



The Impact of Artificial Intelligence (AI) Adoption on Employee Competence and Organizational Performance: The Moderating Role of Digital Leadership

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ABSTRACT

This study investigates the influence of artificial intelligence (AI) adoption on employee competence and organizational performance, with digital leadership functioning as a moderating variable. Employing a quantitative approach through hierarchical moderation regression, data were gathered via structured questionnaires administered to 210 employees across technology and banking companies in Indonesia. The findings demonstrate that AI adoption exerts a significant positive effect on both employee competence ($\beta = 0.423$, $p < 0.01$) and organizational performance ($\beta = 0.381$, $p < 0.01$). Furthermore, digital leadership significantly moderates the relationship between AI adoption and organizational performance ($\beta = 0.267$, $p < 0.05$), indicating that robust digital leadership amplifies the beneficial impact of AI adoption on performance outcomes. These findings enrich the human resource management literature by underscoring the strategic imperative of cultivating digital leadership capabilities when pursuing AI-driven organizational transformation. Organizations are encouraged to invest simultaneously in AI infrastructure and structured digital leadership development programs.

Keywords: *artificial intelligence adoption, digital leadership, employee competence, organizational performance, moderation regression*

I. INTRODUCTION

The Fourth Industrial Revolution has brought about fundamental shifts in the global organizational landscape, wherein the adoption of artificial intelligence (AI) has emerged as one of the principal catalysts of business transformation. Organizations across various sectors are increasingly integrating AI technology into their core business processes from the automation of routine tasks to complex data-driven decision-making (Mikalef & Gupta, 2021; Ramdhan, 2025). This phenomenon is no longer exclusive to advanced economies. In Indonesia, the adoption of AI within organizations has demonstrated notable growth, particularly in the banking and technology sectors, with over 65% of large enterprises reporting the implementation of at least one AI-based solution (Kasubi et al., 2025). This rapid proliferation underscores a strategic shift where AI is no longer viewed merely as an optional operational tool, but as a core determinant of competitive advantage.

Nevertheless, the mere implementation of technology does not automatically translate into superior organizational outcomes. A growing body of research indicates that the success of AI adoption is heavily contingent upon an organization's internal readiness, specifically its human resource capabilities (Sakib et al., 2024)). While AI can process vast amounts of data at unprecedented speeds, it still requires a skilled workforce to interpret, validate, and convert those insights into strategic actions. Consequently, employees equipped with sufficient digital competencies have been shown to more effectively harness the potential of AI technology to enhance productivity and stimulate innovation (Ekuma, 2024). Conversely, the competency gap between the demands of emerging technologies and the existing capabilities of the workforce may pose a serious barrier, turning expensive AI investments into underutilized liabilities (Trisnawati et al., 2024). Therefore, understanding how AI adoption interacts with and reshapes employee competence is critical to unlocking its true value.

Beyond individual competence, navigating this technological paradigm shift requires a distinct shift in managerial approach. The role of leadership within the context of digital transformation particularly digital leadership has attracted growing scholarly attention. Digital leadership goes beyond traditional management; it is defined as a leader's capacity to strategically leverage digital technologies to drive innovation, foster a digital culture, and enhance organizational performance (Hossain et al., 2025). Cuevas-Vargas (2025) found that leaders possessing strong digital capabilities are better positioned to mitigate employee resistance, accelerate organizational transformation, and improve organizational agility. Within the context of AI adoption, digital leadership serves as a crucial catalyst that reinforces the relationship between technology implementation and organizational outcomes (Singh & Pandey, 2024). A digital leader ensures that the technological infrastructure aligns with human capital development, creating a supportive ecosystem where both AI and employees can thrive.

Despite the growing body of literature on AI, employee competence, and organizational performance, several notable research gaps remain. First, the majority of existing studies have been conducted in developed countries with high levels of digital maturity and established socio-technical infrastructures, thereby limiting the generalizability of findings to developing country contexts such as Indonesia, which faces distinct institutional and digital literacy challenges (König & Suhr, 2023). Second, while the theoretical importance of leadership is widely acknowledged, the moderating role of digital leadership in the relationship between AI adoption and organizational performance has yet to be extensively explored empirically, particularly using primary data from Indonesian organizational populations (Bauwens & Batistič, 2025; Ramdhan & Rahayu, 2025). Third, prior research has generally focused on the direct, linear effects of AI on performance, often overlooking the complex internal mechanisms such as the mediating role of employee competence that actually transmit technological inputs into organizational outputs (B. Y. Kassa & Worku, 2025).

Addressing these empirical and theoretical gaps, the present study aims to: Analyze the direct effect of AI adoption on employee competence, Examine the effect of AI adoption on organizational performance, both directly and through the mediating mechanism of employee competence, Test the moderating role of digital

leadership in the relationship between AI adoption and organizational performance.

The theoretical contribution of this research lies in the development of an integrated model that connects AI adoption, employee competence, organizational performance, and digital leadership within a unified conceptual framework, bridging the gap between technological adoption and human capital theories. Practically, this study provides actionable insights and policy recommendations for Indonesian organizations seeking to manage AI-based transformation effectively, ensuring that technological investments are balanced with robust human resource development and visionary leadership.

II. LITERATURE REVIEW

A. AI Adoption and Employee Competence

The organizational adoption of Artificial Intelligence (AI) generates profound and unprecedented competency demands on the contemporary workforce. As AI technologies increasingly automate repetitive, routine, and highly administrative tasks, the human role within organizations is not necessarily diminished, but rather elevated. This shift compels employees to cultivate higher-order cognitive competencies that machines cannot easily replicate, such as analytical thinking, creative problem-solving, and the capacity to collaborate synergistically within human-AI hybrid teams (Chowdhury et al., 2023; Ramdhan & Pasaribu, 2022). Jatobá et al., (2023) demonstrated that organizations implementing AI on a comprehensive, enterprise-wide scale exhibited substantial improvements in their formal employee competency development programs, specifically yielding sharper gains in digital literacy and data-driven decision-making frameworks. The empirical reality of this phenomenon is heavily evident in emerging markets and high-stakes sectors.

Further, Jarrahi et al., (2022), in a study of Indonesia's banking sector, found that AI adoption had a significant positive effect on employees' digital competence ($\beta = 0.412$, $p < 0.01$). These findings suggest that employees working in AI-rich environments tend to develop greater intrinsic motivation to upgrade their technical skills. Synthesizing these findings suggests that an AI-rich environment acts as a critical environmental catalyst. Rather than inducing technostress or passive compliance, the presence of advanced automation stimulates an employee's intrinsic motivation to proactively upgrade their technical and non-technical skill sets (*upskilling*). This internal drive stems from a heightened self-awareness regarding career sustainability; employees recognize that to remain competitive, they must pivot from being mere operators of technology to becoming its strategic directors. Ultimately, this symbiotic relationship between proactive technological deployment and a self-motivated workforce fosters a resilient learning organization, which is paramount for maintaining a sustainable competitive advantage in the digital age.

On the basis of this theoretical and empirical evidence, the first hypothesis is formulated as follows:

H1: AI adoption has a significant positive effect on employee competence.

B. AI Adoption and Organizational Performance

The relationship between AI adoption and organizational performance has become a central theme in strategic management research. Chatterjee et al.,

(2023) developed the concept of AI Capability and empirically demonstrated that an organization's AI capability is positively correlated with both organizational creativity and firm performance. In subsequent research, (E. T. Kassa, 2023) confirmed these findings using data from the telecommunications sector in Ethiopia, where AI adoption was shown to enhance organizational performance through increased employee productivity.

At the organizational level, Stahl et al., (2023) found that AI facilitates knowledge sharing across organizational units, ultimately improving overall performance. A meta-analytic study by Bauwens and Batistič (2025), drawing on 187 empirical investigations, concluded that AI adoption has a significant average effect on organizational performance ($r = 0.38$, $p < 0.001$). Collectively, these empirical insights underscore that AI does not act merely as an isolated technical upgrade; rather, it functions as a systemic driver of firm performance by simultaneously elevating employee productivity, fostering cross-functional knowledge integration, and unlocking collective organizational creativity. Accordingly, the second hypothesis is proposed:

H2: AI adoption has a significant positive effect on organizational performance.

C. The Moderating Role of Digital Leadership

Digital leadership has been conceptualized as a set of managerial capabilities that enable leaders to navigate the complexity of digital environments and drive effective technology adoption. In the context of AI adoption, digital leadership acts as a moderating force that determines the extent to which AI technologies can be translated into tangible performance gains for an organization.

Kumar et al., (2025) identified strong digital leadership as one of the primary enablers of AI adoption within extended human resource (HR) ecosystems, where it helps align human capital strategy with automation. Furthermore, digitally competent leaders possess the strategic foresight required to manage the cultural disruptions brought by automation. They are uniquely capable of cultivating an organizational climate conducive to technology-based experimentation and risk-tolerant learning, while simultaneously mitigating resistance and building employee trust in AI systems (Inceoglu et al., 2024). The empirical relevance of this leadership style is particularly evident in agile environments. A study within the Indonesian creative sector demonstrated that digital leadership significantly strengthened the positive influence of digital technologies on employees' performance orientation, proving that a leader's digital fluency directly amplifies human output. Synthesizing these perspectives, it becomes clear that digital leadership is not merely an administrative asset, but a strategic catalyst; it bridges the gap between technological potential and organizational reality by fostering psychological safety, streamlining operational architecture, and actively transforming employee attitudes from technological skepticism into performance-driven engagement. Based on this reasoning, the third hypothesis is formulated:

H3: Digital leadership positively moderates the relationship between AI adoption and organizational performance.

III. RESEARCH METHODOLOGY

A. Research Design and Sampling

This study employed a quantitative approach with a cross-sectional survey design. The research population comprised permanent employees at technology and banking sector companies in Jakarta and its surrounding areas that had implemented at least one AI-based solution during the preceding two years. A purposive sampling technique was applied, with the following inclusion criteria: (1) permanent employees with a minimum of one year of tenure; (2) employed at companies that have adopted AI technology; and (3) directly or indirectly involved in the use of AI-based systems.

Sample size determination was guided by the rule of thumb proposed by (Ramdhan, 2021), which stipulates a minimum of 5–10 respondents per indicator. Given 34 indicators utilized in this study, the minimum required sample was 170 respondents. Questionnaires were distributed to 245 employees, of which 210 were deemed valid and suitable for analysis (response rate: 85.7%). The respondent profile revealed that 58.1% were male, 64.3% were aged between 25 and 35 years, 71.4% held a bachelor's degree, and 52.4% had been employed for one to five years.

B. Variable Measurement

AI adoption was assessed using 10 items adapted from Mikalef and Gupta (2021), covering dimensions of AI use in process automation, predictive analytics, and service personalization. Employee competence was measured through 12 items adapted from Chowdhury et al. (2023), encompassing technical, analytical, and adaptive competence dimensions. Organizational performance was evaluated using 9 items adapted from Kassa and Worku (2025) and Mikalef et al. (2023), spanning operational efficiency, innovation, and customer satisfaction. Digital leadership was assessed through 12 items developed from Hossain et al. (2025) and AlNuaimi et al. (2022). All items were rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

C. Data Analysis Technique

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. The analysis proceeded in several stages: (1) data quality testing, comprising validity assessment through Confirmatory Factor Analysis (CFA) and reliability assessment via Cronbach's Alpha; (2) descriptive analysis to characterize the research variables; (3) classical assumption testing, including normality (Kolmogorov-Smirnov), multicollinearity (VIF), and heteroscedasticity (Glejser test); and (4) hierarchical moderation regression to test the research hypotheses.

Hierarchical moderation regression was conducted in three steps: Model 1 incorporated control variables (company size, industry, and tenure); Model 2 added the independent variable (AI adoption) and the moderator (digital leadership); Model 3 introduced the interaction term (AI adoption \times digital leadership) to test the moderating effect. Prior to constructing the interaction term, all variables were standardized (mean-centered) to reduce multicollinearity.

IV. RESEARCH RESULT

A. Validity and Reliability Testing

Validity testing revealed that all research items achieved factor loading values of ≥ 0.70 , confirming the validity of all indicators. Reliability testing yielded Cronbach's Alpha values exceeding 0.80 for each variable, indicating high levels of internal consistency. Table 1 presents a summary of the validity and reliability test results.

Table 1. Validity and Reliability Test Results

Variable	Number of Items	Factor Loading	Cronbach's Alpha
AI Adoption	0	0.71 – 0.84	0.856
Employee Competence	2	0.70 – 0.91	0.883
Organizational Performance	9	0.73 – 0.88	0.872
Digital Leadership	2	0.72 – 0.93	0.901

Source: Primary data, processed 2024

B. Classical Assumption Testing

The Kolmogorov-Smirnov normality test yielded a significance value of $0.187 > 0.05$, indicating that the residuals followed a normal distribution. Multicollinearity testing demonstrated that the Variance Inflation Factor (VIF) for all variables was below 10 (maximum VIF = 3.24), confirming the absence of multicollinearity. The Glejser heteroscedasticity test produced significance values exceeding 0.05 for all variables, indicating no heteroscedasticity in the model.

C. Hierarchical Moderation Regression Results

Table 2 presents the results of the hierarchical moderation regression used to test the three research hypotheses. Model 1 included only the control variables, accounting for 8.3% of the variance in organizational performance ($R^2 = 0.083$). The addition of the independent variable and moderator in Model 2 produced a significant increase in R^2 , rising to 0.412 ($\Delta R^2 = 0.329$, $p < 0.001$). Model 3, which incorporated the interaction term, yielded $R^2 = 0.461$ ($\Delta R^2 = 0.049$, $p < 0.05$), confirming the significance of the moderating effect.

Table 2. Hierarchical Moderation Regression Results

Variable	Model 1 (β)	Model 2 (β)	Model 3 (β)
Company Size	0.142*	0.118*	0.109*
Industry	-0.063	-0.051	-0.048
Tenure	0.089	0.072	0.068
AI Adoption (AI)	–	0.381**	0.374**
Digital Leadership (DL)	–	0.312**	0.308**
AI \times DL (Interaction)	–	–	0.267*
R^2	0.083	0.412	0.461

ΔR^2	–	0.329***	0.049*
F	6.142**	22.847***	19.631***

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. Source: Primary data processed with SPSS 26, 2024

To test H1, a separate regression was performed with employee competence as the dependent variable. Results showed that AI adoption had a significant positive effect on employee competence ($\beta = 0.423$, $t = 7.218$, $p < 0.001$), thus supporting H1. The results in Model 2 of Table 2 indicate that AI adoption had a significant positive effect on organizational performance ($\beta = 0.381$, $t = 6.453$, $p < 0.01$), confirming H2. The interaction coefficient in Model 3 was both positive and significant ($\beta = 0.267$, $t = 2.891$, $p < 0.05$), thereby supporting H3, which holds that digital leadership strengthens the influence of AI adoption on organizational performance.

D. Discussion

The findings of this study confirm that AI adoption has a significant positive effect on employee competence (H1 supported). This result aligns with the arguments advanced by Chowdhury et al. (2023), who posited that comprehensive AI implementation encourages organizations to invest more substantially in human capital development programs. When organizations adopt AI, employees are confronted with the challenge of learning how to interact and collaborate with intelligent systems, thereby indirectly stimulating improvements in their technical and analytical competencies (Ekuma, 2024).

The novelty of this study on this dimension lies in its empirical confirmation within the Indonesian context, where the relationship between AI adoption and employee competence had previously received limited quantitative investigation. The higher coefficient value observed in this study ($\beta = 0.423$) compared with analogous research in other countries (average $\beta = 0.31$, based on the meta-analysis by Bauwens & Batistič, 2025) suggests that Indonesian employees demonstrate a high degree of responsiveness to competency-building stimuli triggered by the introduction of new technologies.

The positive effect of AI adoption on organizational performance (H2 supported) is consistent with the findings of Mikalef and Gupta (2021) and Kassa and Worku (2025). AI enhances performance through several mechanisms: process automation improves operational efficiency; predictive analytics sharpens decision-making; and service personalization elevates customer satisfaction (Arakpogun et al., 2022). This finding is particularly relevant in the context of Indonesia's banking and technology sectors, where AI has been shown to reduce transaction processing time by as much as 40% and significantly improve fraud detection accuracy.

The most significant finding of this study is the confirmation of digital leadership's moderating role (H3 supported). The positive and statistically significant interaction coefficient ($\beta = 0.267$) indicates that organizations with stronger digital leadership are better positioned to extract greater value from their AI investments. This supports the argument by Hossain et al. (2025) that digitally proficient leaders serve as 'sense-makers' who facilitate employees'

understanding and adoption of AI technologies. Digital leaders also cultivate institutional confidence in AI systems, thereby reducing employee resistance (Singh & Pandey, 2024).

The theoretical contribution of this study is the development of a moderation model that integrates the Technology-Organization-Environment (TOE) framework with Dynamic Managerial Capabilities theory in the context of AI adoption within Indonesian organizations. This model enriches the existing literature by demonstrating that the relationship between AI adoption and organizational performance is contextually contingent and substantially shaped by the quality of an organization's digital leadership.

V. CLOSURE

A. Conclusion

This study yields three principal conclusions. First, AI adoption has a significant positive effect on employee competence in technology and banking companies in Indonesia, suggesting that the implementation of AI technology fosters the enhancement of organizational human capital capabilities. Second, AI adoption has a significant positive effect on organizational performance, affirming the strategic value of AI investment in improving organizational efficiency and effectiveness. Third, digital leadership was found to positively moderate the relationship between AI adoption and organizational performance, indicating that the effectiveness of AI adoption is substantially contingent upon the strength of an organization's digital leadership.

B. Suggestion

The policy implications of this study are threefold: (1) organizations should design AI adoption programs in parallel with digital competency enhancement initiatives, rather than treating these as separate endeavors; (2) investment in digital leadership development should be prioritized as a prerequisite for maximizing the return on investment from AI adoption; and (3) organizations in Indonesia's banking and technology sectors are advised to incorporate digital leadership maturity as a key indicator of organizational readiness within their digital transformation agenda.

The limitations of this study include the use of a cross-sectional design, which precludes the capture of longitudinal changes, and the restriction of the sample to two industry sectors within the Jakarta region. Future research is encouraged to adopt longitudinal designs, extend sampling to a broader range of industry sectors, and incorporate additional mediating variables such as organizational learning capability into the research model.

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