



Advancing Business Performance Through Artificial Intelligence: The Interplay of Digital Competence, Innovation, and Operational Efficiency

Agustian Agustian* and Indrianty Sudirman

Hasanuddin University, Makassar, Indonesia
*agustian24a@student.unhas.ac.id

Abstract. This study investigates the relationship between Digital Competence (DC), Innovation (I), Operational Efficiency (OE), and Organizational Performance (OP) within the context of Artificial Intelligence (AI) adoption. As AI continues to transform industries, understanding how digital competence, innovation, and operational efficiency interact to enhance organizational performance becomes crucial for businesses striving to gain a competitive edge. A quantitative approach was adopted, utilizing surveys distributed to managers in manufacturing companies in Makassar and Gowa, Indonesia. The findings reveal that digital competence has a strong positive impact on organizational performance ($p = 0.001$), indicating its central role in driving performance improvements. Innovation also positively influences organizational performance ($p = 0.000$), although to a lesser extent than digital competence. Operational efficiency further contributes significantly to organizational performance ($p = 0.001$), demonstrating that improved processes and resource management lead to better business outcomes. The study underscores the importance of integrating AI within an organization's digital transformation strategy, highlighting the need for continuous development of digital skills, fostering innovation, and optimizing operational processes. These insights provide valuable guidance for organizations aiming to enhance their performance through AI adoption and digital transformation.

Keywords: Artificial Intelligence, Digital Competence, Innovation, Operational Efficiency, Organizational Performance.

1 Introduction

In this rapidly evolving digital era, Artificial Intelligence (AI) has become a key driving force for the transformation of businesses across various industries [1, 2]. AI not only offers the potential to enhance operational efficiency but also opens new opportunities for product, service, and business model innovation. The use of AI allows companies to manage and analyze large volumes of data, make more accurate predictions, and automate processes that require human involvement [2, 3, 4]. Despite the immense potential of AI, its implementation often involves complex challenges. Many businesses still struggle to optimize the effective use of AI within their operations, especially in terms of developing digital competence, creating relevant innovation, and improving

operational efficiency. Therefore, understanding how these three elements interact with AI to maximize business performance and create sustainable competitive advantages is crucial.

Although much research has been conducted on Artificial Intelligence (AI) and its applications in business, several significant gaps remain, particularly in understanding how AI, digital competence, innovation, and operational efficiency interact to enhance overall business performance [4, 5, 6]. Many studies have explored AI's individual impact of AI on business outcomes, but few have provided a comprehensive understanding of how these elements work together in practice. For example, while AI adoption can improve operational efficiency, many businesses struggle to integrate AI into their broader strategic objectives because of a lack of digital competence. This highlights the need for a deeper understanding of how organizations can enhance their digital skills and competencies to better implement AI systems and technologies in alignment with their strategic goals [6, 7, 8].

Furthermore, while some studies address AI's role of AI in innovation, particularly in the creation of new products and services, there is a lack of research on how AI-driven innovation translates into tangible business performance improvements. Most studies on innovation focus on the technological aspects of AI or its contribution to product development but overlook how these innovations impact broader organizational processes [6, 9, 10]. Additionally, the role of AI in driving incremental versus transformational innovation in business models remains largely unexplored. This gap is particularly important, as businesses need to understand not only how AI can generate innovative ideas, but also how these innovations can be integrated into existing business strategies to drive sustainable growth.

Another significant gap in existing research is the understanding of how AI integration directly affects operational efficiency across various industries and organizational contexts. Although AI's role of AI in automating repetitive tasks and streamlining processes is well documented, a more comprehensive understanding of how AI affects overall business operations is lacking [7, 12]. Most studies tend to focus on specific applications, such as logistics or customer service automation, without considering broader impacts, such as decision-making, resource management, and internal collaboration [8, 14]. This limited focus on specific areas restricts the scope of operational efficiency research and leaves businesses uncertain how to achieve comprehensive performance improvements through AI.

Additionally, the strategic alignment between AI initiatives and organizational goals remains an underexplored area. Many companies adopt AI tools without a clear strategy for how these tools fit within their broader business objectives. This misalignment often leads to fragmented AI initiatives that fail to deliver long-term value. Furthermore, while there is research on AI adoption in large corporations, little has been done to explore how small and medium-sized enterprises (SMEs) can successfully integrate AI to improve their performance [11, 17]. Specific barriers faced by SMEs, such as limited resources, lack of skilled personnel, and resistance to change, have been largely overlooked. Addressing this gap is essential, as SMEs face unique challenges and opportunities to leverage AI for growth.

Finally, the human factors in AI adoption, including employee engagement, leadership, and organizational culture, have been largely neglected in much of the existing research. While technological and operational aspects of AI adoption have received significant attention, there is insufficient exploration of how people within organizations play a crucial role in the successful deployment of AI [12, 19]. Employee resistance and a lack of managerial support are major barriers to AI adoption; however, these issues remain under-researched. The need for change management frameworks that consider organizational culture and employee engagement in the context of AI integration is a critical gap in the literature [12, 21].

The rapid pace of technological change and increasing availability of AI solutions have led to widespread excitement and anticipation across industries. However, the successful adoption of AI requires more than just the acquisition of cutting-edge technologies. This involves reshaping organizational structures, business models, and even mindsets. As AI continues to evolve, its ability to impact business performance is largely determined by how effectively organizations integrate it into their existing frameworks. This integration is not limited to technology alone but also encompasses strategic decision-making, employee engagement, and organizational culture. Despite the promising potential of AI, many businesses remain in the early stages of integration, struggling to align their technological advancements with broader organizational goals. However, the gap between AI's theoretical benefits of AI and its real-world impact on performance remains a critical challenge. Understanding how AI can enhance business performance requires examining not only the technological infrastructure, but also the organizational processes and human factors that enable or hinder its success. This study offers a comprehensive perspective on how organizations can bridge this gap, ensuring that AI adoption becomes a driver of sustainable business performance and innovation.

This study fills these gaps by offering a comprehensive examination of how digital competence, innovation, and operational efficiency interact in the context of AI adoption. It explores not only the individual impacts of these factors, but also how they collectively influence business performance. By addressing the interplay of these factors, this research provides valuable insights into the organizational, strategic, and operational aspects of AI integration, offering a more holistic framework for understanding AI's role of AI in advancing business performance.

2 Literature Review

2.1 The Resource-Based View (RBV) Theory

The Resource-Based View (RBV) is a strategic management theory that suggests that a firm's competitive advantage is primarily derived from its internal resources and capabilities rather than from its position in the market or its external environment. Introduced by Barney (1991), this theory emphasizes that certain organizational resources, if valuable, rare, inimitable, and non-substitutable (VRIN), can provide sustainable competitive advantages. In the context of Artificial Intelligence (AI) adoption, the RBV suggests that businesses that possess unique resources, such as advanced technological

infrastructure, skilled human capital, or proprietary data, are better positioned to integrate AI effectively and outperform competitors.

Digital competence is a key resource for organizations seeking to leverage AI. The RBV posits that companies with strong digital capabilities, such as the ability to manage and utilize AI technologies, maintain robust data systems, and foster a digital culture, are more likely to succeed in AI adoption [12, 22]. These internal resources, such as technical expertise and experience with digital transformation, allow organizations to navigate the complexities of AI integration and use it to drive innovation and improve operational efficiency. Companies that possess necessary resources, such as skilled personnel or a culture that supports continuous learning, have a better chance of unlocking the full potential of AI, leading to enhanced business performance.

Moreover, this theory underscores that the inimitability of resources plays a crucial role in maintaining a competitive edge. For AI adoption, proprietary technologies, customized AI models, and unique datasets can become resources that are difficult for competitors to replicate. This uniqueness can drive innovation in product development, the customer experience, and operational processes [13, 23]. Additionally, organizational culture and leadership that foster innovation can serve as critical resources that enable businesses to leverage AI in ways that align with long-term strategic goals. Organizations that successfully build these intangible assets are more likely to sustain competitive advantages through AI-driven innovations.

The RBV framework also highlights the importance of aligning resources with business strategy. For businesses to fully exploit the potential of AI, their internal resources technological, human, or organizational, must be strategically aligned with their broader business objectives. This alignment is essential for ensuring that AI adoption not only enhances operational performance but also drives innovation and contributes to overall business success. The RBV perspective, therefore, emphasizes that AI adoption is not just about acquiring technology, but also about ensuring that the organization's resources and capabilities are configured in a way that maximizes the value of AI integration.

2.2 Organizational Performance

Organizational performance is used to assess the extent to which an organization can achieve its objectives effectively and efficiently using its available resources [14, 15, 24]. This performance is typically measured using various indicators, including financial results, customer satisfaction, company growth, and competitive position in the market. In this study, organizational performance refers to an organization's ability to achieve long-term goals and maintain competitiveness in the market, either through increased profitability or operational efficiency.

Generally, organizational performance is measured using two main categories: financial and non-financial performance. Financial performance usually includes indicators such as revenue, net profit, profit margins, and return on investment (ROI). These indicators provide a direct view of the organization's ability to generate profits and create value for stakeholders. Meanwhile, non-financial performance relates to aspects that are not immediately reflected in financial statements, such as customer satisfaction,

product quality, and the innovations an organization introduces to stay relevant to the market.

Sustained organizational performance improvement relies on an organization's ability to adapt to market changes, technological advancements, and customer demand. Therefore, organizations with flexible and innovative business strategies are more likely to improve their performance even in highly dynamic environments. In other words, organizational performance is not only the result of efficient operational management but also of the organization's ability to innovate and adapt to market trends and new technologies [16, 26, 27]. In the long run, good organizational performance encompasses the ability of an organization to continue growing, expanding, and overcoming challenges. Organizations that achieve optimal performance not only improve their profitability and efficiency but also strengthen their position in the global market and enhance their competitiveness against industry rivals.

2.3 Digital Competence

Digital competence refers to an organization's ability to effectively utilize digital technologies and manage digital transformation processes to achieve strategic goals [17, 28]. It encompasses a wide range of skills, including the capacity to integrate new technologies, such as Artificial Intelligence (AI), managing digital tools, ensuring cybersecurity, and leveraging data for decision-making. In the context of AI adoption, digital competence is a critical factor that determines how successfully an organization can implement AI solutions to enhance its business processes, innovation, and efficiency.

At the organizational level, digital competence involves several key elements: the technological infrastructure to support digital initiatives, availability of skilled personnel who can operate and optimize digital tools, and leadership that drives digital transformation [17, 29]. An organization with strong digital competence is more likely to adopt AI effectively, integrate it into its existing systems, and use it to gain competitive advantage. Furthermore, digital competence is not limited to the IT department, but should be embedded throughout the organization, with all employees understanding and leveraging digital tools to improve productivity and innovation.

In the context of AI, digital competence also includes the ability to analyze and interpret data, which is a fundamental requirement for AI systems to function effectively [18, 30]. This involves not only having access to the right technologies, but also developing a culture that encourages continuous learning and adaptation of digital skills. Organizations that foster digital competence are better positioned to leverage AI to drive innovation and streamline operations and ultimately enhance their organizational performance. Therefore, digital competence plays a central role in the successful integration of AI into business practices. Without the right technological capabilities, skilled workforce, and digital culture, organizations may struggle to fully realize the potential of AI and, as a result, fail to improve their performance and achieve sustainable growth.

2.4 Innovation

Innovation in the business context refers to the process of developing and implementing new ideas, products, services, or processes that add value to the organization and its customers [18, 31]. Innovation involves not only creating new products, but also continuously improving how a company operates, designs business models, and interacts with customers. In this study, innovation as variable X2 plays a crucial role in enhancing organizational performance, especially when integrated with advanced technologies such as Artificial Intelligence (AI).

Innovation can be categorized into two main types: product and process. Product innovation involves development of new products or services that meet evolving market needs or that create new markets [19, 32, 33]. On the other hand, process innovation is related to improving how an organization conducts its operations, whether through automation, operational efficiency, or applying new technologies to improve existing processes. The adoption of AI can drive both types of innovation, enabling companies to create more advanced products and enhance their operational methods to achieve greater efficiency.

For companies, innovation driven by technology, such as AI, can also be key to creating a sustainable competitive advantage. Organizations that can innovate quickly and effectively can introduce products or services that are more relevant to customer needs and more efficient in their operations. AI, for example, provides the ability to analyze large datasets and generate insights that can be used to design better and new solutions. Organizations that leverage the potential of this innovation can strengthen their market position and create greater value for customers and stakeholders [20, 34, 35].

Innovation is also closely related to an organization's ability to adapt to change. In a dynamic business world, companies that can continuously innovate are likely to survive longer and remain relevant. Innovation is not only about developing new products but also about responding quickly to market, technological, and customer changes [22, 36]. Therefore, innovation, as variable X2, is a critical factor in improving organizational performance through better products and services and more efficient and effective business processes.

2.5 Operational Efficiency

Operational efficiency refers to an organization's ability to optimally use its resources to produce maximum output with minimal costs. This involves managing and optimizing various business processes, including production, distribution, and resource management, to ensure that operations run smoothly and effectively [22, 37]. In the context of adopting technologies such as Artificial Intelligence (AI), operational efficiency becomes crucial for increasing productivity and reducing waste, enabling the company to achieve its business objectives more effectively.

Operational efficiency can be measured using various indicators, including the time taken to complete tasks, production costs, and resource utilization. With the adoption of AI technology, companies can automate repetitive tasks, reduce human errors, and leverage data analytics for faster and more accurate decision making. AI technologies

enable organizations to process large amounts of information more efficiently than traditional methods, which directly contributes to improving the operational efficiency.

Implementing AI in operations can also help companies optimize their processes.

For example, in supply chain management, AI can be used to predict demand and automatically manage inventory, thereby reducing the chances of overstocking or stock-outs, which can lead to losses [23, 38]. Furthermore, AI can streamline internal workflows by identifying areas that require improvement and providing recommendations based on data analysis, ultimately improving efficiency and reducing operational costs.

Operational efficiency encompasses time and human resource management. AI can speed up processes that usually take a long time, such as data processing or market analysis, allowing employees to focus on more valuable and strategic tasks. Therefore, better operational efficiency not only results in cost savings but also improves product and service quality while supporting faster innovation within the organization.

2.6 Hypothesis Development

Digital Competence on Organizational Performance. Digital competence plays a crucial role in determining an organization's success in adopting and leveraging advanced technologies such as Artificial Intelligence (AI) [23, 39]. Organizations with strong digital competence are more likely to effectively utilize technology to enhance operational efficiency, accelerate innovation, and improve market competitiveness. The ability to manage and integrate digital technologies enables organizations to enhance the quality and speed of their operations, which, in turn, contributes to overall organizational performance.

The improvement of digital competence within an organization is directly related to its performance in resource management, process improvement, and the creation of innovative products or services. Organizations with high levels of digital competence can respond more quickly to technological and market changes and can use AI to optimize various operational functions, such as data analysis and technology-driven decision-making.

Based on this relationship, it can be hypothesized that an increase in digital competence has a positive impact on organizational performance. Therefore, the proposed hypothesis is as follows:

H1: Digital competence positively influences organizational performance.

Innovation on Organizational Performance. Innovation is widely recognized as a key driver of organizational success and improved performance. By fostering the development of new products, services, or processes, organizations can differentiate themselves in competitive markets, meet changing customer demands, and enhance their overall operational effectiveness [24, 40]. Innovation can occur in various forms, including product, process, and business model innovation, each contributing to the organization's ability to adapt, grow, and improve its performance.

Product innovation allows companies to offer new or improved products that capture a larger market share, attract new customers, and increase their revenue. In contrast,

processer innovation focuses on improving the efficiency of internal operations, reducing costs, and increasing productivity. Both types of innovation are essential for enhancing operational performance, that is, the ability to execute business processes efficiently and deliver quality products or services to customers.

In addition to improving operational efficiency, innovation contributes to long-term sustainability. Organizations that continuously innovate are better positioned to respond to industry shifts, technological advancements, and evolving customer needs. This adaptability ensures the organization's ongoing success, as it can remain relevant and competitive. Therefore, innovation not only enhances day-to-day performance but also builds a foundation for sustained growth and competitive advantage [25, 41]. Based on these insights, it can be hypothesized that organizations that invest in innovation will experience improvements in their overall organizational performance. By focusing on innovation, companies can enhance efficiency, reduce costs, improve customer satisfaction, and increase profitability.

H2: Innovation positively influences organizational performance.

Operational Efficiency on Organizational Performance. Operational efficiency is a fundamental component of organizational performance as it directly influences how well an organization can utilize its resources to achieve its objectives. By optimizing business processes, reducing waste, and improving productivity, organizations can lower costs and increase output without sacrificing quality. Operational efficiency is achieved through continuous improvements in the systems, workflows, and resource management. It allows organizations to deliver products and services more effectively, enhance customer satisfaction, and ultimately improve profitability.

An organization that maintains high operational efficiency can streamline its processes, minimize delays, and allocate resources more effectively, leading to better financial outcomes. For instance, organizations that automate routine tasks, use technology to optimize supply chains, and improve decision-making processes tend to experience higher levels of productivity and cost savings. These improvements in operational efficiency often result in a significant competitive advantage as they enable organizations to offer superior value to customers while maintaining low operational costs.

Operational efficiency is closely tied to an organization's ability to innovate and adapt. Efficient operations provide the flexibility and resources necessary to invest in new technologies, R&D, and market expansion. Operationally efficient organizations can reinvest savings from streamlined processes into growth initiatives, such as product innovation or market penetration [25, 42, 43]. The ability to reinvest in strategic areas is essential for long-term sustainability and growth, which enhances overall organizational performance.

Based on these considerations, it can be hypothesized that improvements in operational efficiency lead to higher organizational performance. By enhancing their operational processes, organizations can achieve greater profitability, improve customer satisfaction, and strengthen their competitive positions in the market.

H3: Operational efficiency positively influences organizational performance.

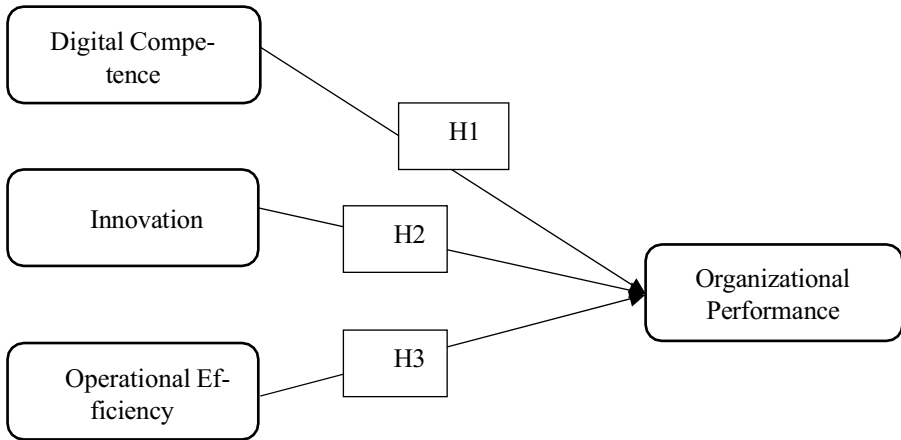


Fig. 1. Research Framework

3 Methodology

This study adopts a quantitative approach with a survey design to examine the relationship between digital competence, innovation, and operational efficiency and organizational performance within the context of Artificial Intelligence (AI) adoption. Data will be collected by distributing questionnaires via Google Forms to manufacturing companies in Makassar and Gowa that have implemented AI in their operations. Respondents included senior managers and decision-makers from manufacturing firms located in Makassar and Gowa that have adopted AI technologies in their business processes. To analyze the data, this research utilizes Smart Partial Least Squares (PLS), which allows for the testing of structural models and the measurement of complex relationships between variables. Smart PLS was selected because of its ability to handle complex data structures and flexibly test the relationships between multiple indicators. The analysis employed structural equation modeling to test the hypotheses related to the impact of AI adoption on organizational performance.

4 Results

4.1 Data

The data collected in this study comprised 211 questionnaires gathered from respondents working in manufacturing companies in Makassar & Gowa, Indonesia. The questionnaire was designed to measure variables related to digital competence, innovation, and operational efficiency in relation to the adoption of Artificial Intelligence (AI) in business operations. The respondents were managers and decision makers with knowledge of AI implementation in their organizations. A 5-point Likert scale was used

to measure respondents' perceptions of AI's impact of AI on business performance and the internal factors supporting it. Data collection was facilitated using Google Forms, which enabled quick access and responses. The collected data were subsequently analyzed using Smart PLS to test the relationships between the variables. These data provide comprehensive insights into how digital competence, innovation, and operational efficiency interact to enhance organizational performance through AI adoption.

4.2 Instrument Testing Results

Outer Model Analysis.

Table 1. Outer Loading

	DC	I	OE	OG
DC_1	0.746			
DC_2	0.767			
DC_3	0.812			
DC_4	0.855			
DC_5	0.867			
I_1		0.823		
I_2		0.854		
I_3		0.753		
I_4		0.785		
I_5		0.773		
OE_1			0.824	
OE_2			0.757	
OE_3			0.764	
OE_4			0.832	
OE_5			0.823	
OG_1				0.735
OG_2				0.835
OG_3				0.773
OG_4				0.733
OG_5				0.767

Source: SmartPLS 4 output, authors' calculations (2025).

The table presents the outer loadings of indicators for four constructs. Each indicator demonstrated a strong relationship with its respective construct, with values exceeding the accepted threshold of 0.70, indicating good validity. For the Digital Competence (DC) construct, the indicators contribute the most to the construct. Similarly, the Innovation (I) construct shows a significant influence from its indicators. In the Operational Efficiency (OE) construct, the indicators demonstrate strong validity, reflecting the importance of Digital Competence. Finally, for Ogranizational Performance (OP), the indicators stand out, with one contributing the most, showing that these factors effectively measure Employee Performance. These data suggest that all constructs and their indicators are reliable for further analysis.

Construct Reability and Validity.

Table 2. Construct Reability and Validity

	Cronbach's al- pha	Composite re- liability (rho_a)	Composite re- liability (rho_c)	Average vari- ance extracted (AVE)
DC	0.855	0.854	0.867	0.665
I	0.873	0.876	0.823	0.656
OE	0.874	0.823	0.955	0.623
OP	0.847	0.865	0.865	0.676

Source: SmartPLS 4 output, authors’ calculations (2025).

This table presents the reliability and validity statistics for four constructs: Work Environment (WE), Leadership Style (LS), Digital Competence (CD), and Employee Performance (EP). Cronbach's alpha values for each construct exceeded the recommended threshold of 0.70, indicating good internal consistency for all constructs. Composite reliability (rho_a) and composite reliability (rho_c) also showed high values for all constructs, each exceeding 0.80, confirming that the indicators are well correlated with each other. The Average Variance Extracted (AVE), used to assess convergent validity, shows values above 0.50 for all constructs, with Work Environment (WE) and Employee Performance (EP) having higher AVE values, meaning the indicators explain a sufficient amount of variance within each construct. Overall, these statistics indicate that the constructs and their indicators are reliable and valid for further analyses.

4.3 Hypotheses Test

Direct Test.

Table 3. T-statistics and P-values of Hypotheses

Original sam- ple (O)	Sample mean (M)	Standard devia- tion (STDEV)	T statistics (O/STDEV)	P values
DC -> OP	0.521	0.050	10.420	0.001
I -> OP	0.282	0.038	7.421	0.000
OE -> OP	0.462	0.045	10.267	0.000

Source: SmartPLS 4 output, authors’ calculations (2025).

The findings from the analysis provide robust support for all three hypotheses, demonstrating clear and statistically significant positive relationships between the independent variables— Digital Competence (DC), Innovation (I), Operational Efficiency (OE)—and the dependent variable, Organizational Performance (OP). The results underscore the complex interplay between these organizational factors and how they collectively influence overall performance outcomes.

For Digital Competence (DC), the data reveal a substantial and highly significant positive impact on Organizational Performance (OP), with an Original Sample (O) value of 0.521 and a T Statistics value of 10.420. This indicates that digital competence is a crucial factor in shaping organizational performance. Organizations with high digital competence are better positioned to leverage advanced technologies, improving processes and decision-making, which enhances overall performance.

In the case of Innovation (I), the relationship with Organizational Performance (OP) is positive, but the effect is comparatively weaker, with an Original Sample (O) value of 0.282 and a T-statistic value of 7.421. While innovation plays an important role in organizational performance, its direct impact may be less pronounced than that of other factors, such as digital competence. Innovation can drive improvements in products, services, and processes, but its ability to translate into stronger organizational performance may require a more significant digital infrastructure and operational efficiency.

The Operational Efficiency (OE) variable demonstrates a particularly strong positive relationship with Organizational Performance (OP), with an Original Sample (O) value of 0.462 and a T-statistic value of 10.267. This result highlights the critical role of operational efficiency in enhancing organizational performance. Efficient operations reduce costs, improve productivity, and streamline processes, all of which lead to better performance outcomes. Organizations that can optimize their operations tend to perform better in terms of financial results, customer satisfaction, and overall competitiveness.

5 Conclusion

This study advances understanding of how digital competence, innovation, and operational efficiency jointly shape organizational performance under conditions of AI adoption in manufacturing firms from Makassar and Gowa. The empirical results based on 211 respondents show that digital competence exerts the largest direct effect on performance ($\beta=0.521$, $p\leq 0.001$), operational efficiency also has a strong positive relationship ($\beta=0.462$, $p\leq 0.001$), and innovation contributes positively but more modestly ($\beta=0.282$, $p\leq 0.001$). These coefficients are consistent with the view that performance improvements materialize first where firms have the foundational ability to deploy, integrate, and govern digital technologies and where processes are sufficiently disciplined to convert analytics into routine operational decisions.

The prominence of digital competence suggests that AI's performance payoffs depend on an organization's readiness to build robust data architectures, analytics pipelines, cybersecurity, and governance routines that make data and models usable at scale. Prior work on digital transformation and performance systems underscores how such idiosyncratic, hard-to-imitate digital capabilities enable faster learning, better resource orchestration, and superior decision quality, thereby strengthening firm outcomes [12, 16, 29]. In emerging-economy manufacturing contexts, digital readiness also complements agility by lowering the cost of experimentation and increasing the reliability with

which AI pilots can be translated into production use, echoing evidence that transformation capabilities and absorptive capacity channel technology into measurable results [16, 32].

Operational efficiency appears to be the primary conversion mechanism through which AI's informational value becomes economic value. By improving forecasting, scheduling, anomaly detection, and maintenance planning, AI augments lean and TPM practices, reducing variability, cycle times, and defects—classic drivers of cost, quality, and delivery performance [7, 21, 22]. Practical guidance on embedding analytics in customer and process workflows similarly highlights that value is realized when digital insights are integrated into standardized operating procedures and frontline decision aids, rather than isolated in dashboards [23]. The strength of the OE→OP path in our data is thus consistent with research that positions supply-chain and operations digitization as a direct route to performance improvement in industrial settings [21, 22].

The relatively smaller direct effect of innovation should not be read as marginality; rather, it is consistent with innovation paying off indirectly and often with a time lag. Studies on emerging technologies and business-model change show that product and service innovations tend to influence performance via process reliability, market responsiveness, and complementary organizational investments, especially in resource-constrained firms [24]. In such settings, new offerings or business-model experiments are more likely to translate into measurable performance when supported by reliable processes and data maturity, which our results signal through the stronger roles of digital competence and operational efficiency [26]. A plausible capability cascade—digital competence enabling better data access and literacy, which stabilizes processes and de-risks experimentation—fits both the empirical pattern and the broader transformation literature [16, 29].

Taken together, the findings refine a capability-based perspective on AI by showing that digital competence functions as a primary, distinctive resource while operational efficiency acts as a complementary asset that allows firms to appropriate the benefits of AI at scale. Prior evidence on knowledge sharing and digitally enabled routines points in the same direction: organizations realize greater gains when data and learning mechanisms are institutionalized across units, not confined to IT or analytics teams [29]. This also helps explain why innovation's direct effect is smaller in our cross-sectional snapshot: where data governance, process discipline, and workforce skills are uneven, the returns from novel products or business models are dampened until operational and digital scaffolds are strengthened [24, 31].

The regional manufacturing context of Makassar and Gowa makes these complementarities particularly salient. Supply-chain volatility, heterogeneous skills, and capital constraints heighten the premium on low-capex, high-throughput digital upgrades—such as AI-assisted quality inspection, demand forecasting, and adaptive scheduling—that immediately improve process stability while building the foundations for subsequent innovation. Research on implementing AI in business models and on digital transformation's link to organizational agility supports a staged approach in which firms stabilize data, standardize processes, and then scale AI use cases progressively [31, 32]. Evidence from supply-chain and operations studies likewise indicates

that modular AI deployments embedded in day-to-day workflows tend to yield earlier, more durable performance gains in manufacturing SMEs [21, 22].

Methodologically, the measurement properties reported—outer loadings above 0.70 and AVE exceeding 0.50—indicate acceptable convergent validity, aligning with norms for SmartPLS studies in digital and operations research [17]. To further strengthen the evidence base, future analyses should report discriminant validity (e.g., HTMT), global fit and predictive relevance (e.g., SRMR, R^2 , Q^2), and practical importance (e.g., f^2 , PLSpredict or IPMA), in line with evolving performance-measurement guidance in digital transformation settings [12, 17]. Given the observed pattern of direct effects, formal tests of mediation by operational efficiency and of sequential pathways from digital competence to innovation and then to performance would be theoretically informative, as would moderator tests for AI maturity and data-governance quality [26, 29].

Limitations of the study also point to promising extensions. The cross-sectional design and perception-based measures raise concerns about common-method bias and temporal dynamics; incorporating temporal variation or phased AI rollouts would sharpen causal inference. Blending survey data with objective KPIs—such as OEE, scrap rates, on-time delivery, and inventory turns—would triangulate the performance impacts that operations-focused AI deployments aim to produce [21, 22]. Finally, broadening beyond manufacturing and beyond the Makassar–Gowa corridor would clarify boundary conditions and help explain when innovation’s direct contribution to performance strengthens, as suggested in research on product/service innovation complementarities and business-model change [24, 26, 43].

In summary, the evidence indicates that digital competence is the principal lever for realizing AI’s promise, operational efficiency is the engine that converts analytics into results, and innovation’s benefits are maximized when supported by both. This configuration resonates with prior work on technology-enabled transformation, absorptive capacity, and knowledge-sharing routines in determining whether AI initiatives mature from pilots to organization-wide performance advantages [12, 16, 32].

6 Conclusion

This study provides valuable insights into the interplay among digital competence, innovation, and operational efficiency in enhancing business performance through Artificial Intelligence (AI) adoption. The findings underscore that these factors significantly contribute to improving employee performance and organizational outcomes. It was found that a positive Work Environment and strong Digital Competence have the most substantial impact on Employee Performance, while Leadership Style and Social Environment also contribute, but to a lesser extent. The results provide a more comprehensive understanding of how AI-driven innovation, when combined with organizational support and employee capabilities, can significantly enhance business performance.

However, this study has several limitations. First, the data were collected from manufacturing companies in Makassar and Gowa, which may limit the generalizability of

the results to other regions and industries. Furthermore, the research focuses primarily on the perceptions of senior managers and decision makers, potentially overlooking insights from other employees or stakeholders who are directly involved in daily operations. Additionally, while this study explores the relationships between digital competence, innovation, and operational efficiency, it does not account for other potential moderating or mediating factors, such as organizational culture, that might influence these relationships.

Future research should expand the scope of the sample to include companies from different industries and geographical locations, allowing for a broader understanding of the factors influencing AI adoption and business performance across various contexts. Furthermore, future studies could incorporate longitudinal approaches to examine how the impact of digital competence, innovation, and operational efficiency evolve over time. It would also be valuable to explore the role of organizational culture and employee engagement more deeply, as these factors may provide additional insights into how AI can be successfully integrated to improve business performance.

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