Journal of Midwifery and Nursing, 7 (3) (2025) pp. 433-440

Published by: IOCSCIENCE

Journal of Midwifery and Nursing

Journal homepage: www.iocscience.org/ejournal/index.php/JMN

"Answering the challenges of healthcare services: A study of the effectivness of mobile JKN as a BPJS digital innovation in Sibolga 2025"

Benri Situmorang[1], Roni Gunawan[2], Herlina[3]

[1]Public Health, Master of Public Health, Helvetia Health dari Institut, Medan, Indonesia
[2]Public Health, Health Promotion, Helvetia Health dari Institut, Medan, Indonesia
[3]Nutrition, Public Health, STIKes Nauli Husada, Sibolga, Indonesia

ARTICLE INFO

Article history:

Received Jul 9, 2025
Revised Jul 20, 2025
Accepted Jul 30, 2025

Keywords:

Effectiveness;
JKN Mobile Application;
Services.

ABSTRACT

The National Health Insurance (JKN) mobile application provides convenience for BPJS participants. This convenience includes paying BPJS contributions, updating participant data, accessing family member data, and more. The purpose of this study was to specifically evaluate the perceived effectiveness and practical benefits of the JKN mobile application in improving service access among users in Sibolga City. This research employed a descriptive qualitative method, involving four purposively selected informants: two BPJS Health officers and two active users of the JKN application. Data were collected through in-depth interviews, direct observation, and document review. The study found that the JKN mobile application significantly enhances healthcare service accessibility and user autonomy. Informants reported that essential features-such as digital membership cards (E-ID), online queue registration (antrean online), and contribution tracking-were particularly useful in reducing administrative burden and time. Users no longer need to physically visit the BPJS Health office, as the application-readily available on the Play Store-enables them to access services anytime and anywhere.

Corresponding Author:

Benri Situmorang,
Public Health,
Master of Public Health,
Helvetia Health dari Institut,
Jl. Kapten Sumarsono, No. 107, Medan, 20124, Indonesia
Email: benrisitumorang@helvetia.ac.id

1. Introduction

The integration of Information and Communication Technology (ICT) has become increasingly prevalent across various sectors, including business and organizational operations, as a means to optimize both time and cost efficiency. This trend reflects a growing awareness among institutions of the vital role ICT plays in supporting their overall performance and effectiveness (Nigar, 2019). This digital transformation reflects a growing institutional awareness of the essential role ICT plays in supporting service performance and citizen engagement. Accordingly, the Social Security Administering Body (BPJS Kesehatan) must adapt to this shift by integrating modern ICT solutions to meet public expectations and streamline its services. One significant innovation is the development of the **Jaminan Kesehatan Nasional (JKN) mobile application**, which enables BPJS participants to perform various administrative tasks-such as checking membership status, accessing family data, making contributions, and registering for services-without visiting physical offices (Wang & Zhao, 2025).

This is particularly relevant given that, prior to the JKN application, many residents in regions like **Sibolga City** experienced persistent challenges in accessing BPJS services, including long queues, limited office hours, geographical distance, and administrative delays. In response to these issues, the Indonesian government continues to reform and improve the quality of its social security management systems. Social protection, particularly in the form of health insurance, is essential to ensure that citizens can fulfill their basic needs in a sustainable manner. The current BPJS system evolved from earlier programs such as **Jamkesmas**, **Jamkesda**, and **ASKES**, and now plays a central role in delivering universal health coverage (Hidayati et al., 2025). Given this context, this study aims to examine **the level of use of the JKN mobile application in Sibolga City**, and to explore **the specific challenges that residents previously faced in accessing BPJS Health services prior to its implementation**. The findings are expected to contribute to a better understanding of how digital platforms can improve public health service delivery, especially in regional areas.

The government has been making efforts to adjust and improve the quality of public health insurance and social security management. These improvements are very necessary because social security is one form of social protection provided by the government to ensure that citizens can meet their basic living needs adequately (Mulligan et al., n.d.). Indonesia's social security system evolved from earlier programs such as Jamkesmas, Jamkesda, and ASKES, culminating in the establishment of the current government initiative, the Social Security Administering Body (BPJS) (Hidayati et al., 2025).

BPJS Kesehatan is dedicated to delivering high-quality services to the public, encompassing both healthcare provision and the dissemination of relevant information to the Indonesian population (Endalamaw et al., 2025). BPJS Kesehatan continues to adapt to technological developments, as demonstrated by several innovations most notably the launch of the JKN mobile application—as part of its ongoing efforts to improve services for participants of the National Health Insurance–Healthy Indonesia Card (JKN-KIS) program (Theoharis et al., 2024).

The JKN mobile application represents a digital transformation of BPJS Kesehatan's service model, shifting administrative processes that were previously conducted at branch offices or health facilities into a self-service platform accessible to participants anytime and anywhere. This application was officially launched in 2020 by the President Director of BPJS Kesehatan, Ali Ghufron Mukti (Susanti, 2022). The JKN mobile application offers various conveniences for the public and program participants. These include simplified processes for premium payments and data updates, easy access to family membership information, real-time contribution billing details, comprehensive information on available health facilities, and user-friendly features for submitting complaints or inquiries related to the JKN-KIS program.

Autio, Et al (Autio et al., 2024) said "Effectiveness refers to the extent to which predetermined goals are achieved-where a higher level of effectiveness indicates better performance". The JKN mobile application is designed to enhance service delivery by minimizing queues at BPJS Kesehatan Branch Offices, which traditionally serve as central points for managing various administrative processes for the public (Akbarian et al., 2024). Crowded queues are frequently observed at BPJS Kesehatan Branch Offices, as many individuals seek to manage their BPJS-related administrative matters. In response to this situation, the researcher intends to conduct a study entitled *"The Effectiveness of the National Health Insurance (JKN) Mobile Application in Improving BPJS Kesehatan Services in Sibolga City in 2025"*.

2. Methods

This study employed a descriptive qualitative research method, aimed at understanding the effectiveness of the JKN mobile application from both the provider and user perspectives in Sibolga City. The primary subjects consisted of BPJS Health service personnel and BPJS participants, selected purposively to capture diverse experiences and insights. Data were collected using semi-structured interview instruments, supported by an interview guide tailored separately for each informant group to explore specific themes such as service accessibility, user experience, and system efficiency. Additional data were gathered through direct observation and document analysis, allowing for methodological triangulation. To maintain objectivity in interpreting the data, the researcher applied a thematic analysis approach, coding the responses independently and cross-checking patterns between groups. Credibility

and validity were ensured through data triangulation, member checking, and careful documentation of each step in the analytical process. Differences between service personnel and BPJS participants were identified by categorizing data based on roles, responsibilities, and service usage experiences. Effectiveness of the JKN application was evaluated using indicators such as ease of access, frequency of use, reduction in physical visits to BPJS offices, and user satisfaction, as consistently reported by informants.

3. Results and Discussion

As a social study, this research deals with complex social phenomena. The use of a qualitative approach necessitates the involvement of informants who can provide in-depth, accurate, valid, and reliable information. This enables the researcher to conduct thorough data analysis manually. Any numerical data included will function solely as supporting elements to strengthen the qualitative interpretation and discussion.

Table 1.
Description of sources based on gender

Sex	Frekwensi	Persentase
Male	1	25
Female	3	75
Total	4	100

Based on the table above, with the resources possessed by BPJS officers, it shows that the company's value reflects how the company is able to achieve performance and potential future growth (Hidayati et al., 2025). The quality and increase in the company's value strengthen market confidence, demonstrating belief not only in the company's current performance but also in its long-term prospects. This study indirectly supports the core principles of the Technology Acceptance Model (TAM), which suggests that two primary factors-Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)-strongly influence a user's decision to adopt and continue using a technological system. Although TAM was not explicitly referenced in the methodology, the data gathered and interpreted in this study aligns well with its theoretical framework.

Perceived Usefulness (PU)

Participants in the study consistently highlighted the practical benefits of using the JKN mobile application. These include: a) The ability to pay BPJS contributions without visiting the office; b) The ease of updating personal and family member data directly through the app; c) The convenience of accessing health service information anytime and from any location. These benefits demonstrate that users perceive the application as significantly improving the efficiency of their interactions with the BPJS health system, which corresponds directly to the concept of perceived usefulness. This is further supported by users' acknowledgment that the application reduces time, cost, and administrative burdens, thereby enhancing the overall experience of engaging with BPJS services.

Perceived Ease of Use (PEOU)

In terms of accessibility and user interaction, participants noted that the JKN application: a) Is easy to download and install via the Google Play Store; b) Has a clear and user-friendly interface; c) Does not require advanced technical knowledge to operate. These factors suggest that the application is not only functional but also intuitively designed, enabling users to navigate its features with minimal difficulty. The seamless interaction experienced by users directly reflects TAM's second major component—perceived ease of use. A system that is easy to use lowers barriers to adoption, particularly among users who may not be technologically inclined.

Link to Institutional Performance

Beyond individual acceptance, the study also highlights how the effectiveness of the JKN application contributes to the broader institutional performance of BPJS. As the organization continues to optimize digital services, internal controllable factors—such as staff competence and system

responsiveness—enhance its overall value and public trust. This institutional alignment further supports TAM's assertion that user perception strongly influences system success.

Implications of Findings

The convergence between user experiences and TAM indicators implies that: a) The effectiveness of the JKN application is not solely technical—it also lies in how users subjectively experience the benefits of the system; b) Behavioral intention to continue using the app is likely to remain high, given its perceived usefulness and ease of use.

These perceptions are crucial to sustaining user engagement and ensuring that digital transformation efforts in public health services yield measurable results. Estimating a company's value accurately remains a challenge for participants due to the numerous factors that influence it. This determination can be categorized into controllable factors (internal), which can be managed by the company, and uncontrollable factors (external), which are beyond the company's control. As a result, companies focus more on internal aspects, as they are relatively easier to manage and optimize to increase the company's value.

Table 2.
Description of informants based on age and education

No	Sex	Frekwensi	Persentase
1	31-40	2	50
2	41-50	2	50
	Total	4	100
	Education	Frekwensi	Persentase
1	Senior high school	3	60
2	Bachelor	1	40
	Total	4	100

Based on the data presented in the table and an interview conducted with Mrs. Diana Safitri, a BPJS Kesehatan participant, on Wednesday, August 10, 2024, at 09:00 WIB, regarding her understanding of the JKN Mobile Application, she indicated that she is familiar with the application's usage. However, she reported persistent difficulties when attempting to register her child and husband through the platform. Specifically, she did not receive an OTP code during her child's registration process, and her husband consistently experienced login failures (Zhang et al., 2025). She also noted that they had contacted the BPJS Kesehatan care center; however, according to Mrs. Diana Safitri, the response provided was unsatisfactory and appeared to be merely procedural or normative in nature, without offering a concrete solution to the issues encountered (Zhang et al., 2025). He also hopes that the JKN Mobile Application will become even better, so that the public will be enthusiastic about using the application because it can make it easier for BPJS Kesehatan participants.

The experiences of Mrs. Diana and Mr. Aris illustrate that although the Mobile JKN application is already accessible to the public, technical obstacles such as frequent system failures and delayed OTP codes remain a hindrance. This shows that the challenges of digitization are not just about the availability of internet access, but also about the community's ability to use technology and the readiness of the supporting infrastructure. In areas like the city of Sibolga, this becomes very relevant. This analysis aligns with the opinion (Konopik & Blunck, 2023), Digital transformation in the healthcare sector will only succeed if accompanied by infrastructure improvements and adequate education for the community.

Furthermore, based on an interview with Mr. Aris Budiman Nasution, a BPJS Kesehatan participant from Sibolga City, conducted on Thursday, August 11, 2022, at 09:30 WIB, regarding his understanding of the National Health Insurance (JKN) Mobile Application, his experience aligns with that of the previously mentioned participant. Mr. Aris stated that although he understands how to operate the Mobile JKN application, he encountered repeated issues during registration. Specifically, his

attempt to register for BPJS Kesehatan services failed even after two days, as the process consistently stalled at the verification stage-no code was sent, and connection errors persisted. He noted that despite using Wi-Fi with a full signal, the application's connectivity remained unstable. Although the application claims to offer ease of access, in practice, it did not function effectively, according to Mr. Aris during the interview (Akbarian et al., 2024).

According to the Technology Acceptance Model, there are two main factors that influence a person's acceptance and use of technology, namely the extent to which the technology is perceived as useful and the extent to which the technology is perceived as easy to use. From the interview results, the informants indeed felt significant benefits from the Mobile JKN application. BPJS participants also reported various technical obstacles that made the usage process not easy. This illustrates that although the application functions well, the level of public acceptance remains low if the ease of use is not truly felt.

Many sources state that the application facilitates access without the need to go to the BPJS office, which means it theoretically meets the criteria for effectiveness. However, from the efficiency side, this application is not yet optimal because it still requires direct intervention from employees or physical visits to the office. This contradicts the goal of digitalization, which is to reduce the operational burden of public service institutions.

The Head of the Membership and Participant Services Division of BPJS Kesehatan stated that the National Health Insurance (JKN) Mobile Application undergoes continuous evaluation. This is reflected in the various improvements that have been implemented since its initial launch in 2017. These evaluations aim not only to optimize the functionality and user experience of the JKN Mobile Application but also to enhance the competence of BPJS Kesehatan personnel in delivering effective services to both the public and program participants (Liu et al., 2024). The Technology Acceptance Model (TAM) posits that an individual's willingness to adopt and utilize a technological system is fundamentally determined by two critical perceptions: the degree to which the technology is considered useful in enhancing performance (perceived usefulness), and the extent to which it is viewed as easy to operate without significant effort (perceived ease of use). These two constructs play a pivotal role in shaping user behavior and determining the overall acceptance of new technologies (Junaidi et al., 2024). From the interview results, the informants indeed felt significant benefits from the Mobile JKN application. However, they also reported various technical obstacles that made the usage process not easy. This illustrates that although the application functions well, the level of public acceptance remains low if the ease of use is not truly felt.

Based on an interview conducted with Mrs. Diana Safitri, a BPJS Kesehatan participant in Sibolga, on Wednesday, August 10, 2024, at 09:00 WIB, regarding the facilities and infrastructure at the BPJS Kesehatan Sibolga office in relation to the National Health Insurance (JKN) Mobile Application, she expressed dissatisfaction with the application's performance. According to her, despite having a stable internet connection, the JKN Mobile Application often experiences significant connectivity issues, rendering it difficult or even impossible to access. She also highlighted the slow responsiveness and suboptimal performance of BPJS Kesehatan staff in addressing service-related concerns (Endalamaw et al., 2025).

Healthcare personnel are often unable to provide concrete solutions when technical issues arise with the JKN Mobile Application. In such cases, participants are simply advised to wait until the system is functioning properly, and as a result, many are ultimately forced to visit the BPJS Kesehatan office in person. Similarly, the interview conducted with Mr. Aris Budiman Nasution, a BPJS Kesehatan participant in Sibolga City, on Thursday, August 11, 2024, at 09:30 WIB, revealed experiences consistent with those of the previous informant. He reported similar difficulties in understanding and using the JKN Mobile Application due to its poor performance and recurring technical problems (Akbarian et al., 2024) (Fasano et al., 2025). He expressed that the performance of the JKN Mobile Application remains inadequate, as evidenced by frequent failures in accessing the system. He emphasized that these issues are not due to user network problems, but rather stem from recurring system errors within the application itself. He further stressed the urgency of addressing these technical shortcomings promptly,

particularly in the context of the ongoing pandemic, when visiting BPJS Kesehatan offices directly poses additional challenges for participants (Mulligan et al., n.d.).

Issues with Mobile JKN reflect that digitalization has not yet been fully integrated into the BPJS public service system. This is in line with findings that state that digital adoption in public institutions often lags due to weak periodic evaluation processes and internal training. Therefore, there is a need for regular governance audits of this application.

An interview with Mrs. Latifah Putri, a BPJS Kesehatan participant, was conducted on Friday, August 12, 2024, at 09:00 WIB, concerning the facilities and infrastructure related to the National Health Insurance (JKN) Mobile Application. She stated that due to her inability to access and use the Mobile JKN Application, the issue of overcrowded queues-particularly prior to the pandemic-remains a major concern. According to her, the excessive number of visitors caused the ticketing machine to malfunction, further exacerbating the queue. In addition, she highlighted the inadequate infrastructure at the BPJS Kesehatan office, such as the limited number of seats, which forced many participants to stand while waiting, and even led some to leave before being served (Schaer et al., 2025) (Mulligan et al., n.d.). During the pandemic, the queuing system was relocated to an outdoor area, specifically outside the BPJS Kesehatan building, which coincides with the motorbike parking lot and is situated along the roadside. This arrangement has occasionally led to traffic congestion and discomfort for participants. She also expressed hope that BPJS Kesehatan in Sibolga City will continue to improve its services and infrastructure in the future (Jafarian & Khorsandi, n.d.).

An interview was conducted with Mr. Haris Budiman Nasution, a BPJS Kesehatan participant from Sibolga City, on Thursday, August 11, 2024, at 09:30 WIB, regarding the effectiveness and efficiency of the National Health Insurance (JKN) Mobile Application. His responses aligned with those of previous interviewees. Mr. Haris highlighted that, despite the intended purpose of the application to streamline services, its current performance remains suboptimal and inefficient, often failing to support user needs effectively (Emami et al., n.d.). He stated that the JKN Mobile Application is currently less effective, particularly in terms of its network connectivity. According to him, the application requires significant updates and improvements to ensure it can function optimally and provide the intended level of service to its users (Autio et al., 2024)(Schaer et al., 2025). He also acknowledged that, in principle, the JKN Mobile Application is highly beneficial for BPJS Kesehatan users-particularly during the pandemic-since it enables participants to access services without leaving their homes. However, he noted that frequent system errors within the application hinder its usability, often forcing users to visit the BPJS Kesehatan office in person despite the intended convenience of the digital platform (Konopik & Blunck, 2023) (Schaer et al., 2025).

An interview with Mrs. Latifah Putri, a BPJS Kesehatan participant, was conducted on Friday, August 12, 2024, at 09:00 WIB, concerning the effectiveness and efficiency of the National Health Insurance (JKN) Mobile Application. She acknowledged that BPJS Kesehatan has shown effectiveness in providing healthcare services to its participants. However, she emphasized the need for greater attention to be paid to the issue of overcrowded queues and the improvement of existing service facilities. Furthermore, she expressed the view that BPJS Kesehatan cannot yet be considered efficient, as further enhancements are required in both direct (on-site) services and digital services provided through the mobile application (Susanti, 2022). Although many users reported that they understood how to operate the JKN Mobile Application, technical difficulties remained a significant barrier to effective usage. This indicates that user empowerment extends beyond socialization and education; it also requires the provision of responsive and accessible technical support. To address this gap, BPJS Kesehatan could consider implementing a live chat support system or integrating an AI-based chatbot-similar to innovations adopted in the digital *Posyandu* system-to enhance user assistance and real-time problem resolution.

Although the JKN Mobile App was developed with comprehensive and user-oriented features, field analysis showed significant gaps between the system design and actual performance in the field. Obstacles such as system login failures, OTP errors, and connectivity limitations indicate that system testing has not considered variations in network conditions in various regions, especially small cities like

Sibolga. The implication is that system evaluation needs to adopt a real environment testing approach and expand the scope of simulation to areas with limited infrastructure. Many informants stated that they understood how to use the application, but still experienced recurring technical difficulties. This suggests that functional digital literacy has been established, but not accompanied by system reliability. In addition, people's expectations of digitalization backfire when the system fails to meet expectations. The implication is that the education strategy should not only focus on how to use, but also on basic troubleshooting, as well as providing fast and solutive technical support. Although the application was launched to reduce the burden of services at the BPJS office, the facts on the ground show that many problems still have to be resolved manually at the office. This shows that digitalization has not been fully integrated with the organization's workflow. The implication is that BPJS needs to implement a digital-first approach.

Discusstion

This research provides important lessons for other researchers interested in the study of technology effectiveness in public services. The findings show that the successful implementation of digital applications such as Mobile JKN is not only determined by technical features, but is also strongly influenced by infrastructure readiness, system responsiveness, and user digital literacy. Researchers in similar fields need to pay attention to contextual aspects such as the social, cultural, and geographical characteristics of local communities. This study emphasizes the importance of a holistic approach-combining technical evaluation with in-depth user experience analysis. In addition, regular evaluation and active involvement from the service provider (in this case BPJS) are important factors in ensuring that the technology implemented is truly effective and efficient in the field. Thus, this study can serve as an initial reference for the development of further research related to the digitization of health services, especially in the context of regions that are not fully technologically and infrastructure ready.

4. Conclusion

In terms of program comprehension, field observations suggest that the socialization efforts by BPJS Kesehatan have been relatively effective in raising public awareness and understanding of the JKN Mobile Application. Nonetheless, the application's operational performance remains below optimal standards. Users continue to encounter various challenges, most notably recurrent network-related errors that impede access and functionality. These technical issues appear to stem from internal system inefficiencies, which require major software updates and are often associated with prolonged resolution times. Furthermore, the responsiveness of BPJS personnel in addressing application-related complaints remains inadequate. This lack of prompt support compels many users to bypass the app altogether and visit BPJS Health Offices in person to resolve their issues. This not only undermines the application's intended function of convenience and accessibility but also signals a critical need for improvements on multiple fronts-including technical infrastructure, system reliability, and frontline staff training. To address these shortcomings effectively, future strategies should include targeted system upgrades, clear service-level response protocols for IT-related issues, and comprehensive training for BPJS staff to enhance their capacity in supporting digital service users.

References

Akbarian, P., Asadi, F., & Sabahi, A. (2024). *Developing Mobile Health Applications for Inflammatory Bowel Disease : A Systematic Review of Features and Technologies*. *16*(October), 211–220. https://doi.org/10.34172/mejdd.2024.394

Autio, E., Chiyachantana, C., Castillejos-petalcorin, C., Fu, K., Autio, E., Chiyachantana, C., Jinjarak, Y., & Muftiadi, A. (2024). *ADOPTION OF DIGITAL TECHNOLOGIES , BUSINESS MODEL INNOVATION , AND FINANCIAL AND SUSTAINABILITY PERFORMANCE IN START-UP FIRMS ADB ECONOMICS WORKING PAPER SERIES*. *734*.

Emami, Y., Li, K., Member, S., Almeida, L., Member, S., Zou, S., & Ni, W. (n.d.). *On the Use of AI-Driven Immersive Digital Technologies for Designing and Operating UAVs*.

Endalamaw, A., Zewdie, A., Wolka, E., & Assefa, Y. (2025). *A scoping review of digital health technologies in multimorbidity management : mechanisms , outcomes , challenges , and strategies*. *5*.

Fasano, A., Mauro, M. C., Beani, E., Nicora, G., Germanotta, M., Falchini, F., Pavan, A., Habib, V., Quaglini, S., Sgandurra, G., & Aprile, I. G. (2025). *Towards the Identification of Patients ' Needs for Promoting Robotics and Allied Digital Technologies in Rehabilitation : A Systematic Review*. 1–20.

Hidayati, L. N., Alteza, M., Ryansa, M., & Gagah, G. (2025). *The Power of Digitalization : How Information Disclosure Shapes Company Value*. *16*(3), 531–538.

Jafarian, I., & Khorsandi, S. (n.d.). *C c .' a p i h t*. 1–5.

Junaidi, K., Rahmanta, & Wibowo, R. P. (2024). The influence of perceived usefulness in the technology acceptance model on the success of ERP implementation to support sustainability in North Sumatra's palm oil companies. *IOP Conference Series: Earth and Environmental Science*, *1413*(1), 1–7. https://doi.org/10.1088/1755-1315/1413/1/012096

Konopik, J., & Blunck, D. (2023). *Development of an Evidence-Based Conceptual Model of the Health Care Sector Under Digital Transformation : Integrative Review Corresponding Author :* 25. https://doi.org/10.2196/41512

Liu, W., Wang, Z., Shi, Q., & Bao, S. (2024). *performance*. https://doi.org/10.1057/s41599-024-03109-y

Mulligan, C., Berti, G., Kumar, S. G., & Anna, S. (n.d.). *Community-Based Resilience : Digital Technologies for Living within Planetary Boundaries*.

Nigar, N. (2019). A Study on Internet of Things in Women and Children Healthcare. *International Journal of Machine Learning and Networked Collaborative Engineering*, *03*(01), 1–15. https://doi.org/10.30991/ijmlnce.2019v03i01.001

Schaer, E., Commenge, J., & Perrin, L. (2025). *Education 4 . 0 : défi de la révolution digitale dans l ' actualisation des connaissances et compétences des cursus de génie des procédés Education 4 . 0 : the challenge of the digital revolution in updating the knowledge and skills of chemical and proces*. *03001*.

Susanti, A. I. (2022). *Development of a Chatbot for Pregnant Women on a Posyandu Application in Indonesia : From Qualitative Approach to Decision Tree Method*.

Theoharis, A., Yan, W., Pang, S., & Faiz, G. (2024). *Using assurance frameworks to manage the risks and uncertainties of an energy sector digital spine*. *October*, 1054–1063. https://doi.org/10.1049/stg2.12195

Wang, J., & Zhao, H. (2025). Enterprise digital transformation and sustainable productivity. *Discover Sustainability*, *April*. https://doi.org/10.1007/s43621-025-01128-6

Zhang, Y., Zhang, J., Lu, Y., & Ji, F. (2025). *Digitalization and Firm Value : The Evidence from China ' s Manufacturing Enterprises*. 1–23.