performance enhancement generated by these systems is in largely depends on the level on employee digital competency (Jahangir, 2025).

Robotics and Employee Digital Competency

There is firm-level evidence on the use of industrial robots in manufacturing with a significant positive relationship between robots and total productivity (Zhao et al., 2025). According to Zhao et al. (2025), there is evidence cross organization level on using robotics in manufacturing industry, resulting positive relationships between the implementation of robotics and total firm productivity. To generate maximum benefits of adopting robotics within the organization, there is a need for human supervision for robotics, programming bodies and maintenance for better utilization of robotics. The productivity effectiveness from the implementation of industrial robotics therefore requires a workforce that has digital competency to convert robotics investment into added and sustainable manufacturing productivity. This is not simply a capital effect (Soori, et al., 2024).

Table 1
Summary of technology-specific links between advanced technology, employee digital competency, and firm performance

Technology	Link to Employee Digital Competency → Firm Performance
Artificial Intelligence	Digital competency increases favorable AI perception, a precondition for sustained, performance-relevant use (Piotrowski & Revtiuk, 2026).
Big Data Analytics	Employee analytical/data-literacy capability determines whether BDA capability converts into firm performance (Korherr & Kanbach, 2023).
Cloud Computing	Perceived ease of use/usefulness, shaped by user competency, drives adoption and organizational performance gains (Abdalla et al., 2024).
Internet of Things	Employee competency significantly shapes effectiveness of technology-enabled operational/HR outcomes (Pea-Assounga & Bindel Sibassaha, 2024).
Robotics	Robot deployment raises total factor productivity, an effect consistent with competent human supervision/operation (Zhao et al., 2025).

This pattern holds through the five types, and within each type, the same underlying pattern holds: Without employee digital competency, there is no use from implementation technology within organization, that will not be the sufficient reasons to generate better returns on investment and increasing firm performance. This cross-technology pattern is the data basis for treating employees' digital skills as a general mediating factor, as opposed to a side effect of specific technologies.

Literature Gap

The current literature review conducted for this paper recognizes four main gaps in the present literature that are adopted by the proposed model. Moreover, the major gap is the divided of presented studies into technology categories (i.e., AI in Piotrowski & Revtiuk, 2026; big data in Korherr & Kanbach, 2023; cloud computing in Abdalla et al., 2024; IoT-enabled HR in Pea-Assounga & Bindel Sibassaha, (2024), robotics in Zhao et al., (2025), whereas the human-competency mechanism could and should be tested as a mediator for employee digital competency across all of these technology categories in a single, integrated research model. Second, Construct ambiguity, related to absence of evidence related to general measure of employee digital competency with comparison to the technology usage (Caroline et al., 2025). Third, Under-tested mediation logic: according to (Cao et al., 2026; Fan & He, 2025) stated that, much research still relay directly on the effect of technology or mainly on company digital capability and examine employee digital competency as mediator with one or other specific types of technology, not as will be test in this research. Fourth, several technologies in identifiable studies have limitations relating to the context in which the results can be applied. Most of the research reviewed were established on single country or industry samples for example, Bahraini SMEs, Congolese telcos, Pakistani SMEs, Chinese manufacturing firms, labor markets in EU countries).

Research Objectives and Questions

Research Objectives

RO_1: To examine the relationship between advanced technology adoption and employee digital competency.

RO_2: To examine the relationship between employee digital competency and firm performance.

RO_3: To examine the direct relationship between advanced technology adoption and firm performance.

RO_4: To examine the mediating role of employee digital competency in the relationship between advanced technology and firm performance.

RO_5: To conceptually map how specific advanced technologies AI, big data analytics, cloud computing, IoT, and robotics relate individually to employee digital competency and firm performance.

Research Questions

RQ_1: What is the relationship between advanced technology adoption and employee digital competency?

RQ_2: What is the relationship between employee digital competency and firm performance?

RQ_3: What is the direct relationship between advanced technology adoption and firm performance?

RQ_4: Does employee digital competency mediate the relationship between advanced technology and firm performance?

RQ_5: How do different categories of advanced technology (AI, big data, cloud, IoT, robotics) relate to employee digital competency and firm performance?

Significance of the Study

Theoretical Significance

This study contributes a novel idea of digital transformation literature by shifting the primary idea of adopting advanced technology to specifically focusing on determination of employee digital competency as distinguished mediating variable among various technologies. Consequently, it helps to rubric calls in existing systematic literature for more focusing into building and conceptualization business measurement of employee digital competency. Additionally, the research continues to expand the implication of three types of theories such as resource-based view (RBV), dynamic capabilities theory and technology organization environment (TOE) framework by recognizing employee competency that can transform the different advance technologies into gaining business capabilities.

Practical / Managerial Significance

Top management must shift the investment not only for acquiring advance technology but also to enhance employee digital competency by incentive training. Thuse will help the management to create value for the employee while using technology in workplace (Cao et al., 2026). Furthermore, the firm that is spending more on increasing employee digital competence can translate their investment to tangible performance (Guo et al., 2023).

Policy and Societal Significance

On a broader scale, these models' organizations and universities formulate policies amide at bridging the national skills gap and enhancing the proficiency of the national force in digital

competency (Mhaske et al., 2025; Yoganandham, 2025). As the study mentions, realizing and sustaining tangible productivity for the organization and knowledge for the students by pursuing education and training in this field.

Theoretical Foundation

This study is underpinned by three related theoretical lenses. First, the resource-based view (RBV) of the organization recognizes sustained competitive advantages with resources that are valuable, rare and cannot be easily imitated by competitors. Advanced technology has become a commodity that can be easily imitated by competitors. However, employees' firm-specific digital capability to apply technology within a specific organizational context is a rare, socially complex resource that is of utmost significance to a firm's performance (Lu, 2026). Second, the dynamic capabilities theory explains how a company can seize market opportunities by reconfiguring resources and changing business processes (Karami., 2026). Third, the technological, organizational and environmental factors that affect a company can be viewed through the Technology Organization Environment (TOE) framework. This framework has frequently been integrated with the Technology Acceptance Model (TAM) and the Resource-Based View (RBV) in studies on digital-skills management within companies (Mhaske et al., 2025; Yang et al., 2026). We position technology as antecedent conditions, digital competencies of employees as the corresponding capabilities and company performance as the outcomes resulting from both.

Conceptual Framework and Hypotheses Development

This research advances a single mediator model that posits the employee's advanced technology as the independent variable, the employee's digital competency at the mediating variable and the organization's performance at the dependent variable. Figure 1 shows the single-mediator model as proposed by the author of this paper.

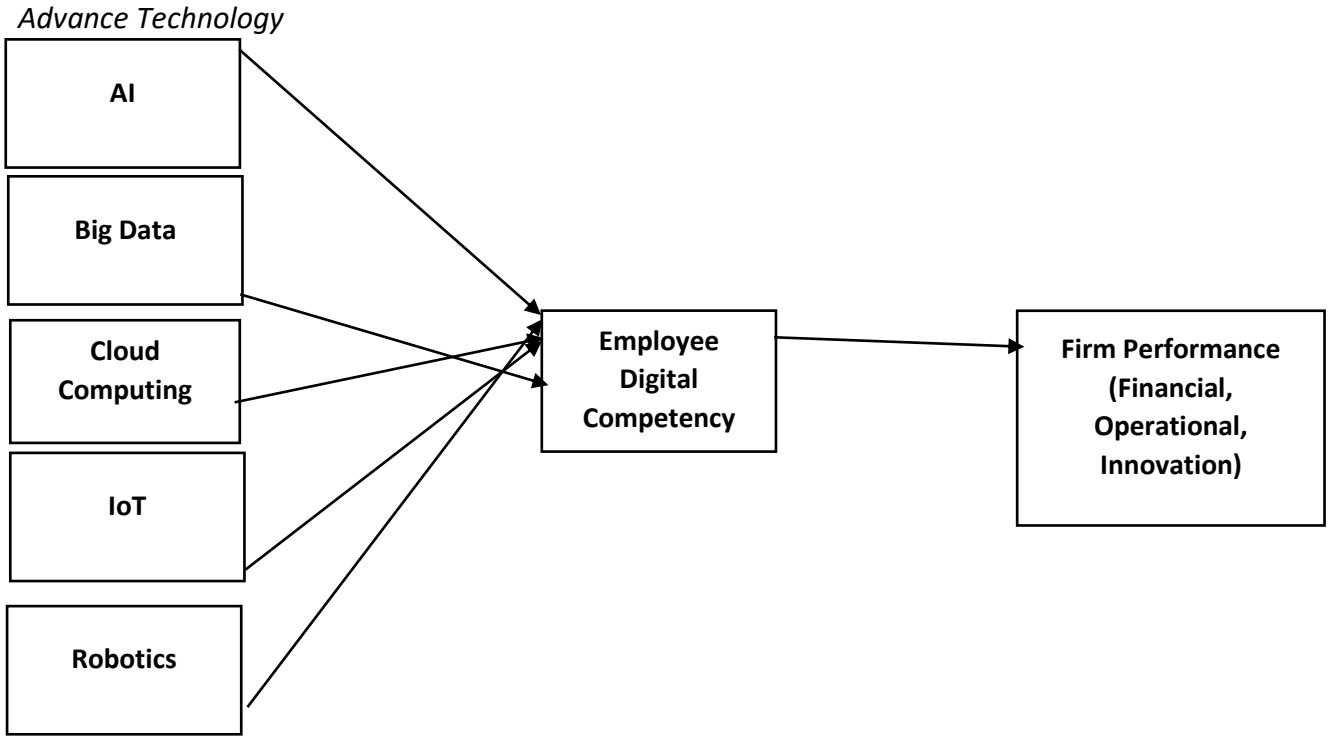


Figure 1. Conceptual framework linking advanced technology, employee digital competency, and firm performance.

Hypotheses Discussion and Hypotheses Development

The Relationship between AI Adoption on Firm Performance

Research has already established that AI adoption influences innovation, increased creativity, more accurate decisions and improved efficiency for firms in the high-tech sector (Ali et al., 2024). Here, as with other advanced digital technologies, the relationship between technology adoption and firm innovation performance (Nafizah, 2023) tends to improve as AI adoption improves firm performance. While the relationship is not necessarily 'automated' (outside of basic processing), it is not entirely of a conditional nature either (Siminică et al., 2025). Within the sphere of EU banks' use of AI for example, the relationship is best described as a 'double-edged sword' in that beneficial and negative effects are experienced by firms according to how AI is implemented and supported. It is this latter point that is explored further below with employee digital competency playing a key mediating function (H7a). But for now, it seems sufficient to conclude that the adoption of AI improves decision making and enhances efficiency in a wide variety of organizational contexts. Thus, the following hypothesis was development.

H_1: Adoption of AI has a positive effect on firm performance

The Relationship between Big Data Adoption and Firm Performance

Big data analytics capability refers to a company's ability to gather, process, and make sense of large amounts of data to generate insight. Studies have frequently found that big data analytics capability is positively related to company performance. The mechanism by which big data analytics generates value, however, is not purely technical in nature. In other words, simply processing large amounts of data is not enough to create value. Rather, the value of big data analytics is frequently created through the organization's learning process. Garmaki et al. (2023) found that the performance contribution of big data analytics capability was substantial through organizational learning. In manufacturing contexts, studies have frequently examined big data analytics in conjunction with digital literacy as two complementary drivers of company performance. Bilal et al. (2026) studied big data analytics in manufacturing firms and examined its relationship with other key drivers of performance. Similarly, Korherr and Kanbach (2023) identified specific human-related capabilities that were critical to the translation of big data initiatives into company performance in various contexts. Ojong (2025) discussed the role of AI and big data in entrepreneurial and sustainability-related strategies to generate value. Overall, evidence supports a direct but organization-specific relationship between big data adoption and performance. Thus, the following hypothesis was development.

H_2: Big data adoption has a positive effect on firm performance

The Relationship between Cloud Computing and Firm Performance

Cloud computing has become a main component of digital infrastructure which companies can use to scale their computing capacity, reduce IT-expenditure and speed up the introduction of new digital services. The adoption of cloud computing positively affects the operational performance of small medium-sized enterprises (SMEs) (Abdalla et al., 2024). Also, the effect of cloud computing on the organizational performance and on the development of IT services of IT-service providers in Taiwan is investigated (Wu et al., 2024).

Furthermore, an analysis of the adoption of advanced digital technologies and platforms by UK companies has identified cloud services as one of the main components of the digital technologies' portfolio (Massini et al., 2025). As such, cloud computing has become a standard part of the IT infrastructure of companies, instead of a special technology that differentiates companies from each other. Thus, the following hypothesis was development.

H_3: Cloud computing adoption has a positive effect on firm performance

The Relationship between Internet of things and Firm Performance

The Internet of Things (IoT) enables inter-device and real-time data capture interaction through organizational processes, standing it as a key facilitating technology within Industry 4.0 ecosystems. Díaz-Martínez et al. (2026) connect IoT adoption to corporate sustainability paths, to illustrate its role in expanding organizational capability beyond solely operational process metrics into wider strategic firm outcomes. At operational level, Jahangir (2025) links IoT implementation immediately with benefits in firm operational efficiency, a immediate driver of firm performance. Nevertheless, this connection is not subjected: Hansen et al. (2025) attention that technology implementation alone is not enough for gaining successful digital transformation among SMEs, recognizing constant resource-based and organizational hindrances that can inhibit the returns of IoT investment on performance. This requirement is consistent with the larger theoretical premise of the recent study that acceptance creates possible value that must be organizationally recognized and supports a positive, though tentatively contingent. Thus, the following hypothesis was development.

H_4*:* IoT adoption has a positive effect on firm performance

The Relationship between Robotics and Firm Performance

The role of industrial robotics has been immediately implicated in boosting productivity obtains at the firm level. Zhao et al. (2025) specify that there is considerable amount of empirical evidence from Chinese manufacturing companies viewing that industrial robotics application enhance total factor productivity, a burly and widely used measure of firm performance. Soori et al. (2024), in an inclusive review of intelligent robotic application within Industry 4.0, likewise indicates robotics as a fundamental driver of automation and extended manufacturing capability for the firm level. Significantly, however, the performance gains of robotics implementation are not essentially mechanical: Islam et al. (2025) dispute that the ongoing shifting toward Industry 5.0 places highs the importance on human–machine association, indicating that robotics produces larger organizational worth when the workforce is skilled of cooperating effectively with automated systems rather than becoming functionally separate by them. This highlighted the wider theoretical logic of the current study, in which technology and human as two competencies are complementary concepts instead of substitutable inputs to performance and could create additional value to the firm. Thus, the following hypothesis was development.

H_5: Robotics adoption has a positive effect on firm performance

The Relationship between Employee Digital Competency and Firm Performance

Employee digital competency (EDC) as a strategic human capital asset influences firm performance in two ways: directly and through technology adoption. This assertion can be explained using the Resource-Based View (RBV) as a theoretical foundation. The RBV posits that a firm's sustained competitive advantage comes from resources and capabilities that are valuable, rare, inimitable and non-substitutable. A workforce equipped with the right digital

skills is rare and cannot be easily imitated by competitors as it has been built up through the firm-specific experience gained through the collective learning process of the firm. Research, such as that conducted by Cao et al. (2026) supports the notion that investments in digital human capital are positively related to firm performance. Furthermore, Fan and He (2025) investigated the role of human capital in the digital transformation process and its subsequent impact on firm performance. Meena and Santhanalakshmi (2025) examined the impact of digital literacy on human capital formation and organizational performance and conclude that EDC is a core performance resource. Building on the RBV framework, we note that technology itself is imitable, but its value is enhanced by the presence of human resources. Previous studies (e.g., Guo et al., 2023) have found that IT investment in a firm can enhance innovation when complemented by IT-related human resources. Other studies (e.g., Zhao et al., 2024a, Karami, 2026) have also shown that digital literacy plays a significant role in moderating the technology adoption process by firms in various industries, not least high-tech ones. In summary, an AI-ready workforce with required digital skills is deemed strategic to sustain competitiveness in the changing business environment. Thus, the following hypothesis was development.

H_6: Employee digital competency has a positive effect on firm performance

The Mediating Role of Employee Digital Competency

This mediation hypothesis is based on the premise that digital technologies generate performance value only when employees can make effective use of them. Therefore, the simple adoption of technology does not necessarily lead to organizational benefits. Hansen et al. (2025) and Oostveen et al. (2025) identified that to generate desired change, technology adoption alone is not sufficient and that employees need to be ready for the corresponding technology. The importance of digital skills to use technology effectively has been also confirmed by research on AI acceptance. Digital literacy and skill level have been found to be significant determinants of employees' willingness to use and ability to use AI-based tools (Piotrowski & Revtiuk, 2026; Schiavo et al., 2024). In the broader sense, the literature on competencies in the AI era (Santana & Díaz-Fernández, 2023) confirms that new technologies require employees to possess additional digital skills. Frameworks on skill demand in digital transformation (Bouwmans et al., 2024) and the persistent digital skill gaps in the global workforce (Mhaske et al., 2025) have increased the competency burden on employees because of new technology adoption. Therefore, EDC acts as the critical link between technology adoption and organizational value creation. Empirical evidence on the mediating role of human capital in the relationship between digital transformation and firm performance has been provided by Fan and He (2025) and by Cao et al. (2026). This structural mediation mechanism is the theoretical and empirical foundation of the expected role of EDC as a mechanism that transforms technology adoption into performance gains for the organization through each specific technology.

H7a: EDC mediates the relationship between AI adoption and firm performance.
H7b: EDC mediates the relationship between big data adoption and firm performance.
H7c: EDC mediates the relationship between cloud computing adoption and firm performance.
H7d: EDC mediates the relationship between IoT adoption and firm performance.
H7e: EDC mediates the relationship between robotics adoption and firm performance.

Discussion

Organizational research on digital technologies often assumes that investing in the latest technology automatically translates into higher performance for organizations. The review of technology-specific evidence in Section 2.4 reveals consistent two-stage logic for all the technologies considered (AI, big data, cloud, IoT, and robotics). In the first stage of the two stages, the range of possible actions that an organization can take is expanded by the introduction of new technology. The newly created operational capacity and the corresponding process affordances can, however, only be successfully realized in the second stage, however, if the employees possess the necessary digital competency (Korherr & Kanbach, 2023). That is, technology is a necessary but not sufficient condition for higher performance. The actual value of technology investments can easily be lost if the corresponding workforce competency is not available. Moreover, the present model can explain a seeming paradox in earlier studies that found a positive relationship between firms' digital capabilities and their performance. Some such studies reported that the relationship was highly positive while others reported only weakly positive or even non-significant relationships. When digital innovation, organizational learning, and human capital are included in a model as mediating variables, the direct effect of a firm's digital capability on its performance ceases to be statistically significant (Fan & He, 2025; Shah et al., 2024). This seeming contradiction between earlier studies on the topic can be resolved by positing that in models that do not include mediating variables their effects get rolled into the direct relationship between technology and performance, that is, into an inflated estimate of the relationship's size. Once the mediating variables are correctly modeled, however, the size of the direct effect in question typically decreases because the model now includes and estimates all the relevant causal pathways. Thus, the earlier seemingly contradictory results do not represent a paradox but rather another manifestation of the present model's basic two-stage-logic.In conclusion, the varying results in digital transformation research relate more to the degree of model completeness rather than a fluctuating relationship. Studies that examine a direct technology effect on performance are likely to overestimate the technology's impact and thus underestimate the impact of required workforce competencies. Conversely, studies that find a weak direct technology effect on performance when including mediators provide stronger evidence of a competency-mediated technology effect on performance rather than no technology effect on performance.

Theoretical and Managerial Implications

Theoretical Implications

This research presents a novel contribution to advance technology adoption research by proposing framework with mediating factors concerning how employee digital competence will lead to increased firm performance while using advanced technologies (Caroline et al., 2025). Although that was the baseline research topic for past couple of years, there is a dearth of adopting 4 types of advanced technologies as independent variables. However, employees' firm-specific digital capability to apply technology within a specific organizational context is a rare, socially complex resource that is of utmost significance to a firm's performance (Lu, 2026). So that supports the Resource-Based View (RBV). The second theory adopted for this paper is Dynamic Capabilities Theory it justifies how a firm can catch up market opportunities by reconfiguring resources and changing business processes thus will be utilized by focusing on enhancing employee digital competence that helps to maximize the advantage of the adoption of technology. In this study we position technology as antecedent conditions, digital

competencies of employees as the corresponding capabilities and company performance as the outcomes resulting from both that help to support Technology Organization Environment (TOE) theory.

Managerial Implications

Management must avoid adopting advanced technologies merely as recent trend in the market. There must be clear plans before technology procurement such as firm performance only gains when the top management commitments to actively involve employees in early stage prior to adoption, support organization culture to avoid any employee resistance. In addition, meagers must implement new technologies within steady phases to mitigate any risk as the technology cause complicity and high financial risks. Specific training is the variables in recent workforce studies that are most strongly related to employees' digital competency (Mhaske et al., 2025).

Limitations and Future Research Directions

This is a conceptual study; therefore, hypotheses have not yet been examined by means of empirical studies. The relationships between variables that have been suggested in this research are based on a synthesis of current studies that were published in the period 2023-2026. Most of the studies that have been synthesized are on specific nature, industry or firm size. Therefore, the generalization of other sectors and sizes of companies is subject to further research.

Future research related to employee digital competency first needs to be operationalized by means of established comprehensive and multi-dimensional scales, which so far are underdeveloped (Caroline et al., 2025). After that, the proposed mediation model can be tested by means of empirical or longitudinal or time-lagged data of companies, It would also be very relevant to test all 5 technologies in one model, thus allowing to directly test the five technology-specific hypotheses as well as their indirect effects via employee Digital Competency in a more comprehensive manner than one aggregated model. This would also reveal whether some of the technologies in question are more dependent on their employees' Digital Competency than others.

Conclusion

This paper presents a conceptual model that links five advanced technologies such as artificial intelligence, big data, cloud computing, the Internet of Things, and robotics, to firm performance as dependent variables, through the mediating role of employee digital competency. In order to develop this model, by drawing on a synthesis of literature published between 2023 and 2026, the researchers examine each technology separately before adding them into a unified framework grounded in the Resource-Based View, Dynamic Capabilities Theory, the Technology Organization Environment (TOE) framework.

The resulting set of hypotheses presented in this paper will form a solid structured agenda for future empirical study and advances a central proposition: advanced technologies can be valuable as a potential organizational resource, but their value to companies can be realize from that resource depends on the employee digital competency who use it. In rabid change of organization structure and increasing to digitalized economies, firm performance is

therefore likely to depend not purely on which technologies a firm implements, but on the range to which its workforce is prepared to use them in effective manner.

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