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Digital banking research trends: a bibliometric analysis of banking technology developments

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Abstract

Purpose – This research aims to analyze the trend of digital banking research on the development of banking technology through a bibliometric approach.
Methodology – The method used in this study uses a mixed-method, which is a combination of quantitative methods in the form of a bibliometric analysis approach and qualitative methods in the form of a literature review study. The data in this study were obtained from secondary data. Data analysis tools use Mendeley Desktop and VOSviewer software. The analysis was conducted on abstracts and research keywords related to the development of digital banking-based banking technology.
Findings – The results of the study show that based on the mapping of journal publications, there are 76 articles on the development of digital banking technology, the results of network visualization around the development of digital banking technology are divided into 6 clusters and 25 topic items.
Implications – There are four problems that are challenges in the development of banking technology, 1) cybersecurity, 2) digital financial literacy, 3) infrastructure gaps, 4) regulation and compliance.
Originality – There has never been a study that use bibliometric analysis to find main problems on digital banking and give the implication to development of banking technology.

Introduction

Recent years have seen a substantial shift in the banking sector, particularly with the adoption of automated digital banking systems. Enhanced customer service and increased operational efficiency have been made possible by this transformation. With these modifications, the use of integrated digital technology is replacing manual methods and paper records (Irsyad et al., 2024). Banks have a great opportunity to meet higher customer satisfaction, improve operational effectiveness, and expand access to financial services through digital transformation (Shkarlet et al., 2020).

As is well known, one industry that has the potential to boost the Indonesian economy is the banking industry. Banking contributes to Indonesia's growth by providing revenue streams for banks. Bank income can come from fee-based income, banking margins, and other sources. Unsettled economic fluctuations like today, of course, greatly impact and risk the banking industry (Johan, 2024). Corporate or business changes are triggered by rapid technological advances due to the accelerated pace of technological innovation (Ardianto et ., 2024). If previously technological

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innovation was limited to internal banking, there has now been a significant shift in recent years, because innovation has now penetrated the consumer or customer side (Susilawaty & Nicola, 2020).

Banking services are becoming interconnected and complex due to the growth of digitalization. Modern consumers want more effective, simple, and efficient services, which is possible with the help of advanced digital technology (Parapat et al., 2024). Financial technology or known as Fintech, as used in various banking institutions, fintech is one area that is currently the focus of Indonesia's attention. It is an innovation in the financial services sector that combines contemporary technology with financial services (Marginingsih, 2019). Fintech companies provide a wide range of financial services, including asset management, payments, financing, and many others. The main focus of fintech use in Indonesia is the development of payment instruments, bank transfers, e-wallets, and peer-to-peer transfers. And these technologies continue to improve and evolve to create new trends every year (Bere et al., 2022).

With the development of the creative economy, Indonesia has significant opportunities to support economic growth, especially in the banking sector (Tartila & Asmuni, 2022). In today's modern banking era, it is expected that banking institutions can take advantage of this opportunity to continue to grow. The gradual and sustainable implementation of digital financial services is one of the strategies that can be used (Mawarni et al., 2021). According to Cupian et al. (2022) one innovation that has the potential to increase competition in the Indonesian banking market is digital banking. With digital banking services, banks can attract more customers, especially from young people who are considered early adopters of technology. When digital banking is able to attract young customers, it will have a quite positive impact on the competitiveness of Indonesian banking in the future (Maghfiroh & Dwiridotjahjono, 2023).

The Financial Services Authority or Otoritas Jasa Keuangan (OJK) explains, digital banking is included as banking activities or services carried out through electronic or digital banking devices and can be accessed by customers themselves through digital media. Customers can conduct and receive information, communication, registration, banking transactions, account withdrawals, e-commerce transactions, financial consultations, and investments through this service (Yudhanto et al., 2022). It is intended that banks can improve their operational excellence and provide the best service to consumers. Therefore, it is expected that banks can create their own digital banking (Vebiana, 2018).

Technology changes with human evolution over time. Humans sometimes want to acquire things easily to fulfill all their needs. With digital technology, anything can be done easily nowadays. This has gradually extended to the financial industry especially banking. In addition, people started learning about fintech around 2015 (Kholis, 2020). Financial technology is used by almost all banks in their service applications, such as internet banking, mobile banking, or others. Along with the development of the digital era, the banking sector continues to build digital banking technology (Chrismastianto, 2017). This is done to steal the attention and interest of new customers, especially those in the modern era or millennial generation (Mutiasari, 2020).

The banking industry will certainly face challenges to survive and grow rapidly in the business in the banking sector with this digital transformation. When compared to other industrial sectors, the banking sector is the most lagging sector in terms of digital transformation (Suganda & Mujib, 2023). The COVID-19 outbreak has accelerated innovation in the Islamic banking sector, which has led to the development of digital products. All digital services can reduce human contact when Large Scale Social Restrictions (PSBB) are in place (Shabri et al., 2022). According to Wewege et al. (2020) the banking and fintech sectors will continue to evolve in a number of ways as the new decade begins. With the financial ecosystem fully digitally transformed, digital technologies such as blockchain and artificial intelligence, data platforms, cybersecurity regtech, and strategic alliances will essentially be well positioned to survive in the banking industry.

A bibliometric analysis study is a research technique used to quantitatively evaluate and analyze literature or information sources on a particular topic. This approach entails collecting information from bibliographic databases, such as Web of Science or Scopus, to assess the features of publications and formulate trends and patterns in them. Bibliometric studies can be used to map

collaborative networks between researchers and institutions, identify and investigate the most frequently mentioned research topics in a field, and measure the impact or influence of a study using metrics such as journal impact factors or citation counts (Budianto & Dewi, 2023). In practice, bibliometric studies are often used in scientific research that is used as a decision-making tool in various fields, such as market or industry research, institutional or researcher performance evaluation, and public policy making (Dubyna et al., 2022)

This research aims to analyze the development trend of digital banking technology through a bibliometric approach. This research aims to identify research patterns related to digital banking, evaluate the impact of digital technology development on the banking industry, and map the opportunities and challenges that must be faced by banking institutions in Indonesia in adopting digital banking services.

Literature Review

Digital Banking

According to the Financial Services Authority or Otoritas Jasa Keuangan (OJK) (2023) digital banking is any banking activity or service that makes use of electronic or digital banking equipment and that clients can access on their own via digital media. Digital banking is a transformation of banking services where the entire process is conducted digitally, utilizing information technology and the internet, without the need to visit a branch office. Digital banks typically have no physical branches or only a few, as all activities are conducted through a secure and efficient electronic system (Hasanah et al., 2024). This allows customers to make and receive communications, registration, banking transactions, account withdrawals, e-commerce transactions, financial information consultations, and investments (Chrismastianto, 2017). The objective is for banks to enhance the quality of their operations and provide the best possible customer service. Banks should be able to create their own digital banking as a result (Suganda & Mujib, 2023).

Development of Banking Technology

In his research, Kholis (2020) clarified that technology has changed throughout time to match the advancement of humanity. People have always looked for convenience to fulfill their needs. These days, digital technology makes everything simple. This has gradually extended to the financial industry such as banking. Additionally, the public started to learn about Fintech around 2015 (Rahman & Astria, 2023). Financial technology, such as online banking and mobile banking, has been incorporated into the services offered by almost all banks. As we move into the digital age, the banking sector is creating more and more digital banking technologies. This is being done in an effort to draw in new clients, particularly millennials or contemporary consumers (Susanti, 2024). Entering the era of the fintech and open banking revolution from the 2010s to the present, technology has played an increasingly important role in creating a more efficient, faster, and more secure banking system. Collaboration between banks and financial technology (fintech) companies has given rise to various innovations (Huang et al., 2016).

Digital Tranformation

Digital transformation is a challenge for the banking industry, as banks are required to remain competitive in the financial sector. The banking industry is arguably lagging behind other industries in terms of digital transformation. The primary goal is to improve efficiency, speed, innovation, and service quality, while adapting to the needs and behaviors of a society increasingly reliant on technology. Digital transformation encompasses more than just the use of technological devices; it also encompasses changes in work culture, business strategy, and mindset to become more adaptive to changing times (Trimulyana, 2024). The implementation of Large Scale Social Restrictions (PSBB) allowed all digital services to reduce in-person interactions between individuals, and the Covid-19 pandemic has spurred innovation in the Islamic banking sector to provide digital goods (Shabri et al., 2022). The banking and fintech sectors will continue to expand across a range of business models as we approach the new decade. They will be in a fundamentally

better position to prosper in a banking sector that has completely undergone digital transformation thanks to digital technologies like blockchain and artificial intelligence, data platforms, cybersecurity regtech, and strategic alliances (Sila & Martini, 2020).

Bibliometric Analysis

According to Budianto & Dewi (2023) One research technique for quantitatively analyzing literature or information sources in a certain topic is bibliometric analysis. This approach entails gathering information from bibliographic databases, such Web of Science or Scopus, in order to assess the features of publications and look for trends and patterns within them. Bibliometric studies may be used to map collaboration networks between researchers and institutions, discover and examine the most frequently discussed research issues in a field, and evaluate the effect or influence of a study using metrics such as the journal impact factor or the number of citations. In reality, bibliometric studies are frequently employed in scientific research and as a tool for decision-making in a variety of domains, including market or industrial research, institutional or researcher performance evaluation, and the creation of public policies (Dubyna et al., 2022).

Research Methods

This research uses a mixed-method, which is a combination of quantitative methods in the form of a bibliometric analysis approach and qualitative methods in the form of literature review studies. The data collection technique in this study uses secondary data sources obtained from searching Sinta accredited national journals through the Google Scholar and Garuda (Garba Rujukan Digital) websites. Mendeley Dekstop and VOSviewer software are data analysis tools used in this research.

The following are the stages of data collection techniques: 1) visiting the Google Scholar website, then searching for journal titles based on the title category with the keywords "development of digital banking technology" within the period 2017-2024; 2) collecting journal title data in Microsoft Excel, and identifying the same journal titles; 3) downloading PDF (Portable Document Format) and RIS (Research Information Systems) format files from all journals that have collected data; then 4) entering RIS data files into Mendeley Desktop software.

The following are several stages of data analysis techniques: 1) mapping RIS data files on Mendeley Desktop based on the order of year, author, publisher, abstract, and keywoards; 2) mapping the results of bibliometric network visualization and trends in scientific publications using the VOSviewer (Visualization of Similarities) algorithm software based on the number of items and clusters; then 3) mapping topics and research findings around the development of banking technology using literature review studies (Rohimah et al., 2019).

Results and Discussion

Mapping the Distribution of Scientific Publications Banking Technology Developments

There are 76 scientific articles based on the results of data collection using Mendeley Dekstop from the Google Scholar and Garuda (Garba Rujukan Digital) websites during the 2017-2024 period. The following are the results of the collection from the two sources above:

Table 1. Journal publication data by year

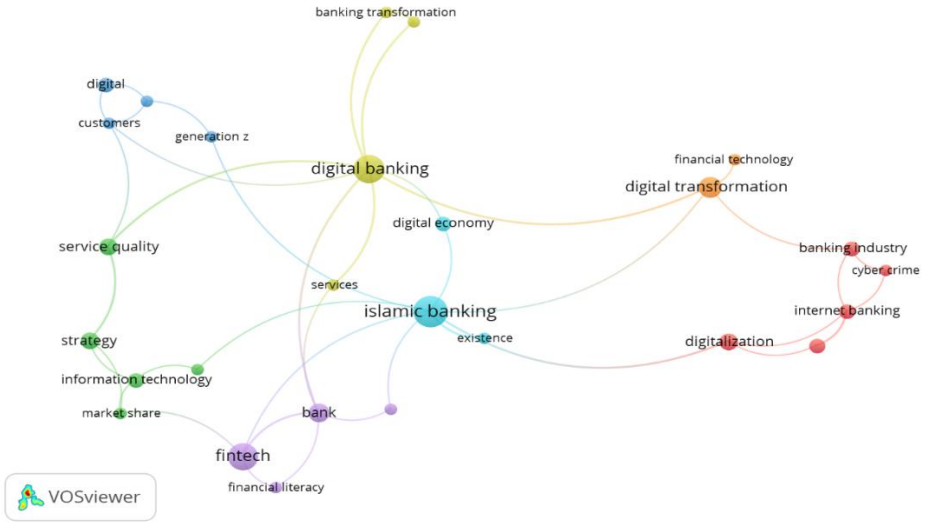
Year of Publication	Number of Articles
2017	4
2018	5
2019	5
2020	12
2021	9
2022	17
2023	16

2024	8
Total	**76**

Source: Data processed by the author, Microsoft Excel

Mapping VOSviewer Bibliometric Studies around Banking Technology Developments

Figure 1. Network Visualization of Banking Technology Development Map



Source: Data processed by the author, VOSviewer software

The visualization results in the VOSviewer software related to the banking technology development map have 6 clusters and 25 topic items on the mapping, including the following:

- Cluster 1, there are 5 topic items, namely: banking industry, cyber crime, digitalization, internet banking, mobile banking
- Cluster 2, there are 5 topic items, namely: information technology, innovation, market share, service quality, strategy
- Cluster 3, there are 4 topic items, namely: banking technology, customer, digital, generation z
- Cluster 4, there are 4 topic items, namely: banking transformation, digital banking, services, financial innovation
- Cluster 5, there are 4 topic items, namely: bank, digital banking services, financial literacy, fintech
- Cluster 6, there are 3 topic items, namely: digital economy, existence, Islamic banking

Each cluster represents a different research topic in banking technology development. The total number of items in each cluster is provided, along with the most frequent keywords and their occurrence within the cluster. The following discussion outlines the clusters and their keywords:

- Cluster 1 (Internet Banking)

  The banking industry has undergone many changes thanks to technological advancements, especially digitalization, which has made financial services faster, more effective and accessible. Internet banking and mobile banking are obvious aspects of digitalization, as they allow customers to perform various transactions, such as fund transfers, payments, and managing investments directly from their devices without having to go to the bank. These technological advancements also open up new avenues for cybercrime. The banking industry is investing in cybersecurity technologies such as multifactor authentication, data encryption, and artificial intelligence-based monitoring to protect banking systems and customer data security from attacks such as phishing, malware, and hacking.

  Through the integration of evolving technologies, banking not only provides convenience for users but also strengthens trust by providing secure solutions. This transformation makes digitalization, internet banking, mobile banking, and managing the threat

of cyber crime as the main pillars in building a more inclusive and resilient future of the banking industry.

- Cluster 2 (Strategy)

  The development of banking technology today is greatly influenced by the application of information technology (IT), which is the foundation for creating innovations in various services. By utilizing IT, banks are able to provide solutions such as mobile banking, digital payments, and blockchain-based services, which not only accelerate operational processes but also increase efficiency. These innovations play an important role in improving service quality, where services become faster, safer, and more convenient for customers. For example, features such as artificial intelligence-based chatbots and online loan applications without physical documents make the customer experience more practical and satisfying.

  This improvement in service quality helps banks expand market share, as customers tend to choose services that provide added value and convenience. Banks that are able to adopt the latest technology quickly and effectively have a competitive advantage over their competitors. However, this success cannot be separated from the importance of implementing the right strategy. Banks must formulate a comprehensive digital strategy, including investing in technology infrastructure, building collaboration with fintech, and ensuring customer data security to face the challenges of the digital era.

- Cluster 3 (Generation)

  The development of banking technology has revolutionized the way financial services are delivered, along with the massive adoption of digitalization. Innovations such as mobile banking, digital wallets, and AI-based platforms are designed to improve the convenience and efficiency of customer service. This transformation is rooted in the understanding that modern customers, especially generation Z, want an all-digital, accessible and personalized banking experience.

  In the context of digitalization, banks are not only changing the way they operate, but also the way they interact with customers. Technology enables services such as online account opening, instant payments, and chatbot-based financial consultations. This is particularly relevant to Generation Z, known as digital natives. They tend to rely on mobile devices and apps to manage their finances as opposed to traditional methods. Banking technology provides the foundation, customers are the focus of services, digitalization is the medium of transformation, and Generation Z is the main catalyst of change, with their preference for innovative solutions that are practical and secure. This combination drives banks to innovate, creating services that are not only efficient but also meet the expectations of the new generation that dominates the global financial market.

- Cluster 4 (Digital Banking)

  Digital banking has replaced most traditional services, bringing faster, more flexible and secure access to customers. This transformation enables banks to offer more personalized and need-based services, such as instant payments, automated investments, and data-driven financial analytics. Financial innovation plays a key role in accelerating this change. Technologies such as blockchain, artificial intelligence (AI), and big data are being used to improve operational efficiency and create innovative products that suit the needs of modern customers. Examples include blockchain-based cross-border payment services or app-based financial management.

- Cluster 5 (Fintech)

  Fintechs are expanding the financial ecosystem by providing innovative solutions that are often faster and more flexible than traditional banks. Fintech platforms help reach segments of society that previously had no path to digital financial services. Collaborations between banks and fintechs are increasingly common, resulting in hybrid services that combine the trustworthiness of banking institutions with the technological innovation of fintech. However, the increasing accessibility of financial services also highlights the importance of *financial literacy*. Without adequate understanding, customers risk making unwise financial decisions, despite the availability of technological services. Therefore, banks and fintechs also play a role in improving

financial literacy through digital education, training, and features that help customers better manage their finances.

- Cluster 6 (Islamic Banking)

  The existence of Islamic banking is becoming increasingly relevant as the demand for financial services that comply with sharia principles is also increasing in the digital era. Islamic banking is adapting to the digital economy trend through the development of technology-based services such as digital banking that complies with Islamic law, including products such as interest-free accounts, technology-based halal investments, and Islamic crowdfunding platforms. These innovations allow Islamic banking to remain relevant amidst the rapid competition with conventional financial institutions and fintech. The existence of Islamic banking in the digital economy era also has strategic value. In addition to answering the needs of segments of society who are looking for sharia-based financial services, Islamic banking makes an important contribution to building a sustainable economy. Digital technology helps Islamic banking reach communities that were previously difficult to access, such as MSMEs in remote areas, through applicationbased services and online platforms.

Mapping of Literature Review Studies around Issues in the Development of Banking Technology

Based on several studies, there are 4 issues that are a challenge in the development of Banking Technology, namely:

First, Cyber Security. Cybersecurity is a key foundation in the development of banking technology. Digital transformation that enables services such as internet banking and mobile banking has increased the risk of cyberattacks. Banks are prime targets as they store sensitive customer data, while new systems implemented often have security gaps that can be exploited by criminals. In addition, low customer awareness of digital security measures, such as the use of strong passwords or vigilance against fraudulent emails, exacerbates the situation. These threats not only cause financial losses to banks, but also threaten the reputation of the institution, which can reduce customer confidence and disrupt operations.

Second, Digital Financial Literacy. Low digital financial literacy is a major obstacle in encouraging the adoption of banking technology. Many customers do not understand how to use services such as internet banking, mobile banking, or e-wallets safely and efficiently. This ignorance often leads to customers falling victim to cyber fraud or using technology suboptimally. In addition, there is an understanding gap between the younger, more tech savvy generation and the older generation, who are often reluctant to adopt digital services. Effective solutions require a combination of comprehensive education, development of accessible technologies, and collaboration between stakeholders. By improving digital literacy, banks not only expand access to services but also reduce financial risk among customers

Third, Infrastructure Gap. The technology infrastructure gap is a major barrier to the development of digital banking in Indonesia. Uneven internet access, limited technological devices, and lack of digital infrastructure support prevent many people from enjoying digital banking services. In addition, small or medium-sized banks often struggle to adopt new technologies due to limited budget for investment in advanced digital systems. By improving access and supporting inclusive technology, the banking sector can achieve equitable and sustainable digital transformation.

Fourth, Regulation and Compliance. Digital transformation in the banking sector is often constrained by regulations that are slow to adapt to new technologies. Existing regulations are usually designed for traditional banking systems and have not fully accommodated digital services. In addition, banks face major challenges in meeting data security, privacy and consumer protection standards. The high cost of regulatory compliance is also an additional burden, especially for small or medium-sized banks. Solutions include regulatory updates that support innovation, adoption of regtech technologies, and close collaboration between regulators and industry players.

Conclusion

Based on the results of the analysis and interpretation above, the following conclusions can be obtained: First, the number of publications based on the mapping of research publications on the development of digital banking technology during the period 2017 to 2024, there are 76 articles from Sinta-accredited national journal sources. Second, based on the results of the VOSviewer bibliometric study analysis, the network visualization results regarding the development of digital banking technology are divided into 6 clusters and 25 topic items. In cluster 1, there are 5 topics, cluster 2 has 5 topics, cluster 3 has 4 topics, cluster 4 has 4 topics, cluster 5 has 4 topics, and finally cluster 6 has 3 topics. Third, based on the mapping of the literature review study, there are four issues that pose challenges in the development of banking technology, 1) cyber security, 2) digital financial literacy, 3) infrastructure gaps, and 4) regulation and compliance. Future research is expected to use a larger data sample, seeing the limitations of the data sample used in this study, it is recommended to use in order to increase the longer period of research data and provide a more comprehensive explanation of research mapping so that more complex research results can be obtained and the mapping results show broader generalization results.

Author Contributions

Conceptualization: Miftahul Farichah, Mohamad Safriyanto Lamondo
Data curation: Mohamad Safriyanto Lamondo
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