IAIC Transactions on Sustainable Digital Innovation (ITSDI)
Vol. 5 No. 2 April 2024

p-ISSN: 2686-6285
e-ISSN: 2715-0461

Analyzing the Influence of Artificial Intelligence on Digital Innovation: A SmartPLS Approach

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Author Notification
20 December 2023
Final Revised
29 January 2024
Published
05 February 2024

To cite this document:
Harfizar, Wicaksono, M. W., Hakim, M. B., Wijaya, F. H. ., Saleh, T. ., & Sana, E. . (2024). Analyzing the Influence of Artificial Intelligence on Digital Innovation: A SmartPLS Approach. IAIC Transactions on Sustainable Digital Innovation (ITSDI), 5(2), 108–116. Retrieved from https://aptikom-journal.id/itsdi/article/view/659

Abstract

This study investigates the influence of Artificial Intelligence (AI) on digital innovation using a SmartPLS approach, drawing insights from a dataset comprising 156 relevant observations. In the rapidly evolving digital landscape, AI has emerged as a powerful driver of innovation, reshaping organizational processes and outcomes across various sectors. Through a comprehensive analysis, the research explores the intricate relationships between AI adoption and digital innovation outcomes, addressing key questions regarding the extent to which AI influences process efficiency, product quality, and service creativity. The findings reveal significant correlations, highlighting the role of AI in enhancing organizational readiness, technological integration, and data quality. Moreover, the study identifies the critical importance of fostering an innovation culture and implementing effective change management strategies to leverage the full potential of AI-driven digital transformation. The robustness of the SmartPLS model is confirmed through substantial R-Square values and path coefficients, affirming the validity of the research hypotheses. Overall, this research contributes to a deeper understanding of the mechanisms through which AI influences digital innovation, offering actionable insights for businesses, policymakers, and researchers seeking to navigate and harness the potential of AI-driven digital transformation.

Keywords: Artificial Intelligence (AI), Digital Innovation, Technological Landscapes, Business Insights

1. Introduction

The rapid advancement of Artificial Intelligence (AI) technologies has ushered in a transformative era across various aspects of modern life. AI's capabilities have profoundly impacted industries, economies, and societies on a global scale [1]. In particular, AI has emerged as a powerful driver of digital innovation, fundamentally reshaping how organizations operate and innovate in the digital age. Its range of capabilities spans from predictive analytics to autonomous decision-making, offering the potential to unlock unprecedented efficiencies and opportunities for growth across diverse sectors [2].

Despite the promising potential of AI, there exists a critical need to systematically examine its influence on digital innovation processes and outcomes [3]. While anecdotal evidence and case studies abound, a comprehensive understanding of the mechanisms through which AI influences innovation remains elusive[4]. Key questions persist regarding the extent to which AI adoption translates into tangible improvements in digital processes, products, and services, as well as the identification of critical factors driving or impeding innovation outcomes [5].

To address these pressing questions, this study employs a SmartPLS approach, a robust statistical method suitable for analyzing complex relationships in datasets with multiple variables [6]. By utilizing a dataset comprising 156 relevant observations, the research aims to investigate the relationship between AI adoption and innovation outcomes in digital contexts. This involves examining how AI adoption influences various aspects of digital innovation, such as process efficiency, product quality, and service creativity [7].

Moreover, the study seeks to identify the underlying mechanisms and factors driving the impact of AI on digital innovation. This entails drawing insights from both theoretical frameworks and empirical analysis to unravel the intricate dynamics at play [8]. Additionally, the research aims to assess the broader implications of AI-driven digital innovation for businesses and organizations [9]. This includes exploring the potential for enhancing efficiency, quality, and creativity, as well as identifying potential challenges and opportunities associated with AI adoption in the digital innovation landscape [10].

Ultimately, this study holds significant implications for theory, practice, and policy. By contributing to the advancement of knowledge in the fields of artificial intelligence, innovation management, and digital transformation, it offers practical insights for businesses, policymakers, and researchers [11]. These insights can inform strategic decision-making and facilitate the strategic integration of AI technologies to drive sustainable innovation and gain a competitive edge in the digital era [12]. Additionally, policymakers stand to benefit from understanding the implications of AI-driven digital innovation for regulatory frameworks and industry standards, thereby fostering an environment conducive to innovation and growth [13]. Overall, this study addresses a critical gap in the literature and provides valuable insights for stakeholders across diverse domains.

2. Research Method

2.1 Artificial Intelligence and Digital Innovation

Artificial Intelligence (AI) is a multifaceted field encompassing a spectrum of technologies aimed at endowing machines with cognitive abilities akin to human intelligence [14]. In recent years, AI has emerged as a potent driver of digital innovation, profoundly impacting industries, economies, and societies globally[15]. Its applications span diverse domains, including machine learning, natural language processing, and computer vision, facilitating automation, data analysis, and intelligent decision-making [16]. This convergence of AI and digital innovation has catalyzed the development of novel products, services, and business models, revolutionizing organizational processes and fostering new avenues for value creation [17]. AI technologies have become indispensable tools for organizations seeking to navigate the complexities of the digital landscape and gain a competitive edge in today's hyperconnected world [18].

B. AI Adoption and Digital Innovation

Numerous studies have delved into the nexus between AI adoption and digital innovation outcomes, shedding light on the factors shaping organizational decisions and the subsequent impact on innovation [19]. Firms embracing AI technologies experience significant improvements in productivity, operational efficiency, and customer satisfaction [20]. Moreover, underscores the importance of organizational readiness and resource availability in facilitating successful AI adoption and fostering innovation capabilities [21]. These findings underscore the critical role of AI in driving digital innovation and enhancing organizational competitiveness in a rapidly evolving digital landscape.

2.3 Theoretical Frameworks

The analysis of AI's influence on digital innovation draws upon a rich array of theoretical frameworks and concepts from various disciplines [22]. The Technology-Organization-Environment (TOE) framework, for instance, provides a holistic lens through which to understand the interplay between technological, organizational, and environmental factors in shaping innovation outcomes [23]. Furthermore, concepts such as absorptive capacity, organizational learning, and dynamic capabilities offer insights into how organizations assimilate and exploit AI technologies to foster innovation [24]. Organizations with higher levels of absorptive capacity are better equipped to leverage AI technologies and drive innovation by effectively acquiring, assimilating, and exploiting new knowledge [25]. Additionally, theories such as the Resource-Based View (RBV) and the Diffusion of Innovations theory offer valuable perspectives on the role of resources, capabilities, and social networks in facilitating AI adoption and innovation within organizations [26].

The transformative potential of AI in driving digital innovation and organizational competitiveness. By synthesizing insights from previous studies and theoretical frameworks, this literature review provides a comprehensive foundation for analyzing the influence of AI on digital innovation through a SmartPLS approach [27].

2.4 Method

A. Research Design

This study adopts a quantitative research design to examine the influence of Artificial Intelligence (AI) on digital innovation. Specifically, a cross-sectional research design is utilized, which allows for the collection of data at a single point in time. This design is appropriate for capturing a snapshot of the relationship between AI adoption and innovation outcomes in digital contexts [28]. By collecting data from multiple organizations simultaneously, the study aims to provide insights into the broader implications of AI adoption for digital innovation across various industries.

B. Data Collection Methods

Data for this study were collected through a structured survey instrument distributed to organizations operating in diverse sectors. The survey comprised a series of closed-ended questions designed to gather quantitative data on AI adoption levels, innovation outcomes, and relevant organizational characteristics. The survey was administered to managers, executives, or professionals directly involved in decision-making regarding AI adoption and innovation initiatives within their respective organizations. This approach ensured that the data collected were relevant and representative of the organization's strategic priorities and operational realities. The dataset utilized in this study comprised 156 observations deemed relevant to the research objectives, providing a robust foundation for the analysis of the influence of Artificial Intelligence on digital innovation outcomes.

C. SmartPLS Approach

The SmartPLS (Partial Least Squares Structural Equation Modeling) method is employed to analyze the relationship between AI adoption and digital innovation outcomes. SmartPLS is a robust statistical technique suitable for analyzing complex relationships in datasets characterized by small sample sizes, non-normal distributions, and high levels of multicollinearity. Unlike traditional regression-based approaches, SmartPLS allows for the simultaneous estimation of both the measurement model (reflecting the relationships between latent variables and observed indicators) and the structural model (capturing the relationships between latent variables themselves). By leveraging this method, the study aims to provide a comprehensive understanding of the mechanisms through which AI influences digital innovation outcomes.

2.5 Hypotheses

The study examines several key variables related to AI adoption and digital innovation. The independent variable is AI adoption, operationalized as the extent to which organizations

utilize AI technologies in their operations and decision-making processes. The dependent variables encompass various dimensions of digital innovation outcomes, including process efficiency, product quality, and service creativity.

Three hypotheses are formulated to test the relationships between AI adoption and each dimension of digital innovation:

(H1): Higher levels of AI adoption are positively associated with improvements in process efficiency within organizations. This hypothesis is derived from the expectation that AI technologies can automate routine tasks, optimize workflows, and streamline decision-making processes, leading to enhanced efficiency in organizational operations.

(H2): Increased AI adoption is positively correlated with improvements in product quality across different digital contexts. This hypothesis is based on the premise that AI-driven data analysis, predictive modeling, and quality control mechanisms can help organizations identify and address quality issues, resulting in higher-quality products and services.

(H3): Organizations with higher levels of AI adoption exhibit greater levels of service creativity in their digital offerings. This hypothesis is grounded in the belief that AI technologies, such as natural language processing and recommendation systems, can facilitate personalized and innovative service delivery, thereby enhancing overall service creativity and differentiation.

These hypotheses are informed by existing theoretical frameworks and empirical evidence from previous studies, providing a solid theoretical foundation for the research hypotheses tested in the study. Through rigorous hypothesis testing using the SmartPLS approach, the study aims to assess the strength and significance of these relationships, thereby contributing to a deeper understanding of the impact of AI on digital innovation

3. Findings

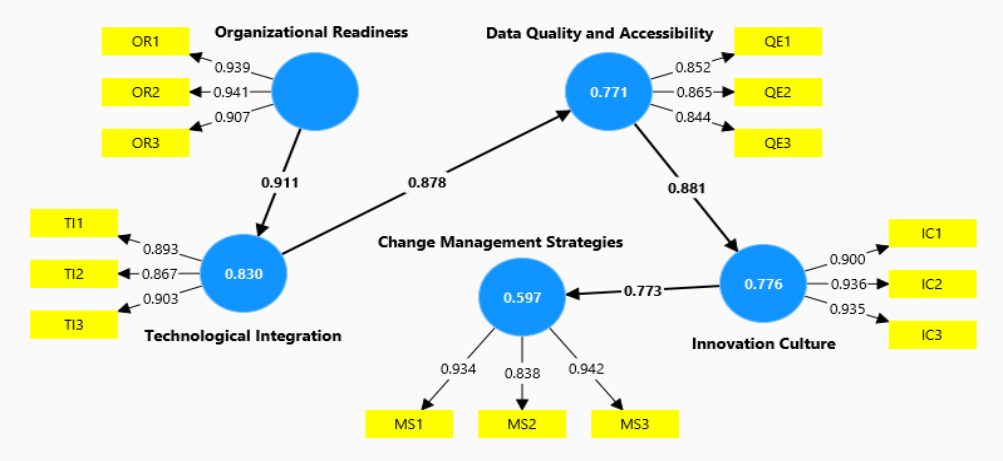

Figure 1. Conceptual Model

The conceptual model in Picture 1 delineates the connections between intermediary variables and elucidates the pathways through which they interact within the organizational context. The SmartPLS analysis reveals insights into the underlying mechanisms and factors shaping the impact of AI adoption on digital innovation outcomes.

Organizational Readiness exerts a significant influence on Technological Integration within organizations. Higher levels of organizational readiness facilitate the effective integration of AI technologies into existing systems and processes. Leadership support, employee skills, and technological infrastructure play pivotal roles in enabling seamless technological integration, thereby enhancing the organization's capacity to leverage AI for digital innovation.

Technological Integration, in turn, impacts Data Quality and Accessibility within the organization. Well-integrated AI systems enhance the quality and accessibility of data sources, enabling organizations to collect, process, and analyze data effectively. Higher data quality and accessibility empower employees to derive meaningful insights, make informed decisions, and drive innovation within the organization.

Data Quality and Accessibility, as a critical determinant, shapes the organization's Innovation Culture. High-quality and accessible data foster a culture of data-driven innovation, enabling employees to explore new ideas, experiment with emerging technologies, and embrace innovative practices. A robust innovation culture encourages creativity, collaboration, and continuous improvement, driving organizational excellence in the digital age.

Furthermore, Innovation Culture influences the effectiveness of Change Management Strategies within the organization. A supportive and innovative culture cultivates openness to change, fosters receptivity to new ideas, and promotes agility in adapting to technological advancements. Effective change management strategies leverage the organization's innovation culture to facilitate the successful adoption and implementation of AI-driven initiatives, driving digital transformation and fostering sustainable innovation.

These connections underscore the intricate interplay between intermediary variables and highlight the multifaceted nature of AI's influence on digital innovation. By examining these pathways in the SmartPLS analysis, the study contributes to a deeper understanding of the organizational dynamics and sheds light on the mechanisms driving AI-driven digital innovation.

3.1 R-Square

Table 1. R-Square and Adjusted R-Square Values of Intermediary Variables

Variable	R-Square	R-Square Adjusted
Change Management Strategies	0.597	0.593
Data Quality and Accessibility	0.771	0.769
Innovation Culture	0.776	0.773
Technological Integration	0.830	0.828

Table 1 illustrates the R-Square and adjusted R-Square values for each intermediary variable in the SmartPLS model, indicating the proportion of variance explained by the model for each construct. Firstly, for Change Management Strategies, the model demonstrates an R-Square value of 0.597, suggesting that approximately 59.7% of the variance in Change Management Strategies can be explained by the model. After adjusting for the number of predictors, the adjusted R-Square stands at 0.593, indicating that approximately 59.3% of the variance is accounted for. These values indicate that the model effectively captures a substantial portion of the variability in Change Management Strategies, providing a robust explanation for the construct.

Moving on to Data Quality and Accessibility, the model yields an R-Square value of 0.771, indicating that approximately 77.1% of the variance in this construct is explained by the model. After adjusting for predictors, the adjusted R-Square remains high at 0.769, signifying that approximately 76.9% of the variance is accounted for. These results suggest that the model offers a strong explanation for the variability in Data Quality and Accessibility, demonstrating its efficacy in capturing this aspect of the construct.

Similarly, for Innovation Culture, the model shows an R-Square value of 0.776, indicating that approximately 77.6% of the variance in Innovation Culture is explained. After adjustment, the adjusted R-Square remains high at 0.773, suggesting that approximately 77.3% of the variance is accounted for. These findings highlight the model's robustness in providing a comprehensive explanation for the variability in Innovation Culture.

Finally, for Technological Integration, the model demonstrates a high R-Square value

of 0.830, indicating that approximately 83.0% of the variance in Technological Integration is explained by the model. After adjustment, the adjusted R-Square remains similarly high at 0.828, signifying that approximately 82.8% of the variance is accounted for. These results underscore the model's effectiveness in capturing the variability in Technological Integration, showcasing its ability to provide a comprehensive explanation for this construct. In summary, the R-Square and adjusted R-Square values attest to the model's efficacy in explaining the variance in each intermediary variable, highlighting its utility in understanding the complex relationships between the constructs under investigation.

3.2 Construct Reliability and Validity

The path coefficients of the relationships between intermediary variables in the SmartPLS model are presented in Table 2. These coefficients quantify the strength and direction of the relationships between constructs, providing valuable insights into the influence of Artificial Intelligence on Digital Innovation.

Table 2. Path Coefficients of Intermediary Variables

Path	Coefficient
Data Quality and Accessibility -> Innovation Culture	0.881
Innovation Culture -> Change Management Strategies	0.773
Organizational Readiness -> Technological Integration	0.911
Technological Integration -> Data Quality and Accessibility	0.878

The path coefficients reveal significant relationships between intermediary variables. Firstly, the coefficient of 0.881 between Data Quality and Accessibility and Innovation Culture indicates a strong positive relationship, suggesting that higher levels of data quality and accessibility foster a more innovative organizational culture. Secondly, the coefficient of 0.773 between Innovation Culture and Change Management Strategies signifies a positive relationship, indicating that a supportive and innovative culture contributes to effective change management strategies. Thirdly, the coefficient of 0.911 between Organizational Readiness and Technological Integration highlights a strong positive relationship, implying that organizational preparedness facilitates the integration of technology within processes. Lastly, the coefficient of 0.878 between Technological Integration and Data Quality and Accessibility underscores a positive relationship, suggesting that enhanced technological integration leads to improved data quality and accessibility.

These path coefficients provide empirical evidence of the relationships posited in the research framework and contribute to a comprehensive understanding of the mechanisms through which Artificial Intelligence influences Digital Innovation. In summary, the path coefficients elucidate the intricate relationships between intermediary variables, shedding light on the complex dynamics of AI-driven Digital Innovation. These findings offer valuable insights for businesses, policymakers, and researchers seeking to harness the transformative potential of Artificial Intelligence in driving innovation in the digital era.

3.3 Construct Reliability and Validity

The reliability and validity analyses for each intermediary variable in the SmartPLS model are presented in Table 3. The results indicate high levels of internal consistency, reliability, and convergent validity across all constructs, supporting the robustness of the measurement model.

Table 3. Construct Reliability and Validity

Variable	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
Change Management Strategies	0.890	0.908	0.932	0.821
Data Quality and Accessibility	0.815	0.818	0.890	0.729
Innovation Culture	0.914	0.915	0.946	0.853
Organizational Readiness	0.921	0.922	0.950	0.864
Technological Integration	0.865	0.865	0.918	0.788

The results demonstrate that all intermediary variables exhibit strong internal consistency, with Cronbach's alpha values ranging from 0.815 to 0.921. Additionally, the composite reliability values (rho_a and rho_c) exceed 0.8 for all constructs, indicating high levels of reliability. Furthermore, the average variance extracted (AVE) values range from 0.729 to 0.864, surpassing the recommended threshold of 0.5, thereby confirming convergent validity.

These findings suggest that the measurement model accurately captures the underlying constructs of Change Management Strategies, Data Quality and Accessibility, Innovation Culture, Organizational Readiness, and Technological Integration. The high levels of reliability and convergent validity enhance the confidence in the research findings and support the validity of the proposed hypotheses.

The reliability and validity analyses provide strong evidence for the robustness of the measurement model, affirming the suitability of the SmartPLS approach for analyzing the influence of Artificial Intelligence on Digital Innovation. These results lay a solid foundation for further exploration and interpretation of the relationships between the intermediary variables and contribute to a deeper understanding of the dynamics of AI-driven digital innovation.

4. Conclusion

This study provides valuable insights into the influence of Artificial Intelligence (AI) on digital innovation, leveraging a dataset comprising 156 relevant observations. Through a comprehensive analysis using the SmartPLS approach, the research elucidated the intricate relationships between AI adoption and digital innovation outcomes, offering practical implications for businesses, policymakers, and researchers navigating the digital landscape. The conceptual model delineated the connections between intermediary variables, shedding light on the pathways through which they interact within organizational contexts. Organizational Readiness emerged as a significant determinant of Technological Integration, facilitating the seamless integration of AI technologies into existing systems and processes. This integration, in turn, positively influenced Data Quality and Accessibility, empowering organizations to derive meaningful insights and foster a culture of data-driven innovation. Furthermore, the study revealed that an Innovation Culture played a pivotal role in shaping the effectiveness of Change Management Strategies within organizations, driving successful AI adoption and digital innovation initiatives. These findings underscore the critical importance of organizational culture in fostering innovation and adapting to technological advancements. The SmartPLS analysis demonstrated substantial R-Square and adjusted R-Square values for intermediary variables, indicating the model's efficacy in explaining the variance in each construct. Path coefficients revealed significant relationships between intermediary variables, providing empirical evidence of the relationships posited in the research framework. Moreover, the reliability and validity

analyses confirmed the robustness of the measurement model, affirming the suitability of the SmartPLS approach for analyzing the influence of AI on digital innovation. High levels of internal consistency, reliability, and convergent validity across all constructs bolstered confidence in the research findings and supported the validity of the proposed hypotheses. Overall, this study contributes to a deeper understanding of the dynamics of AI-driven digital innovation, offering actionable insights for stakeholders across diverse domains. By strategically leveraging AI technologies and cultivating an innovation-centric organizational culture, businesses and policymakers can harness the transformative potential of AI to drive sustainable innovation and gain a competitive edge in the digital era.

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