Journal of Banks and Financial Institutions

Vol 01 (1) 2025 p. 14-25

Corresponding author:
Ashari
Email:
ashari.bprkendaliartha@gmail.com

Received 12 March 2025;
Accepted 17 March 2025;
Published 25 March 2025.

Conflict of interest statement:
The author (s) reported no conflict of interest

DOI: http://doi.org/10.70764/gdpu-jbfi.2025.1(1)-02

BANKING AND FINTECH IN THE DIGITAL FINANCIAL ECOSYSTEM FOR THE UNBANKABLE POPULATION

Ashari [1], Tri Andi Dewantoko [2]

[1]BPR Kendali Artha, Indonesia
[2] Universitas Universitas 17 Agustus 1945 Semarang

ABSTRACT

Objective: This research aims to analyze the role of banking and fintech in building an inclusive digital financial ecosystem for the unbankable. The main focus of the research is to identify challenges, opportunities, and optimal strategies in increasing access to financial services for segments of society that have not been reached by conventional banking.

Research Design & Methods: This study employs a systematic literature review to synthesize existing research in the financial sector, ensuring methodological rigor and transparency while identifying key issues, research gaps, and areas for further exploration.

Findings: The findings reveal that digitalization has significantly changed banking operations, requiring banks to enhance their technological capabilities and regulatory compliance. Fintech plays a crucial role in driving financial sector transformation by expanding access to financial services, especially for the unbanked population. However, cybersecurity risks and data privacy concerns remain key challenges. The success of digital banking transformation depends on technological adaptation, regulatory frameworks, and consumer trust.

Implications & Recommendations: To create an inclusive and sustainable digital financial ecosystem, synergy between banks, fintechs, regulators, and communities is needed. Strategies include improving financial literacy, strengthening digital infrastructure, and developing regulations that support innovation without ignoring consumer protection.

Contribution & Value Added: This study contributes by highlighting the synergistic role of banking and fintech in accelerating financial inclusion for the unbankable. It also offers strategic insights for stakeholders in designing more inclusive and sustainable digital finance policies and innovations.

Keywords: Fintech, Digital financial, Unbankable population

JEL codes: D14, G21, G23
Article type: research paper

INTRODUCTION

The banking industry in Indonesia has undergone significant changes, especially as a result of globalization and digital developments. Banks must adjust to the rapid advancement of information technology, which has changed the way customers access and utilize banking services. This digitalization has driven increased attention to information technology operations, stakeholder engagement, and customer satisfaction (Saputra et al., 2023). Digital banking is now a central issue in the industry, with Artificial Intelligence (AI) and Big Data Analytics (BDA) playing a crucial role in delivering more customer-oriented data-driven services (Indriasari et al., 2019). This change, in line with the growth of banking and digital development, is not only happening to conventional banks, but also to Islamic banks that are adapting to digitalization, thus shaping the new landscape of the banking sector in Indonesia.

The industrial revolution 4.0 has brought about change and progress. The scale and scope of these changes include a comprehensive transformation in production, management and governance systems (Xu et al., 2018). This revolution has made a significant impact through the utilization of the Internet, social networks, and digital devices. These advancements not only improve efficiency in production and management, but also drive innovation in various sectors, including finance. The digitization of financial services has given birth to new business models that are more inclusive and flexible, especially in banking. One of these technological development innovations is commonly referred to as financial technology (fintech), which is increasingly adapting to the needs of modern society.

According to Bank Indonesia, fintech is an integration between financial services and technology that changes the banking business model from a conventional system to a more modern one. The integration of the financial industry and financial technology plays an important role in increasing the reach and inclusion of financial services for the unbanked population in various countries. Optimizing the adoption of fintech expands financial access to formal financial institutions, especially for vulnerable groups such as the unbankable population who mostly live in rural areas far from formal financial institutions (Setiawan et al., 2021). Fintech is seen as a game changer to bring financial services to unreached communities through information technology and the digital financial landscape.

The role of fintech is significant in accelerating the digitization of the financial and banking sectors (Nejad, 2022). It enables automation, digitization of processes and workflows, reduction of paper use, and improved customer experience by replacing the traditional financial system through well-integrated technology and software-based services (Kaur et al., 2021). In particular, fintech adopts technologies such as Artificial Intelligence (AI), machine learning, blockchain, and Internet of Things (IoT) for various financial functions (Demirguc-Kunt et al., 2017; Luo et al., 2022; Tseng et al., 2021). Fintech innovations are gradually revolutionizing the way financial processes are managed. In addition to providing benefits to the financial sector, fintech also has a positive impact on society (Gomber et al., 2018), especially the unbanked or those who do not have access to traditional banking services.

The phenomenon of the unbanked or the inability of people to access formal banking services is a global issue that has a major impact on economic growth and social welfare. Globally, more than 1.4 billion adults remain unbanked, with approximately 44% of the adult population in developing countries lacking access to formal financial services (Anakpo et al., 2023). This situation reflects significant gaps in the financial system, with low-income groups, informal sector workers, and residents in remote areas being the most affected. The COVID-19 pandemic has further exacerbated this by creating new challenges, such as the closure of physical banks, increased reliance on digital transactions, and reduced access to credit for small and medium-sized enterprises. In 2021, the World Bank reported that Indonesia had an estimated 97.74 million unbanked adults, making it the fourth largest unbanked population in the world. This is equivalent to 48% of Indonesia's adult population.

The development of banking digitalization not only brings convenience and efficiency, but also presents new challenges, especially in terms of cybersecurity and data privacy. With more and more transactions being conducted digitally, banks are faced with the risk of increasingly complex cyber-attacks, including data theft, system hacking, and misuse of customer data information (Hassan et al., 2024; Lottu et al., 2023). Thus, financial institutions, especially banks, should increase investment in technology security infrastructure, including data encryption, two-factor authentication, and artificial intelligence (AI)-based anomaly detection systems to prevent and address cyber threats. In addition, the implementation of stricter regulations and comprehensive data protection policies are also crucial aspects in maintaining the security of digital transactions.

The progress, however also highlights the persistence of the digital financial divide, especially in areas that have not been reached by conventional banking infrastructure. People in rural or remote areas often experience limited access to digital banking services due to lack of internet connectivity, low digital financial literacy, and limited technological devices that support digital transactions (Ebirim & Odonkor, 2024; Ferilli et al., 2024). To overcome these challenges, collaboration between the government, financial institutions, and telecommunication service

providers is needed to develop a more inclusive digital infrastructure. In addition, digital financial education programs need to be expanded so that people better understand and can utilize digital banking services safely.

The development of banks in the digital financial ecosystem has the potential to improve financial inclusion, operational efficiency, and customer experience through faster, safer, and technology-based services. Digitalization allows banks and fintech to reach people who previously had difficulty accessing financial services, supported by AI, blockchain, and cloud computing that strengthen transaction security and efficiency. However, the success of this transformation depends on adapting to technological changes, regulatory compliance, and meeting consumer expectations. Therefore, a comprehensive strategy is needed that includes technological innovation, data protection, financial literacy improvement, and collaboration between various stakeholders to build an inclusive and sustainable digital financial ecosystem.

LITERATURE REVIEW

Concept of Unbankable Population

The unbankable population refers to individuals who cannot access formal banking services due to various constraints, such as economic limitations, low levels of financial literacy, or geographical factors that limit the reach of banking services. Awamirillah and Maharani (2022) revealed that this group generally does not have savings accounts in banks and faces difficulties in obtaining conventional financial services. In this case, fintech plays a crucial role in promoting financial inclusion for them. Financial inclusion remains a significant challenge at the global level, with around two billion adults who do not have access to formal banking services (Chu, 2018; Kim et al., 2024). This population, often referred to as "unbankable" or "unbanked," has difficulty accessing basic financial services, such as savings accounts, credit, insurance, and remittance facilities (Chu, 2018) .

The unbanked have several characteristics that distinguish them from groups that have access to formal financial services. First, they generally live in rural or remote areas far from financial institutions, making it difficult for them to access banking services (Setiawan et al., 2021). Second, they have low levels of financial literacy, leading to a lack of understanding of the benefits of banking services and how to use them effectively (Elouaourti & Ibourk, 2024). Third, they often work in the informal sector or have unstable incomes, and therefore do not meet administrative requirements such as pay slips or collateral needed to open an account or apply for a loan (Elouaourti & Ibourk, 2024). Fourth, the unbanked also face limitations in access to technology, such as lack of smartphone ownership and internet access, which further narrows their opportunities to use digital banking services (Elouaourti & Ibourk, 2024). Finally, cultural factors and distrust of formal financial institutions, especially in communities that rely more on traditional financial systems such as savings and loan cooperatives.

The concept of an unbankable population is particularly common in developing countries, where traditional banking infrastructure is limited and access to financial services remains a major challenge (Larios-Hernández, 2017). Key factors contributing to financial exclusion include gender, education level, age and income (Lotto, 2018). Women, for example, face more obstacles in accessing financial services than men due to cultural and social barriers (Triguswinri & Afrizal, 2021). Women are considered younger individuals, those with lower education levels, and low-income groups are more likely to experience financial exclusion (Lotto, 2018).

In the economic context, unbanked individuals generally work in the informal sector, such as street vendors, day laborers, and freelancers, who do not have regular income and official documents such as pay slips or asset collateral needed to access formal banking services. The inability of the unbanked to fulfill administrative requirements limits their access to formal financial services, such as capital loans, safe deposit, and credit history building. As a result, they rely more on the informal financial system, which often has high interest rates and lacks legal protection. Low financial literacy further exacerbates the situation, as many do not understand the benefits of formal financial services or feel burdened by potential hidden costs. Therefore, inclusive policies that include simplifying banking procedures, developing technology-based services, and financial

education are needed to increase the access of the unbanked to safer and more affordable financial services.

Definition and Concept of Digital Banking

Digital banking is seen as a FinTech innovation that enables the provision of financial services to many unbanked people by improving the accessibility and efficiency of services (Odei-Appiah et al., 2022). It encompasses the use of online platforms, digital payments, blockchain technology, and cryptocurrencies have become key components in this transformation, contributing to increased productivity, financial inclusion, and economic growth (Lottu et al., 2023). Digital banking is a financial service system that uses digital technology to provide access to various banking products and services without requiring the physical presence of customers at bank offices. Digital banking is also defined as digital financial services that include transactions through Automated Teller Machine (ATM), Point of Sale (POS), electronic transfers, internet banking, mobile banking, and electronic money (Fernandes et al., 2021). This innovation has brought about major changes in the financial services industry by creating a more inclusive, efficient, and customer-centric ecosystem (Sanyaolu et al., 2024). Digital banking is seen as a disruptive transformation that changes the operational and business models of traditional financial institutions. It involves the integration of technologies such as artificial intelligence, machine learning, and digital payment systems to create more personalized and inclusive financial products and services (Andronie et al., 2023).

According to Tirtawijaya and Wagiman (2023), digital banking includes electronic transactions governed by regulations and prudential principles that manage relationships between banks, customers, and third parties in the financial system. This service allows customers to conduct various banking activities, such as fund transfers, bill payments, account opening, and credit applications, through internet-based platforms or mobile banking applications. In addition, the development of digital transformation in the banking sector is accelerating with the integration of financial technology (fintech)-based financial services, including e-wallets and digital payment systems (Buwono et al., 2022). Despite providing convenience and efficiency, digital banking is also faced with challenges, such as data security risks and customer privacy protection in an increasingly complex digital ecosystem (Nathania et al., 2023). Therefore, the implementation of digital banking must be supported by strict regulations and increased awareness of cybersecurity for all parties involved in the digital financial system.

Technological advances, especially the Open Application Programming Interface (Open API), have encouraged banks to collaborate with fintech and e-commerce to expand the reach of financial services. Open API enables the integration of banking systems with digital financial service providers and e-commerce platforms, so that people who were previously unreachable by the formal financial system can now access banking services more easily (Sakti et al., 2024). This open banking initiative not only increases financial inclusion but also creates more competitive digital-based banking products and services (Long Nguyen & Megargel, 2022). In Indonesia, the implementation of Open API standards, such as the National Open API Payment Standard (NOAPS), is a strategic step in creating a more secure and standardized digital banking ecosystem (Sugarda & Wicaksono, 2023). Collaboration through these Open APIs continues to grow, encouraging banks and fintech to create more inclusive and innovative financial solutions for the wider community.

METHODS

This study is a comprehensive and up-to-date review that aims to summarize findings and identify gaps in research to provide direction for future studies. This review highlights crucial issues in the financial sector based on perspectives from various other sources (Feyen et al., 2021). According to Okoli (2015), a systematic literature review is a structured, explicit, comprehensive, and reproducible approach to identifying, evaluating, and synthesizing various studies that have been conducted and documented by academics, researchers, and practitioners. Conducting a review of existing literature allows for a deeper understanding of the scope and complexity of previous research, while also assisting in identifying gaps that can be further explored. The literature review method in research is used to analyze and synthesize existing knowledge in a particular field.

Literature reviews can be conducted systematically with a transparent and methodological process to increase rigor and strengthen the basis of primary research. Different types of literature reviews, such as systematic reviews and meta-analyses, can be used according to the needs of the research to avoid subjectivity and increase the reliability of the results (Snyder, 2019).

RESULT

Banking and Fintech in the Digital Financial Ecosystem

Banking and fintech are two main elements in a complementary digital financial ecosystem, both of which play a role in providing wider and more accessible financial services to the public. Banking is a traditional financial system that functions as an intermediary in economic activity by providing services such as savings, credit, investment, and various other financial services through institutions that have strict regulations. However, with the development of digital technology, banking has begun to experience disruption due to the emergence of fintech, which adopts technological innovations in financial services to improve accessibility, efficiency, and convenience for its users.

The digital financial ecosystem is an environment that allows financial transactions to be conducted electronically with various services provided by banks and fintechs. Traditional banks have adapted to the digitization of services to remain competitive in the technological era, while fintechs are growing rapidly by offering innovative solutions for people who have not been reached by conventional banking (Söylemez, 2020). With this ecosystem, people can access easier, faster, and more affordable financial services, including digital payments, online loans, and app-based investments (Adelaja et al., 2024). Banking and fintech have become two main pillars in the digital financial ecosystem that complement each other and contribute to the transformation of the global financial system. The integration of banking and fintech in the digital financial ecosystem has significantly changed the financial services landscape, improving financial inclusion and accessibility. Fintech adoption plays an important role in expanding financial access to formal institutions, especially for vulnerable groups such as the unbanked population in rural areas (Setiawan et al., 2021).

Collaboration between banks and fintech has created a more inclusive and efficient digital financial ecosystem. Banks are starting to adopt financial technologies such as open banking and artificial intelligence to improve customer experience and accelerate financial service processes (Dou et al., 2019). Open banking enables greater data integration, allowing customers to access various financial services on a single platform. Meanwhile, fintech plays a role in providing more flexible financial solutions, with a wider reach for people who have not been reached by traditional banking services. Fintech's excellence in digital-based service innovation, such as electronic payments and peer-to-peer lending, further accelerates financial inclusion (Gomber et al., 2018). With this collaboration, both banks and fintech can complement each other, creating solutions that are more secure, efficient, and accessible to the wider community.

Fintech offers innovative solutions that enable faster, more affordable, and inclusive financial services, especially for people who do not have access to traditional banking. With technologies such as mobile banking, digital payments, P2P lending, and blockchain, fintech is able to overcome geographical and administrative barriers (Singh & Johri, 2024). Nonetheless, banks still play an important role in the digital finance ecosystem thanks to their stable infrastructure and high level of trust. To stay relevant, banks are starting to adopt innovations such as open banking to integrate with fintech and improve their competitiveness in the face of digital transformation.

Fintech's Role in Reaching Unbankable Population

Fintech is playing a crucial role in reaching the unbankable by providing technology-based financial services that are more inclusive and accessible. With the adoption of financial technology, fintech is able to overcome geographical, social, and economic barriers that often become a barrier for the unbankable to access formal financial services. The presence of Fintech has provided easier, more efficient, and affordable access to financial services, especially for people in remote areas or who do not have access to traditional financial services. Fintech has great potential in providing

benefits to various parties, including businesses and the general public, through technology-based financial services. The existence of fintech makes purchasing transactions and payment systems more efficient and cost-effective. In addition, fintech contributes to improving financial inclusion by providing digital banking services, electronic payments, and peer-to-peer lending business models. Technological advances also encourage the emergence of new business models and applications related to financial services.

Fintech enables access to financial services through mobile devices for many unbankable people in the world (Senyo & Osabutey, 2020). The greatest value of the fintech sector is the promotion of financial inclusion, enabling a large number of Micro, Small, and Medium Enterprises (MSMEs) and low-income households to access financial services (Hua & Huang, 2021). By utilizing digital infrastructure and interoperable electronic payment systems, fintech has the potential to transform not only the financial sector, but also the economy and society at large, through financial inclusion and sustainable development (Arner et al., 2020).

Fintech is not only beneficial for the general public, but also for Micro, Small, and Medium Enterprises (MSMEs), which often face challenges in gaining access to finance and conventional banking services (Aziz et al., 2020). The MSME sector plays a crucial role in driving economic growth. Fintech acts as a key driver in increasing MSME access and participation in financial inclusion programs, thus helping this sector develop more optimally. Fintech is considered very potential in supporting the MSME sector, especially in terms of business capital financing, digital payment services, and financial management. To further expand financial inclusion, the government can encourage collaboration between the banking sector and fintech companies. Banks can act as investors by investing in fintech companies, allowing fintechs to perform their duties more effectively and efficiently at a lower cost. Therefore, synergy and close cooperation are needed to develop a fintech system that can drive digital economic growth for people who do not have access to banking services.

Another advantage of fintech is the efficiency and speed in providing financial services. By utilizing digital technology, the transaction process, fund disbursement, and financial management can be done faster than the conventional banking system. This is very beneficial for people in remote areas (Buwono et al., 2022). With these benefits, fintech has become an innovative solution in improving financial inclusion and helping the unbankable to more easily access financial services that were previously difficult to reach.

Strategies to Optimize Fintech and Banking Collaboration

Collaboration between fintechs and banks has become a key strategy in improving the quality of financial services, accelerating innovation, and expanding financial inclusion. Recent research shows that diversified partnerships between banks and fintechs can provide significant benefits, especially in improving risk-adjusted returns for banks, especially for large banks and state-owned banks (Le et al., 2024). According to Khudhori and Hendri (2021) study, the most beneficial forms of cooperation include the development of more innovative financing services, the utilization of fintech's technology network by banks, and regulatory policies that support the sustainability of such collaboration.

Banks that have a mature digital strategy tend to be more active in forging partnerships with fintech, either through investing in fintech startups or by establishing product cooperation with established fintech companies (Hornuf et al., 2021). In the context of small-scale banks, such as rural banks (BPRs), integration with fintech lending services has been shown to improve operational efficiency and profitability, creating mutually beneficial synergies for both parties (Asi & Gularso, 2023). Thus, collaboration between banking and fintech not only encourages the growth of the financial industry but also accelerates adaptation to technological changes and market needs.

Effective collaboration between fintech companies and banking institutions requires a comprehensive approach by integrating technological innovation, customer needs-based services, and prudent risk management. By optimizing their respective advantages, fintechs and banks can build a more solid and inclusive financial ecosystem, provide broader benefits to customers, and maintain financial system stability.

Table 1. Collaboration Strategy of Bank with Fintech

Collaboration Strategy	Explanation	References
Building strategic collaborations	Banks can collaboration with fintech companies to expand their services and improve operational efficiency. Through this collaboration, banks can adopt fintech innovations while maintaining their existing customer base and ensuring regulatory compliance. These partnerships also allow banks to combine technological innovation with effective risk management strategies.	(Drasch et al., 2018; Yu, 2024)
Focusing on customer-driven solutions	Fintech companies have an advantage in providing customer-oriented services, and banks can learn from this approach. Through collaboration, banks can improve the user experience and design services that are more tailored to individual needs.	(Drasch et al., 2018; Werth et al., 2023)
Allocate investment in the latest technology	Banks need to invest in technologies such as blockchain, artificial intelligence, and machine learning to strengthen their capabilities and stay competitive against fintech innovations. The adoption of these technologies can improve financial stability in the banking ecosystem while reducing the potential for disruption.	(Rjoub et al., 2023; Varma et al., 2022)
Tackling regulatory barriers	Collaboration between banks, fintech companies, and regulators is crucial to building an inclusive fintech ecosystem, increasing access to financial services, and ensuring its sustainability. This collaboration can also help address challenges related to regulation and governance risks.	(Ebirim & Odonkor, 2024; Yu, 2024)
Maintaining a balance between innovation and risk management	Banks must achieve the optimal point of adopting fintech innovation while effectively managing capital risk. Studies show that fintech can support banks in optimizing asset allocation as well as act as a countercyclical factor in reducing risk.	(Yu, 2024)

Optimizing collaboration between fintech and banks has broad positive impacts on the financial industry, customers, and economic stability. One of the main advantages is the increased efficiency of financial services through digitalization, which allows transactions to be faster, easier, and accessible without geographical restrictions (Buwono et al., 2022). In addition, this cooperation opens access to finance for underserved groups, such as MSMEs and communities in remote areas or unbankable communities, through more flexible financing schemes (Padli, 2021). For banks, the integration of fintech technology helps increase profitability by reducing operational costs and accelerating adjustments to the development of the digital economy (Tazza & Sari, 2024). Furthermore, this collaboration also strengthens risk mitigation by implementing more sophisticated digital security systems and stricter regulations, thereby increasing public trust in digital-based financial services (Nathania et al., 2023).

DISCUSSION

As with other industries, the financial sector is also experiencing the impact of advances in digital technology. While most banks have started the digitization process with a clear direction, financial institutions in general are still moving slowly. This provides an opportunity for startups and large technology companies to emerge as competitors. The presence of these new competitors is a real threat, and their impact is increasingly significant. Banks must embrace digitalization as a necessity, completely transforming the way they deliver services and interact with customers, both individuals and corporates. This is driven by two main factors: the rapid digitization of various economic sectors and the emergence of new competitors in the financial industry that adopt innovative technology-based business models.

Along with the advancement of digital technology, the financial sector is experiencing significant changes, which requires banks to quickly adopt digitalization to maintain their competitiveness. Although many banks have started the digitization process, this transformation is still slow compared to the rapid development of technology. Noviandra and Santoso (2023) study shows that the industrial revolution 4.0 has driven digitalization in the financial sector, requiring banks to adopt more dynamic policies to keep up with the times.

The unpreparedness of banks in adapting to digital technology opens up opportunities for startups and tech giants to take over roles previously held by traditional financial institutions. Research also shows that banks that do not immediately adopt digitalization will face declining profitability and assets, while competitors that are faster in technological innovation will increasingly dominate the market (Amal et al., 2024). Therefore, digitalization is no longer an option, but a necessity for banks to survive in the digital economy era and face challenges from new competitors that adopt innovative technology-based business models.

To promote financial inclusion through fintech, the government needs to accelerate the improvement of Information and Communication Technology (ICT) infrastructure, such as expanding mobile broadband penetration and developing policies that support digital innovation. Studies show that digitalization in the financial sector, including the adoption of fintech, can increase access to financial services for people who have not been reached by conventional banking (Buwono et al., 2022). In addition, the regulatory sandbox implemented by the government allows fintech companies to test innovative products with more flexible supervision before they are widely implemented, thereby reducing risks and increasing public trust in digital services (Alfarizi, 2022). Collaboration between banks and fintechs is also an important factor in expanding the reach of financial services, especially for the unbankable segment who need access to microloans and digital payment systems (Das & Das, 2020). With the right approach and strong regulatory support, fintech can be an effective tool to improve financial inclusion and drive more inclusive economic growth for the unbanked.

CONCLUSION

The banking industry in Indonesia has undergone significant changes due to globalization and digital developments. Banks have had to adapt to rapid advances in information technology, which has changed the way customers access and utilize banking services. Digitalization has led to increased attention to information technology operations, stakeholder engagement, and customer satisfaction. The industrial revolution 4.0 has brought about change and progress, with the scale and scope of these changes encompassing a comprehensive transformation in production, management and governance systems. Fintech plays an important role in accelerating the digitization of the financial and banking sectors. However, this development also presents new challenges, particularly in terms of cybersecurity and data privacy. The phenomenon of the unbanked, or the inability of people to access formal banking services, is a global problem that has a significant impact on economic growth and social welfare. The development of banking within the digital financial ecosystem has the potential to improve financial inclusion, operational efficiency and customer experience through faster, safer and technology-driven services. The success of this transformation depends on adapting to technological change, regulatory compliance, and meeting consumer expectations. Therefore, a comprehensive strategy is needed that includes technological innovation, data protection, improved financial literacy, and multi-stakeholder collaboration to build an inclusive and sustainable digital financial ecosystem.

REFERENCES

Adelaja, A. O., Umeorah, S. C., Abikoye, B. E., & Nezianya, M. C. (2024). Advancing financial inclusion through fintech: Solutions for unbanked and underbanked populations. *World Journal of Advanced Research and Reviews*, *23*(2), 427–438. https://doi.org/10.30574/wjarr.2024.23.2.2379

Alfarizi, M. (2022). Studi Eksplorasi Penerimaan Digitalisasi Pembayaran Zakat Melalui Aplikasi Fintech Indonesia PascaPandemi Covid-19. *An-Nisbah: Jurnal Ekonomi Syariah*, *9*(2), 410–443. https://doi.org/10.21274/an.v9i2.5982

Amal, I. I., Hafida, H. F. nur, Salsabila, H. A., & Faradila, I. (2024). Pengaruh NPF Gross, ROA, ROE, Terhadap Total Aset Perbankan Syariah Indonesia Tahun 2020-2021. *RIBHUNA : Jurnal Keuangan Dan Perbankan Syariah*, *3*(2), 84-95. https://doi.org/10.69552/ribhuna.v3i2.2202

Anakpo, G., Xhate, Z., & Mishi, S. (2023). The Policies, Practices, and Challenges of Digital Financial Inclusion for Sustainable Development: The Case of the Developing Economy. *FinTech*, *2*(2), 327–343. https://doi.org/10.3390/fintech2020019

Andronie, M., Iatagan, M., Uță, C., Hurloiu, I., Dijmărescu, A., & Dijmărescu, I. (2023). Big data management algorithms in artificial Internet of Things-based fintech. *Oeconomia Copernicana*, *14*(3), 769–793. https://doi.org/10.24136/oc.2023.023

Arner, D. W., Buckley, R. P., Zetzsche, D. A., & Veidt, R. (2020). Sustainability, FinTech and Financial Inclusion. *European Business Organization Law Review*, *21*(1), 7–35. https://doi.org/10.1007/s40804-020-00183-y

Asi, H., & Gularso, K. (2023). Analysis of Collaboration Between Rural Banks and Fintech Lending. *Jurnal Indonesia Sosial Sains*, *4*(12), 1285–1302. https://doi.org/10.59141/jiss.v4i12.950

Awamirillah, Q. F., & Maharani, S. (2022). Peningkatan Akses Layanan Keuangan pada Masyarakat Unbanked di Indonesia melalui Financial Technology. *Journal of Economics, Law, and Humanities*, *1*(2), 136–145. https://doi.org/10.21154/jelhum.v1i2.1198

Aziz, A., Lestari, D. M., & Furwanti, R. (2020). Sinergitas Perbankan dan Financial Technology: Ikhtiar Menuju Inklusifitas Keuangan Masyarakat Unbankable. *Jurnal Dinamika Ekonomi & Bisnis*, *17*(1), 37–47. https://doi.org/10.34001/jdeb.v17i1.1058

Buwono, S. R., Abubakar, L., & Handayani, T. (2022). Kesiapan Perbankan Menuju Transformasi Digital Pasca Pandemi Covid-19 Melalui Financial Technology (Fintech). *Jurnal Poros Hukum Padjadjaran*, *3*(2), 228–241. https://doi.org/10.23920/jphp.v3i2.764

Chu, A. B. (2018). Mobile Technology and Financial Inclusion. In *Handbook of Blockchain, Digital Finance, and Inclusion, Volume 1* (pp. 131–144). Elsevier. https://doi.org/10.1016/B978-0-12-810441-5.00006-3

Das, A., & Das, D. (2020). Perception, Adoption, and Pattern of Usage of FinTech Services by Bank Customers: Evidences from Hojai District of Assam. *Emerging Economy Studies*, *6*(1), 7–22. https://doi.org/10.1177/2394901520907728

Demirguc-Kunt, A., Klapper, L., & Singer, D. (2017). Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence. *Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence*, *April*. https://doi.org/10.1596/1813-9450-8040

Dou, J.-P., Li, H., Pang, X.-L., Zhang, C.-N., Yang, T.-H., & Jin, X.-M. (2019). Research Progress of Quantum Memory. *Acta Physica Sinica*, *68*(3), 030307. https://doi.org/10.7498/aps.68.20190039

Drasch, B. J., Schweizer, A., & Urbach, N. (2018). Integrating the 'Troublemakers': A Taxonomy for Cooperation Between Banks and Fintechs. *Journal of Economics and Business*, *100*, 26–42. https://doi.org/10.1016/j.jeconbus.2018.04.002

Ebirim, G. U., & Odonkor, B. (2024). Enhancing Global Economic Inclusion with Fintech Innovations and Accesibility. *Finance & Accounting Research Journal*, *6*(4), 648–673. https://doi.org/10.51594/farj.v6i4.1067

Elouaourti, Z., & Ibourk, A. (2024). Financial Technologies for All MENA Citizens: Tackling Barriers and Promoting Inclusion. *Regional Science Policy & Practice*, *16*(6), 100019. https://doi.org/10.1016/j.rspp.2024.100019

Ferilli, G. B., Palmieri, E., Miani, S., & Stefanelli, V. (2024). The impact of FinTech Innovation on Digital Financial Literacy in Europe: Insights from the Banking Industry. *Research in International Business and Finance*, *69*, 102218. https://doi.org/10.1016/j.ribaf.2024.102218

Fernandes, C., Borges, M. R., & Caiado, J. (2021). The Contribution of Digital Financial Services to Financial Inclusion in Mozambique: an ARDL Model Approach. *Applied Economics*, *53*(3), 400–409. https://doi.org/10.1080/00036846.2020.1808177

Feyen, E., Frost, J., Gambacorta, L., Natarajan, H., & Saal, M. (2021). Fintech and the Digital Transformation of Financial Services: Implications for Market Structure and Public Policy. In *BIS Papers* (Vol. 117, Issue 117). http://www.bis.org/publ/bppdf/bispap117.htm

Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. *Journal of Management Information Systems*, *35*(1), 220–265.

https://doi.org/10.1080/07421222.2018.1440766

Hassan, A. O., Ewuga, S. K., Abdul, A. A., Abrahams, T. O., Oladeinde, M., & Dawodu, S. O. (2024). Cybersecurity in Banking: A Global Perspective with a Focus on Nigerian Practices. *Computer Science & IT Research Journal*, *5*(1), 41–59. https://doi.org/10.51594/csitrj.v5i1.701

Hornuf, L., Klus, M. F., Lohwasser, T. S., & Schwienbacher, A. (2021). How Do Banks Interact with Fintech Startups? *Small Business Economics*, *57*(3), 1505–1526. https://doi.org/10.1007/s11187-020-00359-3

Hua, X., & Huang, Y. (2021). Understanding China′s Fintech Sector: Development, Impacts and Risks. *The European Journal of Finance*, *27*(4–5), 321–333. https://doi.org/10.1080/1351847X.2020.1811131

Indriasari, E., Gaol, F. L., & Matsuo, T. (2019). Digital Banking Transformation: Application of Artificial Intelligence and Big Data Analytics for Leveraging Customer Experience in the Indonesia Banking Sector. *2019 8th International Congress on Advanced Applied Informatics (IIAI-AAI)*, 863–868. https://doi.org/10.1109/IIAI-AAI.2019.00175

Kaur, G., Habibi Lashkari, Z., & Habibi Lashkari, A. (2021). Introduction to FinTech and Importance Objects. In *In: Understanding Cybersecurity Management in FinTech. Future of Business and Finance* (pp. 1–15). https://doi.org/10.1007/978-3-030-79915-1_1

Khudhori, K. U., & Hendri, L. (2021). Islamic Banking and Fintech: Sustainable Collaboration. *Al-Intaj : Jurnal Ekonomi dan Perbankan Syariah*, *7*(2), 172-182. https://doi.org/10.29300/aij.v7i2.4881

Kim, K. T., Xiao, J. J., & Porto, N. (2024). Financial Inclusion, Financial Capability and Financial Fragility During COVID-19 Pandemic. *International Journal of Bank Marketing*, *42*(3), 414–436. https://doi.org/10.1108/IJBM-07-2023-0373

Larios-Hernández, G. J. (2017). Blockchain Entrepreneurship Opportunity in the Practices of the Unbanked. *Business Horizons*, *60*(6), 865–874. https://doi.org/10.1016/j.bushor.2017.07.012

Le, T., Ngo, T., Nguyen, D. T., & Do, T. T. M. (2024). Fintech and Banking: Friends or Foes? Evidence From Bank–Fintech Cooperation. *International Journal of Bank Marketing*, *42*(7), 1513–1535. https://doi.org/10.1108/IJBM-09-2023-0525

Long Nguyen, H. H., & Megargel, A. (2022). Strategic Business Models Under Open Banking: A Guideline For Incumbent Banks. *Journal of Digital Banking*, *6*(4), 366-380. https://doi.org/10.69554/YZFK7239

Lotto, J. (2018). Examination of the Status of Financial Inclusion and Its Determinants in Tanzania. *Sustainability*, *10*(8), 2873. https://doi.org/10.3390/su10082873

Lottu, O. A., Abdul, A. A., Daraojimba, D. O., Alabi, A. M., John-Ladega, A. A., & Daraojimba, C. (2023). Digital Transformation in Banking: A Review of Nigeria′s Journey to Economic Prosperty. *International Journal of Advanced Economics*, *5*(8), 215–238. https://doi.org/10.51594/ijae.v5i8.572

Luo, S., Sun, Y., Yang, F., & Zhou, G. (2022). Does Fintech Innovation Promote Enterprise Transformation? Evidence from China. *Technology in Society*, *68*, 101821. https://doi.org/10.1016/j.techsoc.2021.101821

Nathania, S. A., Abubakar, L., & Handayani, T. (2023). Implikasi Hukum Pemanfaatan Open Application Programming Interface Terhadap Layanan Perbankan Dikaitkan dengan Ketentuan Perbankan Digital. *Jurnal Poros Hukum Padjadjaran*, *4*(2), 244–259. https://doi.org/10.23920/jphp.v4i2.1209

Nejad, M. G. (2022). Research on Financial Innovations: An Interdisciplinary Review. *International Journal of Bank Marketing*, *40*(3), 578–612. https://doi.org/10.1108/IJBM-07-2021-0305

Noviandra, N., & Santoso, B. (2023). Dampak Revolusi Industri 4.0 terhadap Digitalisasi Kebijakan Fidusia. *Notarius*, *16*(3), 1514–1527. https://doi.org/10.14710/nts.v16i3.42305

Odei-Appiah, S., Wiredu, G., & Adjei, J. K. (2022). Fintech Use, Digital Divide and Financial Inclusion.

Digital Policy, Regulation and Governance, *24*(5), 435–448. https://doi.org/10.1108/DPRG-09-2021-0111

Okoli, C. (2015). A Guide to Conducting a Standalone Systematic Literature Review. *Communications of the Association for Information Systems*, *37*(1), 879–910. https://doi.org/10.17705/1cais.03743

Padli, M. S. (2021). Integrasi Perbankan dan Fintech Syariah Guna Mendukung Merger Bank Bumn Syariah dan Kesejahteraan Sektor Pertanian Indonesia Era Covid-19. *Muslim Heritage*, *6*(2), 303–324. https://doi.org/10.21154/muslimheritage.v6i2.2878

Rjoub, H., Adebayo, T. S., & Kirikkaleli, D. (2023). Blockchain Technology-Based Fintech Banking Sector Involvement Using Adaptive Neuro-Fuzzy-Based K-Nearest Neighbors Algorithm. *Financial Innovation*, *9*(1), 65-. https://doi.org/10.1186/s40854-023-00469-3

Sakti, M., Utami, K., & Sulastri. (2024). The Urgency of Standardizing the Open Application Pogramming Interface in Implementation of Open Banking For Customer Protection. *Jurnal Hukum Samudra Keadilan*, *19*(1), 29–44. https://doi.org/10.33059/jhsk.v19i1.7471

Sanyaolu, T. O., Adeleke, A. G., Azubuko, C. F., & Osundare, O. S. (2024). Exploring Fintech Innovations and Their Potential to Transform the Future of Financial Services And Banking. *International Journal of Scholarly Research in Science and Technology*, *5*(1), 54–72. https://doi.org/10.56781/ijsrst.2024.5.1.0033

Saputra, I., Murwaningsari, E., & Augustine, Y. (2023). Enterprise Risk Management, Management Control Systems, and Digital Banking Transformation Analysis on the Evaluation of Sustainable Banking in Indonesian Banking. *Journal of Law and Sustainable Development*, *11*(3), e715. https://doi.org/10.55908/sdgs.v11i3.715

Senyo, P., & Osabutey, E. L. C. (2020). Unearthing Antecedents to Financial Inclusion Through Fintech Innovations. *Technovation*, *98*, 102155. https://doi.org/10.1016/j.technovation.2020.102155

Setiawan, B., Nugraha, D. P., Irawan, A., Nathan, R. J., & Zoltan, Z. (2021). User Innovativeness and Fintech Adoption in Indonesia. *Journal of Open Innovation: Technology, Market, and Complexity*, *7*(3), 188. https://doi.org/10.3390/joitmc7030188

Singh, A., & Johri, D. S. (2024). Emerging Trends in Fintech: Revolutionizing Financial Services in Commerce. *International Journal For Multidisciplinary Research*, *6*(2). https://doi.org/10.36948/ijfmr.2024.v06i02.15546

Snyder, H. (2019). Literature Review As A Research Methodology: An Overview And Guidelines. *Journal of Business Research*, *104*, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Söylemez, Y. (2020). Fintech Ecosystem and Banking: The Case of Turkey. In U. Hacioglu (Ed.), *Handbook of Research on Strategic Fit and Design in Business Ecosystems* (pp. 332-353). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-7998-1125-1.ch014

Sugarda, P. P., & Wicaksono, M. R. (2023). Enhancing The Competitiveness Of Indonesia's Financial Services Sector in The Digital Era Through Open Banking: Lessons Learned From The UK's Experience. *Journal of Central Banking Law and Institutions*, *2*(1), 153-178. https://doi.org/10.21098/jcli.v2i1.63

Tazza, A., & Sari, A. R. (2024). Pengaruh Pemanfaatan Teknologi Finansial Terhadap Profitabilitas Perbankan (Studi Empiris Pada 5 Entitas Perbankan Konvesional Di Indonesia). *Jurnal Media Akuntansi (Mediasi)*, *7*(1), 146–160. https://doi.org/10.31851/jmediasi.v7i1.16579

Tirtawijaya, Y. K., & Wagiman, W. (2023). Analisis Penguatan Sistem Perbankan Digital Di Indonesia Berdasarkan Asas-Asas Perbankan. *Jurnal Ilmiah Ecosystem*, *23*(1), 172–186. https://doi.org/10.35965/eco.v23i1.2493

Triguswinri, K., & Afrizal, T. (2021). Eksklusi Sosial dalam Kapital Digital dan Kebijakan Virtual (Studi Filantropi Platform KitaBisa.com). *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *7*(3), 303. https://doi.org/10.32884/ideas.v7i3.394

Tseng, F.-M., Palma Gil, E. I. N., & Lu, L. Y. Y. (2021). Developmental Trajectories of Blockchain Research and its Major Subfields. *Technology in Society*, *66*, 101606.

https://doi.org/10.1016/j.techsoc.2021.101606

Varma, P., Nijjer, S., Sood, K., Grima, S., & Rupeika-Apoga, R. (2022). Thematic Analysis of Financial Technology (Fintech) Influence on the Banking Industry. *Risks*, *10*(10), 186. https://doi.org/10.3390/risks10100186

Werth, O., Cardona, D. R., Torno, A., Breitner, M. H., & Muntermann, J. (2023). What Determines FinTech Success?–A Taxonomy-Based Analysis of FinTech Success Factors. *Electronic Markets*, *33*(1), 21. https://doi.org/10.1007/s12525-023-00626-7

Xu, M., David, J. M., & Kim, S. H. (2018). The Fourth Industrial Revolution: Opportunities and Challenges. *International Journal of Financial Research*, *9*(2), 90. https://doi.org/10.5430/ijfr.v9n2p90

Yu, J. (2024). Stabilizing Leverage, Financial Technology Innovation, and Commercial Bank Risks: Evidence from China. *Economic Modelling*, *131*, 106599. https://doi.org/10.1016/j.econmod.2023.106599