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Assessment of Technology Contribution in Digital Lending Transformation Using Technometric and AHP Approach

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ABSTRACT

The rapid development of financial technology (fintech) has accelerated digital transformation in the banking industry, particularly in digital lending services that require effective management of technological resources. However, Bank XYZ has not yet conducted a comprehensive assessment of the contribution of its technological components in supporting digital lending operations. This study aims to measure the contribution of technology and identify strategic priorities for technology development in digital lending services at Bank XYZ. A technometric approach was employed by integrating the Technology Contribution Coefficient (TCC) and Analytical Hierarchy Process (AHP). Data were collected from employees directly involved in digital lending activities and from expert respondents selected based on their experience and involvement in technology management. The analysis focused on four technology components: Technoware, Humanware, Infoware, and Orgaware (THIO). The results show that Technoware has the highest technology contribution (TCC = 0.6931), followed by Orgaware (0.6904), Humanware (0.6794), and Infoware (0.6750). However, AHP results indicate that Humanware is the most strategically important component with a priority weight of 0.388, revealing a gap between actual technology contribution and strategic importance. Furthermore, the State-of-the-Art (SOTA) assessment indicates that Humanware has the lowest maturity level (0.6567), while Infoware requires further enhancement, particularly in analytical capabilities such as scoring engine systems. These findings contribute to the development of an integrated framework for evaluating technology contributions in digital lending and provide practical recommendations for prioritizing human resource development and information management to support sustainable digital transformation in the banking sector.

Keywords: Fintech, Digital Lending, Technometric, TCC, AHP

BACKGROUND

The rapid development of financial technology (fintech) has accelerated digital transformation in the banking industry, particularly in digital lending services (Sulthan, 2026).

Digital transformation encourages banks to provide faster, more flexible, and technology-driven financial services through mobile applications, automated verification systems, and data analytics integration (Ms. Ekta, 2025). The increasing adoption of digital financial services has also changed customer behavior, where banking services are now expected to be accessible without physical interaction and supported by real-time processing capabilities (Nana Dwemoh Benneh, 2025). This transformation has intensified competition between conventional banks and fintech companies, forcing banks to strengthen their technological capabilities in order to maintain competitiveness in the digital financial ecosystem (Rajan, 2025).

The increasing role of fintech is reflected in the rapid growth of digital lending services in Indonesia. According to the Financial Services Authority (OJK), the outstanding value of fintech peer-to-peer lending reached IDR 80.07 trillion in February 2025, increasing by 31.06% compared to the previous year. In addition, the number of licensed fintech lending providers in Indonesia reached 97 companies in 2025, indicating the continued expansion of digital financial services in the national banking ecosystem. The growth of digital lending indicates that technology-based lending services have become an important instrument for expanding financial inclusion and accelerating access to financial services. However, the rapid growth of digital lending also increases the need for banks to ensure that technology investments can support operational effectiveness, service quality, and risk management in a sustainable manner.

As one of the state-owned banks in Indonesia, Bank XYZ has actively implemented digital transformation strategies to respond to fintech disruption (Rajan, 2025). Digital transformation at Bank XYZ is reflected through the development of mobile-based digital lending services supported by big data analytics, scoring engines, and cybersecurity infrastructure (Pramudito et al., 2025; Pamisetty, 2025). The implementation of these technologies enables the credit application and disbursement process to be completed in less than ten minutes without face-to-face interaction (Serfes et al., 2025). The increasing dependence on digital technology has encouraged Bank XYZ to continuously invest in technological infrastructure to maintain service efficiency and competitive advantage . Nevertheless, the increasing investment in technology has not been accompanied by a comprehensive evaluation regarding the contribution of each technological component to the effectiveness of digital lending services (Prawira et al., 2025).

Previous studies mainly focused on the relationship between fintech adoption and banking profitability, customer behavior, or financial performance (Nana Dwemoh Benneh, 2025). Studies conducted by several study generally concluded that fintech adoption positively affects banking performance and innovation (Shaukat et al., 2025). However, previous studies still tend to evaluate fintech from a general perspective without identifying the contribution of internal technological components in supporting digital lending effectiveness (Adamek & Solarz, 2023). As a result, limited studies comprehensively evaluate

the contribution of Technoware, Humanware, Infoware, and Orgaware (THIO) in banking digital transformation using a technometric approach integrated with strategic decision-making methods (Lee & Megargel, 2021).

Based on these conditions, this study aims to measure the contribution of technology components in Bank XYZ's digital lending services using the Technology Contribution Coefficient (TCC) through a technometric approach. This study also applies the Analytical Hierarchy Process (AHP) to determine the strategic priority of each technology component based on expert judgment. Through the integration of technometric and AHP approaches, this study is expected to provide a comprehensive evaluation framework for identifying strategic technology priorities and supporting sustainable digital transformation in the banking industry.

METHODOLOGY

Research Design

This study employed a quantitative descriptive approach to evaluate the contribution of technology components in digital lending services at Bank XYZ. The study focused on the implementation of fintech-based digital lending as part of the bank's digital transformation strategy. The research adopted the technometric approach to assess the contribution of four technology components, namely Technoware, Humanware, Infoware, and Orgaware (THIO). Through this approach, the study aimed to identify the level of technological contribution and determine which components play the most strategic role in supporting digital lending effectiveness. In addition, the Analytical Hierarchy Process (AHP) was applied to determine the priority weight of each technology component based on expert judgment.

The research process consisted of several stages, including technology component identification, State of The Art (SOTA) assessment, technology contribution calculation, AHP weighting analysis, and Technology Contribution Coefficient (TCC) evaluation. The integration of technometric and AHP approaches enabled the study to provide a comprehensive assessment of technology contribution from both technological and managerial perspectives. This research design was selected because it allows organizations to evaluate technology not only from infrastructure capability, but also from the integration of human resources, information systems, and organizational support in digital transformation initiatives.

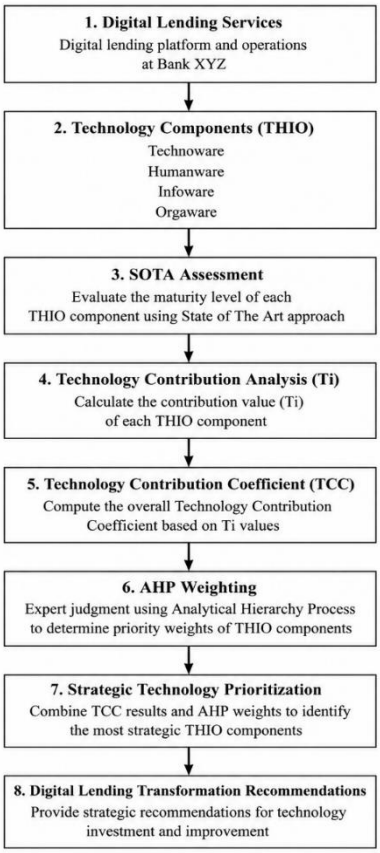

Figure 2. Research Framework of Technometric and AHP Approach in Digital Lending Assessment

Data Collection

Data collection in this study was conducted at Bank XYZ by focusing on the implementation of digital lending services. The study used primary and secondary data sources to obtain comprehensive information regarding the contribution of technology components in digital transformation initiatives. Primary data were collected through interviews, observations, and questionnaires distributed to experts and internal stakeholders involved in digital lending operations, including IT developers, system analysts, operational staff, and digital banking management. The questionnaire assessment was designed based on the Technoware, Humanware, Infoware, and Orgaware (THIO) framework to evaluate the level of technological sophistication and contribution within the digital lending system.

Table 1. Technology Components and Assessment Indicators Based on THIO Framework

Component	Assessment Focus
Technoware	Digital infrastructure and applications
Humanware	Human competencies and expertise
Infoware	Information systems and data integration
Orgaware	Organizational support and governance

The collected data were subsequently used for State of The Art (SOTA) assessment, technology contribution calculation, and Analytical Hierarchy Process (AHP) weighting analysis. Secondary data were obtained from internal company reports, digital lending operational documents, fintech statistics, and previous studies related to digital transformation and technology assessment. The integration of interviews, expert judgment, and documentation analysis enabled this study to generate both quantitative and qualitative evaluations regarding the effectiveness of technology implementation in Bank XYZ's digital lending services. This data collection process also ensured that the technology assessment reflected actual organizational conditions and strategic priorities within the banking digital transformation environment.

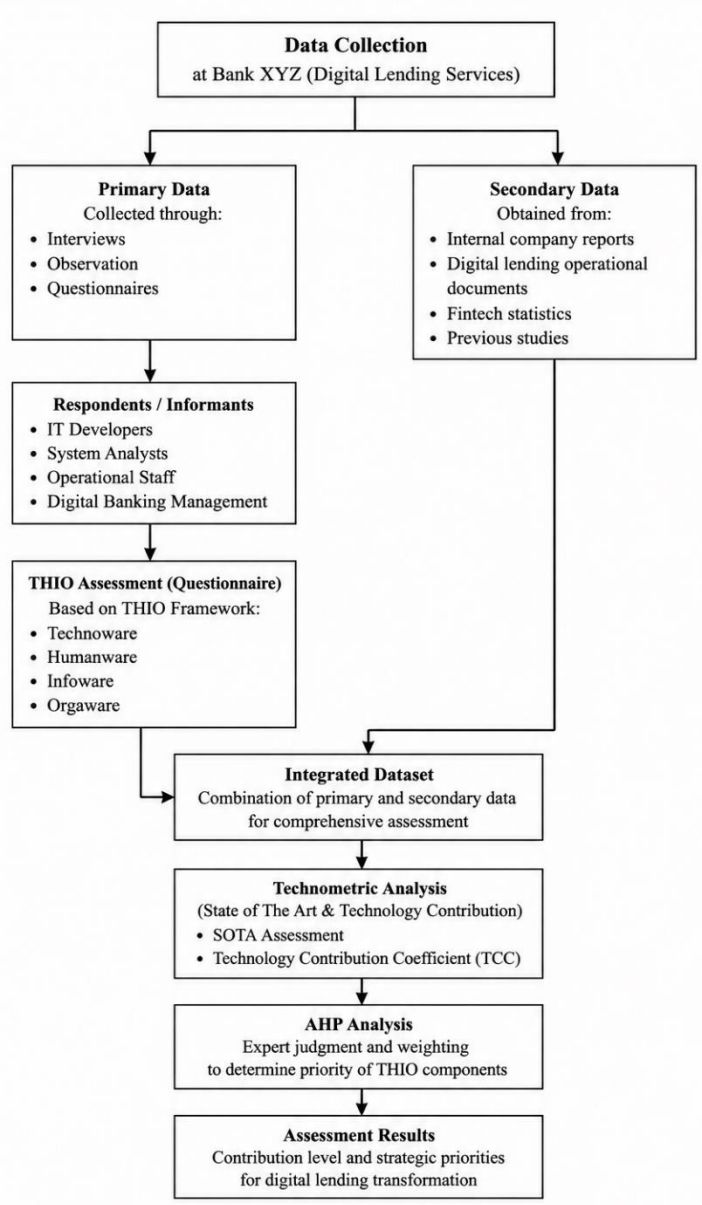

Figure 3. Data Collection Process for Technometric and AHP Assessment

Technometric and AHP Analysis

The technometric analysis in this study was conducted to measure the contribution of technology components in Bank XYZ's digital lending services. The analysis began with the identification of four technology components, namely Technoware, Humanware, Infoware, and Orgaware (THIO). Each component was evaluated using the State of The Art (SOTA) approach to determine the level of technological sophistication and maturity within the digital lending system. The SOTA assessment results were subsequently used to calculate the contribution value of each technology component. Furthermore, the contribution values were integrated into the Technology Contribution Coefficient (TCC) model to determine the overall technology contribution in supporting digital lending transformation.

After obtaining the contribution values of each technology component, the Analytical Hierarchy Process (AHP) was applied to determine the strategic priority weight of each component based on expert judgment. The AHP analysis was conducted through pairwise comparison between technology components to identify which components have the most dominant role in supporting digital lending effectiveness. The consistency of expert judgments was evaluated using the Consistency Ratio (CR) to ensure the reliability of the weighting results. The integration of technometric and AHP approaches enabled this study to evaluate technology contribution not only from the perspective of technological capability, but also from the strategic importance of each technology component in supporting sustainable digital transformation at Bank XYZ.

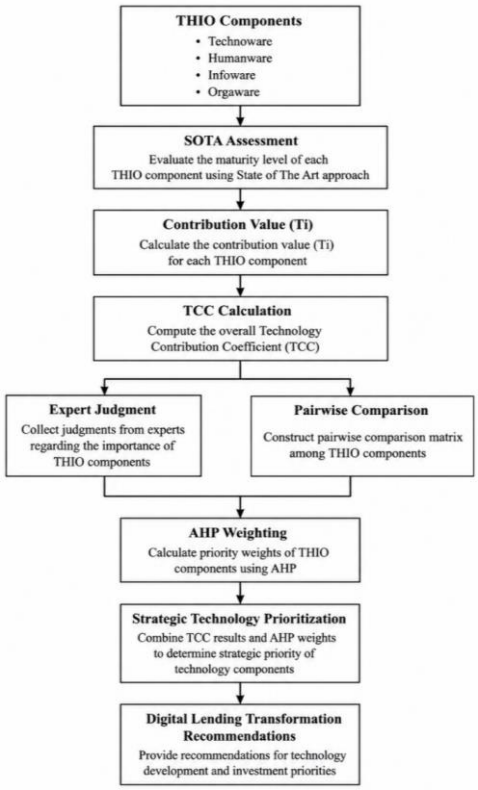

Figure 4. Technometric and AHP Analysis Framework

Table 2. Technometric and AHP Analysis Variables

Analysis Stage	Output
SOTA Assessment	Technology sophistication level
Contribution Analysis (Ti)	Contribution value of THIO components
AHP Weighting	Strategic priority weight
TCC Calculation	Overall technology contribution

RESULT AND DISCUSSION

The State of The Art (SOTA) assessment was conducted to evaluate the level of technological sophistication and maturity of the THIO components in Bank XYZ's digital lending services. The assessment covered Technoware, Humanware, Infoware, and Orgaware as the main components supporting digital transformation within the organization. The SOTA analysis showed that all THIO components were categorized at a relatively high level of technological maturity, indicating that Bank XYZ has implemented digital lending technology with adequate technological readiness. The Technoware component achieved the highest average SOTA value due to the integration of mobile applications, web-based lending systems, core banking systems, and cybersecurity infrastructure that support fast and automated lending processes.

Although the overall SOTA values indicate a high category of technological maturity, several differences were identified among the THIO components. Humanware recorded the lowest SOTA value compared to other components, indicating that human resource capability and digital competency development still require improvement to support sustainable digital transformation. In addition, the scoring engine within the Technoware component also demonstrated relatively lower sophistication compared to other digital infrastructures, suggesting the need for further optimization in analytical capability and automated risk assessment systems. These findings indicate that digital lending effectiveness is influenced not only by technological infrastructure, but also by the integration of human capability, information systems, and organizational support in managing technology-based financial services.

Table 3. State of The Art (SOTA) Assessment Results of THIO Components

Component	**SOTA Value**
Technoware	0.6971
Humanware	0.6567
Infoware	0.6776
Orgaware	0.7063

Technology Contribution Analysis

The technology contribution analysis was conducted to measure the contribution level of each THIO component in supporting the effectiveness of digital lending services at Bank XYZ. The contribution value of each technology component was calculated using the technometric approach by integrating the State of The Art (SOTA) value with the lower and upper sophistication limits of each component. The analysis results showed that Technoware

achieved the highest contribution value among all THIO components. This finding indicates that digital infrastructure, including mobile lending applications, web applications, core banking systems, scoring engines, and cybersecurity infrastructure, plays a dominant role in supporting the operational performance of digital lending services.

Although Technoware demonstrated the highest contribution value, the contribution values of Humanware, Infoware, and Orgaware were also categorized at relatively high levels. The Humanware component reflects the importance of digital competencies and human resource capabilities in managing technology-based financial services. Meanwhile, Infoware represents the role of information systems, customer data integration, and analytical processing in supporting decision-making within digital lending operations. Orgaware also demonstrated a significant contribution, indicating that organizational support, governance structures, and digital transformation strategies are important factors in maintaining technology integration effectiveness. These findings suggest that the success of digital lending transformation is not solely determined by technological infrastructure, but also by the integration of human capability, information systems, and organizational support.

Table 4. Technology Contribution Values of THIO Components

Component	Contribution Value
Technoware	0.6931
Humanware	0.6794
Infoware	0.6750
Orgaware	0.6904

Table 5. Technology Contribution Values of Technoware Subcomponents

Technoware Subcomponent	Contribution Value
Mobile Application Digital Lending	0.7188
Web Application Digital Lending	0.6996
Core Banking System	0.6990
Scoring Engine	0.6571
Security Infrastructure	0.6986

AHP Weighting Analysis

The Analytical Hierarchy Process (AHP) analysis was conducted to determine the strategic priority of each technology component in supporting digital lending transformation at Bank XYZ. The weighting process was performed through pairwise comparisons among the THIO components based on expert judgment from internal stakeholders involved in digital lending operations. The AHP analysis results showed that Humanware obtained the highest priority weight compared to other technology components. This finding indicates that human resource capability, digital competency, and managerial expertise are considered the most strategic factors in supporting the sustainability and effectiveness of digital lending services.

Although Technoware demonstrated the highest actual contribution value in the previous analysis, the AHP results revealed that Humanware has greater strategic importance in supporting future digital transformation initiatives. This condition indicates the existence of a gap between actual technological contribution and strategic organizational priorities. In addition, Orgaware also obtained a relatively high weighting value, reflecting the importance of governance structures, organizational coordination, and digital transformation management in maintaining technology integration effectiveness. The consistency evaluation produced a Consistency Ratio (CR) value below 0.10, indicating that the expert judgments used in the weighting process were logically consistent and acceptable for decision-making purposes. These findings suggest that successful digital lending transformation depends not only on technological infrastructure, but also on the capability of human resources and organizational readiness in managing technology-based financial services.

Table 6. AHP Weighting Results of THIO Components

Component	Weight (β)
Technoware	0.276
Humanware	0.388
Infoware	0.142
Orgaware	0.194

Technology Contribution Coefficient (TCC)

The Technology Contribution Coefficient (TCC) analysis was conducted to evaluate the overall contribution of technology integration in supporting digital lending transformation at Bank XYZ. The TCC value was calculated by integrating the contribution values of Technoware, Humanware, Infoware, and Orgaware with the strategic weighting results obtained from the Analytical Hierarchy Process (AHP). The analysis results showed that the overall TCC value of Bank XYZ's digital lending system reached 0.684, indicating that the contribution of technology implementation is categorized at a high level. This result demonstrates that the integration of digital infrastructure, human capability, information systems, and organizational support has effectively supported the implementation of digital lending services within the bank.

Although the TCC result indicates a relatively high level of technology contribution, the analysis also identified differences between actual technological contribution and strategic organizational priorities. Technoware achieved the highest contribution value due to the strong implementation of mobile applications, core banking systems, and cybersecurity infrastructure. However, Humanware obtained the highest strategic weighting value in the AHP analysis, indicating that human resource capability remains the most critical factor for sustaining digital transformation initiatives. In addition, the relatively lower contribution value of Infoware suggests the need for further improvement in data integration, analytical systems, and scoring engine optimization. These findings indicate that successful digital lending transformation requires not only advanced technological infrastructure, but also

strong human competency, organizational readiness, and integrated information management to ensure sustainable technology implementation.

Table 7. Technology Contribution Coefficient (TCC) Results of Digital Lending System

Component	Contribution Value	Weight (β)
Technoware	0.6931	0.276
Humanware	0.6794	0.388
Infoware	0.6750	0.142
Orgaware	0.6904	0.194
Overall TCC Value 0.684	Category: High	

CONCLUSION AND RECOMMENDATION

The rapid growth of digital lending has encouraged Bank XYZ to strengthen digital transformation through the integration of mobile applications, big data analytics, scoring engines, and cybersecurity infrastructure. The increasing implementation of digital technology has consequently increased the need for a comprehensive evaluation of technology contribution within the digital lending system. The technometric analysis showed that all THIO components were categorized at a high level of contribution, with Technoware achieving the highest contribution value, while Humanware obtained the highest strategic priority weight based on the AHP analysis. The difference between actual contribution and strategic priority indicates that sustainable digital transformation is influenced not only by technological infrastructure, but also by human capability, organizational readiness, and information integration. Furthermore, the overall Technology Contribution Coefficient (TCC) value of 0.684 demonstrates that the integration of technology components at Bank XYZ has effectively supported digital lending transformation and organizational competitiveness in the digital banking industry.

The increasing dependence on digital lending services requires Bank XYZ to continuously strengthen the integration of technology components in order to support sustainable digital transformation. The relatively high contribution of Technoware indicates that digital infrastructure has been implemented effectively, while the higher strategic priority of Humanware suggests that human competency development should become a major organizational focus. Therefore, Bank XYZ is recommended to improve digital capability development programs, strengthen data integration and analytical systems, and optimize scoring engine performance to enhance technology effectiveness and decision-making quality in digital lending operations. In addition, future studies are recommended to integrate financial performance indicators and broader comparative banking data in order to provide a more comprehensive evaluation of technology contribution in the digital banking industry.

REFERENCES

Adamek, J., M. Solarz (2023). Adoption factors in digital lending services offered by FinTech lenders. Oeconomia Copernicana. https://doi.org/10.24136/oc.2023.005.

Hakim, A., D. Setiawan (2025). Multi-Criteria Decision Making (MCDM) Analysis in Vendor Selection Decision-Making Using the Analytical Hierarchy Process (AHP) Method. Qomaruna. https://doi.org/10.62048/qjms.v2i2.89.

Hussain, N. (2023). Peer to Peer Lending Business Agility Strategy for Fintech Startups in the Digital Finance Era in Indonesia. Startupreneur Business Digital (SABDA Journal). https://doi.org/10.33050/sabda.v2i2.340.

Indriartiningtias, R. (2021). Measurement of Technology Capability with Technometric Methods: Case Study at Batik Anugerah, Bangkalan, Madura Island. Jurnal METRIS. https://doi.org/10.25170/metris.v22i01.2608.

Irianto, B., A. Rahman, H. Andayani (2015). Technology Content Analysis with Technometric Theory Approach to Improve Performance in Radiodiagnostic Installation. TELKOMNIKA Indonesian Journal of Electrical Engineering. https://doi.org/10.11591/telkomnika.v14i2.7676.

Jaya, A. (2024). How Do Fintech and Digital Banking Affect Indonesia Digital Bank Share Prices and Trading Volumes?. Revenue Journal: Management and Entrepreneurship. https://doi.org/10.61650/rjme.v2i2.222.

Klungboonkrong, P., W. Chaipanha (2022). Application of Analytical Hierarchy Process (AHP) and Fuzzy Multi-Attribute Decision-Making Approach (FMADM) in the Site Selection of Container Yard Terminal. The Journal of King Mongkut's University of Technology North Bangkok. https://doi.org/10.14416/j.kmutnb.2022.07.011.

Lee, G., A. Megargel (2021). Empowering Singaporeâ€™s SMEs: FinTech P2P lending â€” A lifeline for SMEsâ€™ survival?. Journal of Digital Banking. https://doi.org/10.69554/vbaq4781.

Lee, Y. (2025). UNVEILING KEY CRITERIA FOR EFFECTIVE LEADERSHIP: A MULTI-CRITERIA DECISION-MAKING FRAMEWORK USING TOPIC MODELING AND ANALYTIC HIERARCHY PROCESS (AHP). International Journal of the Analytic Hierarchy Process. https://doi.org/10.13033/ijahp.v17i2.1209.

Mimovic, P., A. Krstic (2016). The integrated application of the AHP and the DEA methods in evaluating the performances of higher education institutions in the Republic of Serbia. Ekonomski horizonti. https://doi.org/10.5937/ekonhor1601071m.

Ms. Ekta, (2025). Digital Transformation in Finance: Impact of Financial Technology (Fintech) on Banking Performance and Customer Satisfaction. International Journal of Advanced Research in Science Communication and Technology. https://doi.org/10.48175/ijarsct-30623.

Nana Dwemoh Benneh, (2025). Fintech Adoption and Digital Banking Transformation: A Structural Analysis of Financial Institutions. International Journal of Computational and Experimental Science and Engineering. https://doi.org/10.22399/ijcesen.5178.

Nurbaiti, N., A. Asmuni, A. Soemitra, I. Imsar, S. Aisyah (2023). Behavior analysis of MSMEs in Indonesia using fintech lending comparative study between sharia fintech

lending and conventional fintech lending. JPPI (Jurnal Penelitian Pendidikan Indonesia). https://doi.org/10.29210/020232273.

Oladimeji, J. (2024). Land Suitability Analysis for Rice Cultivation Using a GIS - based Analytical Hierarchy Process (AHP) Multi - Criteria Decision Making Approach: Kabba / Bunu Local Government Area, Kogi State, Nigeria. International Journal of Science and Research (IJSR). https://doi.org/10.21275/sr24309115421.

Pamisetty, A. (2025). Cloud-Driven Transformation Of Banking Supply Chain Analytics Using Big Data Frameworks. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.5237927.

Pramudito, D., W. Gata, W. Hadikristanto (2025). The Rise of Fintech: Transforming Traditional Banking Through Digital Platforms, Automation, and Big Data. The Journal of Academic Science. https://doi.org/10.59613/ey3jmp43.

Prawira, A., H. Susilowati, R. Ratnaningrum (2025). Assessing How Fintech Peer-to-Peer Lending, Banking Digitization, and Banking Credit Risk Affect the Financial Performance of Indonesian Commercial Banks KBMI 4 in Digital Era. Jurnal Pamator: Jurnal Ilmiah Universitas Trunojoyo. https://doi.org/10.21107/pamator.v17i4.27944.

Rajan, D. (2025). Fintech Disruption of Traditional Banking Services: A Comprehensive Analysis of Digital Transformation in the Financial Sector. International Journal For Multidisciplinary Research. https://doi.org/10.36948/ijfmr.2025.v07i04.53604.

Said, M. (2025). Optimizing Sharia Fintech for Financial Inclusion in Indonesia in the Digital Era: An Islamic Economic Perspective. Balanca: Jurnal Ekonomi dan Bisnis Islam. https://doi.org/10.35905/balanca.v7i1.13214.

Serfes, K., K. Wu, P. Avramidis (2025). FinTech vs. Bank: The impact of lending technology on credit market competition. Journal of Banking & Finance. https://doi.org/10.1016/j.jbankfin.2024.107338.

Shaukat, F., Tusawar Iftikhar Ahmad, Salman Shaukat (2025). Digital Banking Beyond Access: Institutional and Adoption Dynamics of FinTech in South and Southeast Asia. Journal of Agricultural Policy and Transformation. https://doi.org/10.66529/agripat.2025.1.2.26.

Sri Purwati, Nancy Oktyajati, Ica Salsa Bila (2025). Evaluating Sustainable Waste Collection Models Using the Analytical Hierarchy Process (AHP): A Multi-Criteria Decision-Making Approach. Advance Sustainable Science Engineering and Technology. https://doi.org/10.26877/25x2jy26.

Sulthan, H. (2026). Book Review: Fintech and the Transformation of Digital Banking, A Conceptual Review and Its Implications. Islamic Finance and Technology. https://doi.org/10.58968/ift.v3i1.732.

Ulum, B. (2025). Implementation of Sharia Principles in Digital Banking and Financial Technology (Fintech) Services at Bank Syariah Indonesia Jember Branch. JSE: Jurnal Sharia Economica. https://doi.org/10.46773/jse.v4i4.2476.