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# Research Trend of Digital Innovation in Banking: A Bibliometric Analysis

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## Abstract

This paper aims to analyze research trends of Digital Innovation in Banking scientifically through bibliometric studies. Initial data were collected using Publish or Perish from 2011 to 2021 by searching for published papers indexed by Crossref, Google Scholar, Microsoft Academic, and Scopus database. The results show that scientific publications of Digital Innovation in Banking have increased gradually since 2016. The Scopus database is used because it contains journals and conference proceedings deemed more relevant by the academic community with detailed DOIs. VOSviewer and Microsoft excel were used as the tools to analyze co-authorship, co-occurrence, and citation obtained from the Scopus database. The visualization of the research trends of Digital Innovation in Banking resulted in three co-occurrence clusters leading to some of the topic areas mentioned in the results; 1) Digital Innovation in Banking related to the technology implementation and environmental innovations, 2) Digital Innovation in Banking business management in the world, and 3) Digital Innovation in Banking in relating to its effect and benefit to society. Technology is rapidly changing the financial services industry, especially banks. Digital innovation resulting from the use of digital technology will help banking improve customer experience and maintain banking performance. These study findings will help researchers recognize the research trends of Digital Innovation in Banking globally and suggest future research directions.

**Keywords**: *Digital Innovation, Banking, Bibliometric Study, Research Trend, VOSviewer*



## INTRODUCTION

Today's economic and competitive challenges are making the status quo untenable for the banking industry. With fintech attracting millions of new customers, incumbents face a need for bold action that is becoming more urgent by the day (Bhapkar et al., 2021). According to a recent McKinsey survey, 65 percent of financial services businesses that made business building a top-five priority saw revenue growth above their competitors. PwC also mentions that great powers are reshaping the banking industry. Customer expectations, technological capabilities, regulatory requirements, demographics, and the sharing economy create the imperative for change. Banks need to overcome these challenges, radically innovate and transform themselves for the future (PwC, 2020). As the banking industry transitioned from Banking 1.0 era to Banking 4.0, which saw open banking make way for open ecosystems that enabled an exchange of resources and data to expedite innovation and deliver superior customer experience. Open Banking is reshaping the banking sector by extending traditional banking services' reach and convenience by opening up and leveraging consumer data (Zeller & Dahdal, 2021). Banking 4.X is an experience-driven, platform-based optimum channel banking resilient to financial and non-financial threats, built around

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long-term, sustainable growth where human interactions evolve from servicing to advising (Capgemini, 2021).

Sustainable, innovative banking services will be tailored to meet the needs of today and future stakeholders, as well as environmental and social risks. Hence, banks are challenged to integrate the science of sustainability and sustainable development objectives in their business operations and services innovation (Ibrahim et al., 2019). Sustainable competitive advantage is influenced by continuous business innovation (Soebandrija, 2020). There is a lot of competition from outside and within the banking industry itself. Nowadays, almost every aspect of business will be activated by the power of information technology. Digital technology is essential in achieving business goals and its pervasive effects in the restructuring of entire industries (Nylén & Holmström, 2015). Digital disruption has prompted banks to consider digital transformation as part of their strategy. The banking industry is very close to the development of information technology, developing innovative channels (Nazaritehrani & Mashali, 2020) in providing the best service to its customers. Therefore, every bank always tries to innovate products and services to maintain their performance. Based on this issue, the paper focuses on research trends of Digital Innovation in Banking within 2011 to 2021 interval as explained in the research methodology section, with five research questions as follows:

a. What is the publication output profile of Digital Innovation in Banking for 2011 to 2021?
b. How far is the distribution of Digital Innovation in Banking publications in the world?
c. Who are the top authors in researching Digital Innovation in Banking in the world?
d. What is the publication pattern of Digital Innovation in Banking?
e. What is the result of the visualization of research trends in Digital Innovation in Banking?

## LITERATURE REVIEW

A previous literature study collected from the Scopus database found some articles related to digital innovation and banking since 1982, but the similarity has been started from 1996 to 1999. Chevron (1996) discuss the anticipation of the changes in consumer attitudes and behaviors from the growing importance of digital information technology. Liberatore (1997) investigates the adoption patterns and implementation issues of digital imaging technology within the banking and insurance industries. Meanwhile, Giannakoudi (1999) mentioned internet banking technology as the digital voyage of banking. Christie (1999) and Lefebvre (1999) are interested in digital money or e-cash transaction. Many banking, financial products, and services have used ICT in their production and delivery processes to achieve effective and efficient ways of tailoring customer satisfaction and experience (Beccalli, 2007).

Digital Innovation can be defined as "the creation of (and a consequent change in) business processes, market offerings, or models that result from the use of digital technology" (Nambisan, 2020). In recent years every bank has started its journey in digital transformation to improve customer satisfaction with innovative banking experiences that can increase customer retention and acquisition in maintaining banking performance. An organization must immediately transform from traditional processes or services and transform into digital technology-based processes and services. The implementation of digital-based processes and services is expected to increase the effectiveness and efficiency of the company and create new value for all stakeholders (customers, business partners, shareholders, and regulators). Financial institutions need to evaluate their current leadership, structures, talent ecosystems, cultures, and ways of working and then invest strategically to improve the areas that fall short (Kaufman et al., 2015).

The financial services industry, especially the Bank, is currently facing a change in the form of traditional interpersonal services to digital financial services, which are being driven by rapid

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technological changes (Niemand, 2021). With the rapid development of IT, digital technology changes how banks translate new customer demands into new products and services (Lestari & Rahmanto, 2021). The use of innovation and advanced technologies to benefit development will build an efficient and competitive banking system (Diener, 2021). Banking is experiencing disruptive innovation that requires them to be adaptive in almost all cooperative processes in their digitalization process. Digital transformation offer opportunities for business model innovation (Sund, 2021). There is also disruptive technology called blockchain which can be the disruption of banking business. As growing innovation technology, blockchain allows individuals to record transactions on a decentralized, distributed ledger, an advanced technology with no central controlling authority as of financial banking systems (Muralidhara, 2021; Rahman & Dawood, 2019). Disruptive Artificial Intelligence (AI) technologies can dramatically improve banks' performance in four key areas: higher profits, at-scale personalization, smart omnichannel experiences, and rapid innovation cycles (Carson et al., 2021). Modern applications of AI are collectively creating a more inclusive and equitable financial services ecosystem. These innovations will help deliver new value on top of evolving service platforms to create symbiotic relationships between health and wealth that could have significant multigenerational impacts (Lau & Leimer, 2018). The authors intend to observe keywords, correlation, and insightful topics of Digital Innovation in Banking based on the above phenomena.

## RESEARCH METHOD

This study follows some references in the paper of bibliometric studies (Kulakli & Osmanaj, 2020; van Oorschot et al., 2018; Yang et al., 2017). The bibliometric review will benefit both the academic and public communities. It helps us convert publication metadata into visualizations or maps, which are easier to gain valuable insights. Visualizing keywords to identify research themes or clusters in a particular discipline, map author affiliations of a specific journal, map institutional and international collaboration as part of a framework to identify emerging technologies (Tanudjaja & Kow, 2018). The Scopus database was used because it contains journals and conference proceedings deemed more relevant by the academic community with detailed DOIs. The research was started by conducting an online search on July 29-30th, 2021. The complete steps are illustrated in Figure 1, following the Five steps in conducting bibliometric analysis (Masitoh et al., 2021; Suprapto et al., 2021). The authors conducted an online search by entering "Digital Innovation" + Banking in the title, keywords, and abstract from 2011 to 2021.

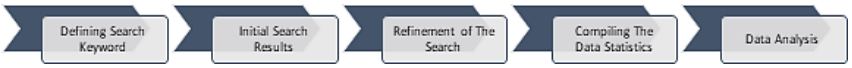


Figure 1. Five steps in conducting a bibliometric study.

The initial exploration used Publish or Perish (PoP) by searching for published papers indexed by Crossref, Google Scholar, Microsoft Academic, and Scopus databases to get the publication trends, as shown in the following summary in Figure 2. The result was documented in the form of (.ris) and (.csv). Furthermore, these records are processed in different bibliometric and network analysis programs: Microsoft Excel and VOSviewer. VOSviewer software was used to find out research trends on Digital Innovation in Banking. The initial data collection investigated the research trend analysis, including the characteristics of publication output, document sources, output distribution in subject categories, top authors, top citations, and publication trends from 2011 to 2021. Keyword co-occurrence analysis was carried out using VOSviewer. It uses an algorithm Visualization of Similarities (VoS) as an alternative to multidimensional scaling (van Eck & Waltman, 2020).

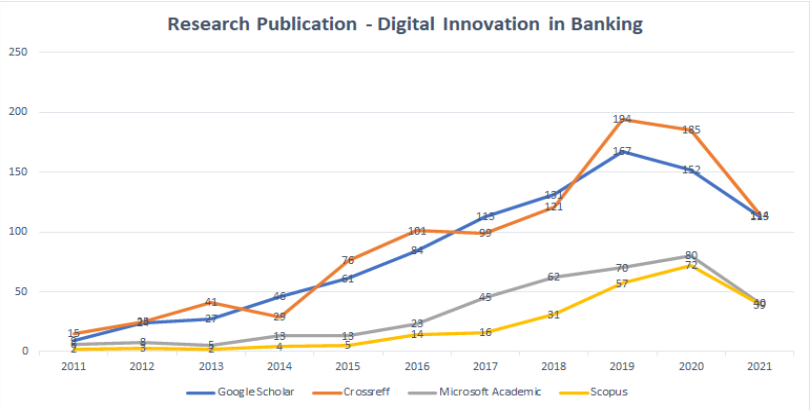


Figure 2. Research Publication summary of Digital Innovation in Banking 2011 to 2021.

## FINDINGS AND DISCUSSION

### Publication Output

PoP was used to search the "Digital Innovation" + Banking keyword and the result that meet criteria obtained for the past ten years (2011 – 2021) in the Scopus database are 245 papers. The result of the term given includes 5 document sources (journal, conference proceeding, book, chapter, and review). The number of articles based on sources indicated the dominance of articles in the journal (119 documents) and conference (73 documents). The publications with the keyword of Digital Innovation in Banking research throughout 2011 to 2021 are illustrated in Figure 3, extracted from the Scopus database.

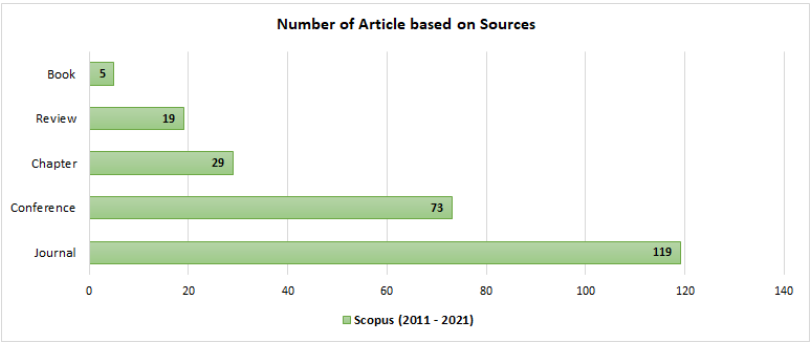


Figure 3. The number of articles on Digital Innovation in Banking is based on source categories.

### Publication Distribution in Journal

Data collected using PoP indicate the most cited authors, as we can see in The top 20 authors most cited from 2011 to 2021 presented in Table 1. Interestingly, two authors (Anagnostopoulos and Drasch) have the most cited from the other authors published in the same journal (Journal of Economics and Business). The published paper with the title "Fintech and regtech Impact on regulators and banks" and "Integrating the 'Troublemakers': A taxonomy for cooperation between banks and fintech" (Drasch et al., 2018) may become an intriguing topic from both of them. We can verify the H-Index of each journal from the Scimago, which shows in Figure 4, so we can see the impact of each journal on the academic and public communities. H-index rank is strongly influenced by the number of published papers on each journal.


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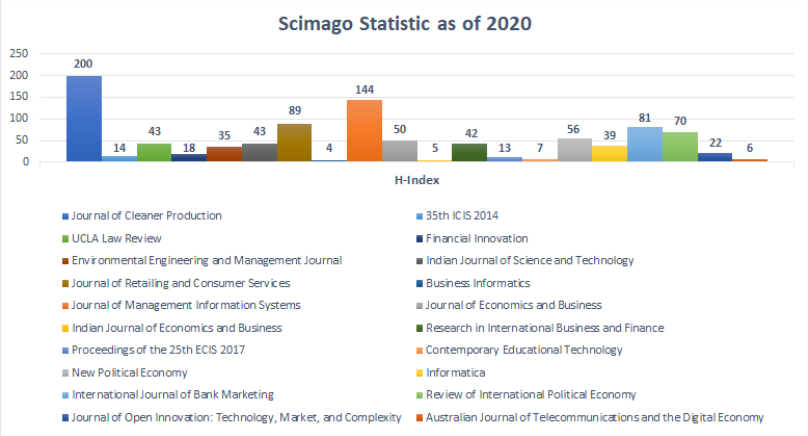


Figure 4. H-Index of Top 20 Journals from Scimago.

Scimago Journal Rank (SJR), as presented in Figure 5, measured the scientific influence of scholarly journals that accounts for the number of citations received by a journal and indicates the average number of weighted citations received during a selected year per document published. Higher Scimago journal ranks are meant to exhibit greater journal prestige (Thomas, 2021).

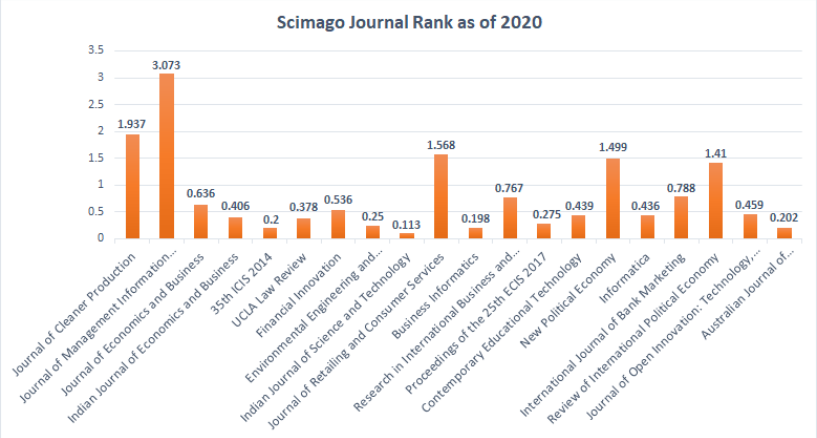


Figure 5. Scimago Journal Rank of Top 20 Journals.

**Top Authors**

The most productive authors presented in figure 6 indicate the top eight authors researching Digital Innovation in Banking from 2011 to 2021 indexed by Scopus. It consists of Riyanto, Bataev, Ciriello, Diener, Ilankumaran, Mahalle, Niemand, and Solms. Data was generated using VOSviewer with 226 authors and filtered by two documents per author, and eight authors are selected. On average, the authors had two documents, and Riyanto from Indonesia already has four papers. But if we compare to the most cited author in Table 1, it's not the most author with documents has the most cited.

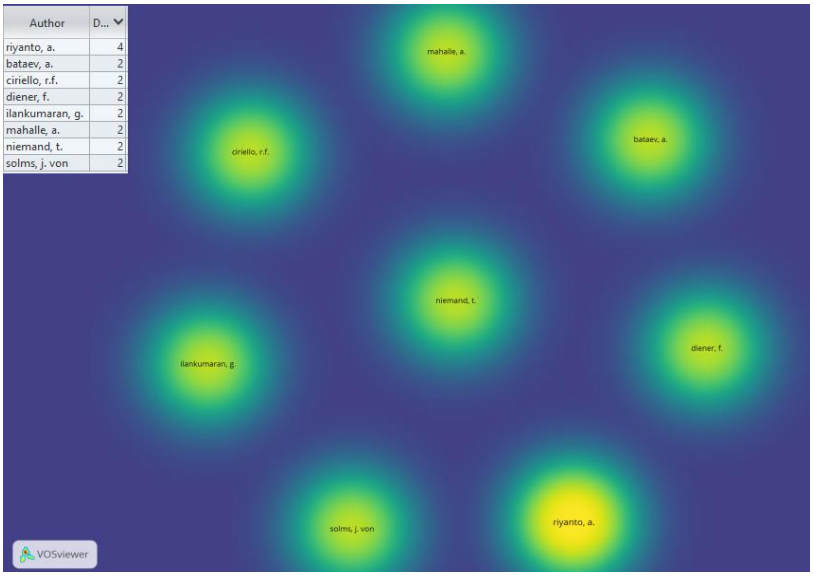

Figure 6. Top Eight Authors who are researching Digital Innovation in Banking from 2011 to 2021.

**Publication Patterns of Source Journal**

We may see the most cited author and journals cited by authors indexed by Scopus in Table 1, i.e., Yip (2018) in Journal of Cleaner Production, Lehrer (2018) in Journal of Management Information System, and Anagnostopoulos (2018) with Drasch (2018) in Journal of Economics and Business.

Table 1. Top 20 Authors Most Cited from 2011 to 2021

| Authors | Journal | Cites/year | Cites |
|---|---|---|---|
| Yip (2018) | Journal of Cleaner Production | 31 | 93 |
| Lehrer (2018) | Journal of Management Information Systems | 29.67 | 89 |
| Anagnostopoulos (2018) | Journal of Economics and Business | 21.67 | 65 |
| Drasch (2018) | Journal of Economics and Business | 12.33 | 37 |
| Kandpal (2019) | Indian Journal of Economics and Business | 18 | 36 |
| Avital (2014) | 35th ICIS 2014 "Building a Better World Through Information Systems." | 4.71 | 33 |
| Van Loo (2018) | UCLA Law Review | 9 | 27 |
| Li (2017) | Financial Innovation | 6.25 | 25 |
| Sposato (2017) | Environmental Engineering and Management Journal | 5.75 | 23 |
| Rao (2015) | Indian Journal of Science and Technology | 3.67 | 22 |
| Reydet (2017) | Journal of Retailing and Consumer Services | 5.5 | 22 |
| Akatkin (2017) | Business Informatics | 4.75 | 19 |
| Shaikh (2017) | Research in International Business and Finance | 4.75 | 19 |
| Niemand (2017) | Proceedings of the 25th ECIS 2017 | 2.75 | 11 |
| Bayanova (2020) | Contemporary Educational Technology | 11 | 11 |
| Gruin (2020) | New Political Economy | 11 | 11 |
| Popescu (2011) | Informatica | 1 | 10 |
| Hedman (2017) | International Journal of Bank Marketing | 2.25 | 9 |
| Clarke (2019) | Review of International Political Economy | 4.5 | 9 |


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| Authors | Journal | Cites/year | Cites |
|---|---|---|---|
| Yigitcanlar (2020) | Journal of Open Innovation: Technology, Market, and Complexity | 9 | 9 |

**Visualization of Research Trend**

Co-occurrence analysis can reveal the research topic statistically. Co-occurrence analysis is simply counting paired data in the collection unit. These methods are helpful for researchers to study an overview of Digital Innovation in the Banking domain. Map analysis is based on text data that created a term co-occurrence map, and terms are extracted from the title and abstract fields with binary counting. Only keywords in the document matter, filtering the minimum number of term occurrences to four. Among the 174 papers related to Digital Innovation in Banking research in the Scopus database from 2011-2021, we found 2004 terms in total and 99 terms meet the threshold. After the relevance score is calculated based on the default choice to choose 60%, the most relevant keywords are 59. Figure 7 shows the overall picture of research on Digital Innovation in Banking within the Scopus database.

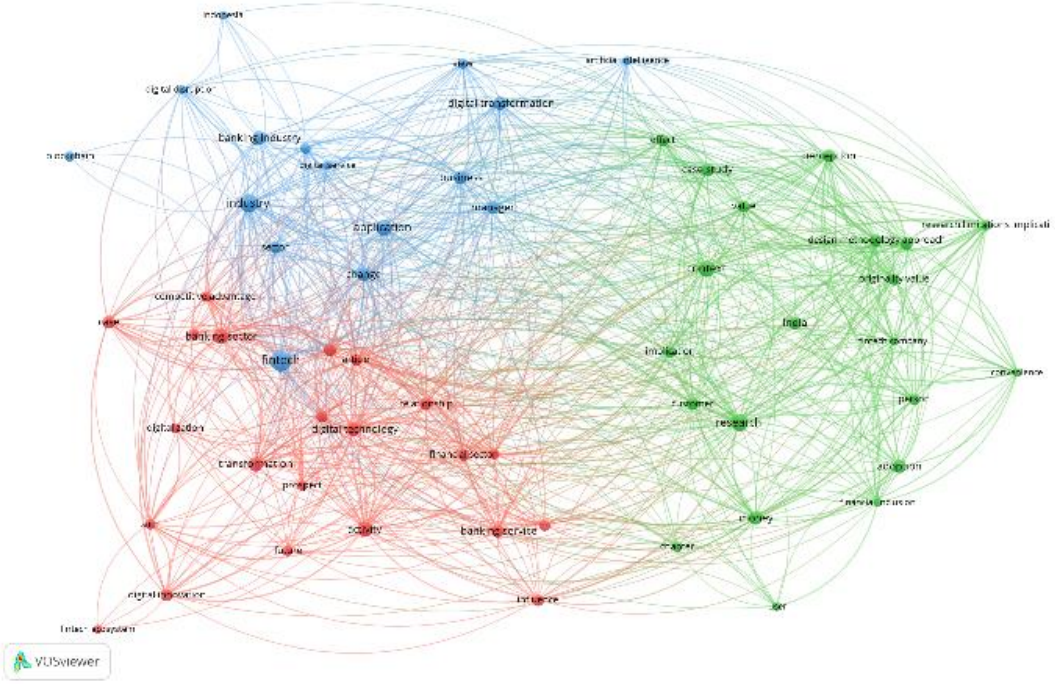


Figure 7. The Co-Occurrence Network Visualization mapped based on text data of Abstract and Title field

From the Co-occurrence network visualization of the Scopus database shown in Figure 7, researchers worldwide produced three primary clusters indicated by red, green, and blue. The first cluster (red color) is grouped by keywords such as digitalization, digital technology, digital innovation, transformation, competitive advantage, banking sector, fintech ecosystem, and prospect leading to the topic of Digital Innovation in Banking related to the technology implementation and environmental innovations. The second cluster (blue) is grouped by keywords such as digital disruption, banking industry, application, fintech, industry, blockchain, AI, and business, leading to the topic of Digital Innovation in Banking business management in the world. Finally, the third cluster (green) is grouped by keywords such as cases study, research, context, perception, adoption, and design methodology approach indicated Digital Innovation in Banking relating to its effect and benefit to society.

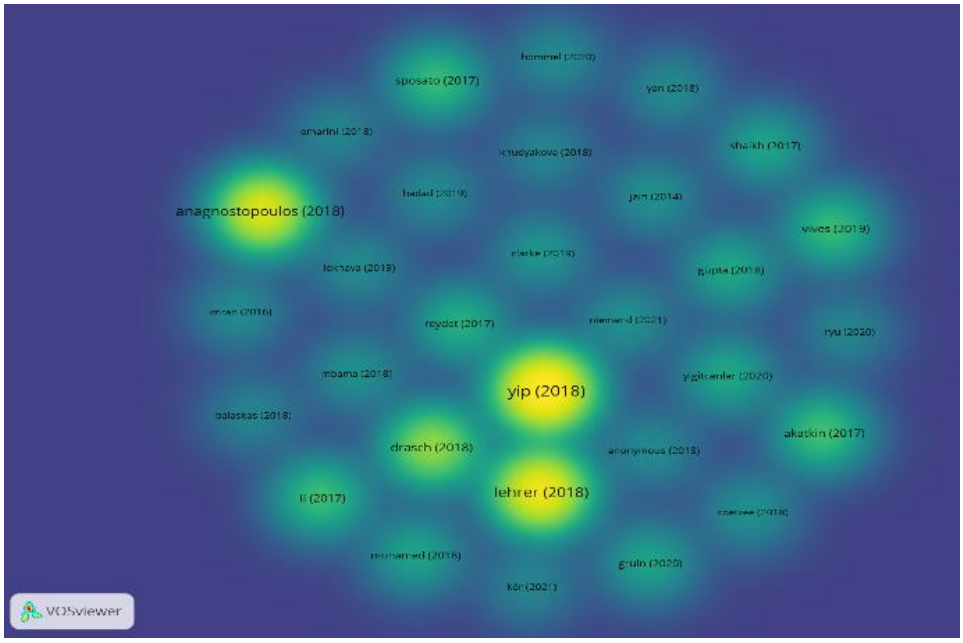


Figure 8. Density Visualization of Citation Analysis.

Citation analysis based on scientific research databases can be legally implemented in applied and technical sciences, social sciences, and humanities. Therefore the most practical level of aggregation is citation analysis because scientific research is the teamwork's result. Based on the data collected from PoP, there is a total of 174 documents retrieved by its valid DOIs, using Citation type of analysis with Documents as the unit of analysis. We found the density of the author in Figure 8, which shows the top-cited author as presented in the previous section.

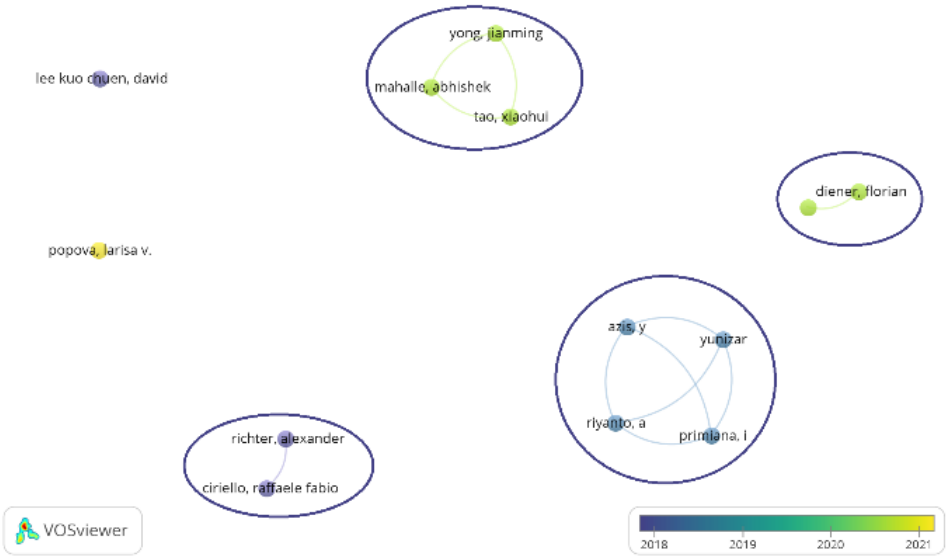


Figure 9. Co-Authorship Network Overlay Visualization.


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Co-authorship analysis is used to find relationships between various studies based on research documents produced by researchers. A co-authorship network is a tool for uncovering the direction of collaboration and identifying researchers and institutions leading research. Analysis of co-authorship networks can help overcome, make a substantial contribution to academic development. Based on 174 documents resulting in 449 authors from the type of analysis co-authorship with Authors as the unit of analysis. Figure 9 presents top authors and their cluster in researching Digital Innovation in the Banking domain. There are four dominant groups of authorships: Riyanto, Azis, Yunizar, and Primiana; Yong, Jianming, Mahalle, Abhishek, Tao, and Xiaohui; Ritcher, Alexander Ciriello, and Raffaele; Diener and Florian. The first group is the most influenced in the cluster, with the most citation and total link strength indicated by VOSviewer. From the figures of network overlay visualization, we can discover the author from the year of their existence to identify the paper related from 2011 to 2021.

**Discussion**

Digital Innovation in Banking may become a widely studied area of research. Previous literature already has an interest in the topic with a different term, as mentioned in the background section. Based on the research result, we may try to explore the idea from top authors. At the same time, Sustainable business model innovation in the banking industry is increasingly seen as a lever for sustainable system change across businesses and industries (Yip & Bocken, 2018). Big data analytics, as growing digital technologies, enable service innovation in the banking organization (Lehrer et al., 2018). Banking has been subject to enables technology-driven banking services as a fundamental of digitalization and creates new customer demands. While some Bank has slow innovation processes, fintech takes advantage of the digital era, delivering customer-centric solutions (Drasch et al., 2018). Disruptive innovation has the potential outcomes for consumers, supervisory, regulatory, and reputational gains for the Financial Service Industry (FSI) and becomes even more critical as the FSI evolves (Anagnostopoulos, 2018). The cashless transaction system is achieving its growth day by day; as soon as the market becomes globalized and the development of the banking sector, more and more people moves from cash to a cashless system (Kandpal, 2019). How digital technologies enable it, and how the massive sociotechnical systems embodied in these new peer platforms may evolve in response to the market and social forces that drive this emerging ecosystem (Avital et al., 2014).

Research planning and evaluation is essential activity for researchers today. Using references quoted from articles with at least 100 references can be seen as an excellent standard for finding taxonomies of research fields. We can compare the accuracy of topic-level taxonomies based on grouping documents using direct citations, bibliographic coupling, and co-citation. Research efforts should focus on value differences between stable taxonomic subjects and incorporate historical records with areas of research that can change rapidly. The innovation of research articles, researchers, institutions, and countries must be more accurate if one uses more accurate methods to detect topics. Direct citations produce a very accurate taxonomy, and it is recommended that this taxonomy be a suitable basis for decision-making (Suprapto et al., 2021).

The current bibliometric analysis technique was employed on published documents in the Scopus database only, and we did not use other databases. Further, it only focused on examining digital collections, digital resources, e-books, using the bibliometric analysis technique of published documents indexed in Scopus from 2011 to 2021.

## CONCLUSION

The overall conclusion that we reached based on the bibliometric analysis enabled us to gain more in-depth insights into the digital resources and support to recognize variables used during research on the subject. The topic development of Digital Innovation in Banking identifies the primary sources from which research papers are published. The most cited journal where the research is published, the top active author, the most cited author in the field, and the main topics of interest in Digital Innovation in Banking that the research focuses on. The authors point out several essential points regarding research on Digital Innovation in Banking from 2011 to 2021. The number of Digital Innovation in Banking documents throughout the year increased, dominated by articles in journals. Then, the visualization of research trends on Digital Innovation in Banking also resulted in three clusters of co-occurrences from the Scopus database, which lead into some topic areas mentioned in the result:

1. Digital Innovation in Banking in relating to the technology implementation and environmental innovations.
2. Digital Innovation in Banking in relating to business management in the world.
3. Digital Innovation in Banking in relating to its effect and benefit to society.

Technology is rapidly changing the financial services industry, especially banks. Digital innovation resulting from the use of digital technology will help banking improve customer experience and maintain banking performance. Disruptive technologies such as blockchain, big data, AI, and machine learning can disrupt the banking business or provide new value. Through research on the topics and analysis of the works listed in the previous section, it is possible to identify which authors are more active and can be used as references when the subject to be researched is related to Digital Innovation in Banking. In addition, it is possible to identify which works are the most cited on the subject, and the authors can use the works consequently to baseline new studies and research on the subjects. Research findings can help related researchers recognize trends in Digital Innovation in Banking research globally. The study also suggested that different bibliometric analysis techniques may be employed from other databases.

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