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MAPPING THE EFFICIENCY: A BIBLIOMETRIC REVIEW OF ISLAMIC AND CONVENTIONAL BANKING

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Abstract:

Bank efficiency is one of the vital indicators to measure a bank's performance. An efficient bank indicates the bank's good performance and contributes to the country's financial health and economic growth. This study aims to investigate the trend of academic literatures in the field of bank efficiency in Islamic and conventional banks using bibliometric analysis. The dataset is collected using LENS.ORG and analysed using VOSviewer. The bibliometric analysis is based on three keywords search which are efficiency, data envelopment analysis (DEA), and Islamic and conventional banks. Three major clusters were linked with efficiency. VOSviewer, through the generated network and density visualization suggested possible area that can be further studied in the future, such as comparing the performance of rural Islamic and conventional banks and incorporating corporate finance, governance, and crises in the studies of bank efficiency.

Keyword:

Bank Efficiency; Bibliometric Analysis; Data Envelopment Analysis; Islamic and Conventional Banks; LENS.ORG; VOSviewer

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Introduction

The world economy relies heavily on the health of the financial system. A deteriorating financial system will jeopardize the global economy. As banks are the main player in most of the countries' finances the performance of banks has become one of the main interests of researchers. Although the performance of banks, in terms of profitability and productivity, is important, measuring a bank's efficiency cannot be neglected. Banks can appear to be profitable due to several factors such as benefiting from the increase in interest rates but may not be efficient in allocating their resources at the same time. This, in the long run, can put the bank at risk. High profitability banks do not indicate that the bank is efficient but efficient banks - knowing the optimum ratio of input used and output produced, can increase the profitability in banks (Dsouza et al., 2022; Lamothe et al., 2024). Efficient banks increase profitability, in addition to being the key factors in promoting bank health, long-term performance and sustainability in the banking industry (Nasim et al., 2024).

However, maintaining efficiency is challenging for banks these days. A bank's nature of business as the intermediary between the surplus unit and the deposit unit increases the bank's exposure to multiple risks. Bank gains profit and revenue through loans and investments. The conflict between maximizing profit and revenue and managing the risks contributes to the inefficiency in banks. Growth in technologies has shifted bank operation from the traditional office to technology-based operations, which makes it a challenge for banks to remain efficient. Operating in the service industry in the knowledge-based era causes the bank to rely heavily on their staff and human capital. Any misallocation in these resources may lead to banks becoming inefficient. On top of that, other internal and environmental factors can also lead to banks becoming inefficient.

Narrative literature review studies are common when looking into past literature. However, bibliometric analysis adds to the comprehensive understanding of the knowledge for a specific field of study. A quantitative approach used to document the intellectual structure of a research field, bibliometric analysis identifies the main research questions, influential aspects of literature, and evolution trends through statistical methods. Bibliometric analysis has the capability to pinpoint the current trends and patterns in research themes, prominent authors in the selected field as well as most cited publications. Up to today, the bibliometric analysis studies on banking performance and issues are still growing (Khuan et al., 2024; Manta et al., 2024). This study contributes to a more structured overview of the study in banking efficiency with the use of LENS.ORG and VOSViewer. The use of these processing tools can increase the accuracy and reliability of the outcomes.

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AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

This study is conducted to achieve two objectives. The first objective is to investigate the trend of academic literature in the field of bank efficiency by using bibliometric analysis. The second objective is to understand the trend in the literatures pertaining the study on bank efficiency in the Islamic and conventional banks using data envelopment analysis (DEA).

Literature Review

Being introduced in the early work of Edgeworth (1881) as an indicator for performance, efficiency as defined by Drucker (1963) is the ability of an organization to achieve its output from the minimum input level. Despite various definitions pertaining to efficiency, efficiency is understood as a measure of effectiveness that produces the minimum waste of time, effort and skill (Alber et al., 2019). The banking industry offers services to their customers. According to Skąpska and Rollnik-Sadowska (2020), measuring the efficiency of services involves a complicated process due to the unique characteristics the industry possesses such as intangibility, heterogeneity and perishability. The services offered by the banking industry are non-physical, customized and cannot be stored (Kayastha, 2011). Defining bank efficiency depends on the approach to the role of the bank. The two main approaches used in banking efficiency studies are the intermediation and production approach (Sealey Jr. & Lindley, 1977). Selection of inputs and outputs to be used in measuring efficiency will be based on the approach chosen. Measuring bank efficiency can be done using multiple methods, such as financial ratio analysis, parametric and also non-parametric methods. Despite each method having its own advantages and disadvantages, data envelopment analysis (DEA) becomes one of the most preferred methods due to the capability of using multiple inputs and outputs in measuring efficiency (Kamarudin et al., 2019; Sun et al., 2018).

Measuring bank efficiency involves the selection of methods, selection of input and output, selection of approach to be used, and also the type of efficiency to be calculated. Farrell (1957) categorized efficiency measurement into two components, technical efficiency and allocative efficiency, where combining both efficiencies will give the overall economic efficiency. There are also other categories of efficiencies. Pure technical efficiency is the effectiveness with which a given set of inputs is used in producing an output. Bank's technical efficiency is the difference between observed quantity of input and output variables, with respect to the optimal quantity of input and output variables. Studies were done on measuring the technical efficiencies in banks as well as factors determining technical efficiency (Abdulahi et al., 2023; Adusei, 2016; Ben Mohamed et al., 2021).

Scale efficiency is the capability of banks to reach optimal operations. A bank is said to have scale efficiency if it operates in the range of constant return to scale (CRS) and studies on scale efficiency can be seen in the work of Aly et al. (1990), as well as Favero and Papi (1995), Marpaung and Octrina (2024) and Kamarudin et al. (2024). Allocative efficiency is the bank's success in using an optimal set of inputs with a given set of inputs price which have been done in the recent research of Getinet Chane et al. (2024), Afroj et al. (2024) and Nugroho (2024). The ability of a bank to provide services without wasting resources as a result of technical or allocative efficiency is defined as cost efficiency, and research on cost efficiency were done by Rakshit (2023), Safa et al. (2018) and Vidyarthi and Tiwari (2019). Finally, scope efficiency can be measured when a bank operates in different diversified locations. Apart from that, there are also studies on profit efficiency (Cao et al., 2024; Duho et al., 2020), operational efficiency (Ayusningtyas & Yendra, 2024; Bueno et al., 2024; Shehadeh et al., 2024) and financial efficiency (Aslam et al., 2024; Gökgöz et al., 2024).

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

Although Islamic banks are said to be new in the industry, they are growing rapidly and is projected to continue growing in the future. Alatassi and Letza (2018) reported that the annual growth rates of Islamic banks are 17.6 % from 2009 to 2013, and grew to 19.7% in 2014, with bank asset approximately $920 trillion of value. Islamic banks are being accepted by both the Muslim and non-Muslim communities globally and are seen to be a good long-term value proposition (Alatassi & Letza, 2018). Despite being in the same industry and operating similarly, Islamic banks differ from conventional banks as Islamic banks focus on asset values whereas conventional banks are credit focused. Islamic banks operate within the Shariah principles, prohibiting speculation, gambling and interest-based activities in their operation. The difference in principles between Islamic and conventional banks had resulted in Islamic banks to react differently during the 2007/2008 Global Financial Crises. Islamic banks were said to perform better (Bourkhis & Nabi, 2013), were more resilient during the crises period (Baber, 2018), more efficient (Alqahtani et al., 2017) and less prone to failure (Alatassi & Letza, 2018). This has brought interest among researchers to continuously compare the performance difference between Islamic and conventional banks.

Methodology

The development and accessibility of softwares such as VOSviewer and Leximancer has spurred the rise of bibliometric analysis in the social sciences research in the current years (Alam et al., 2021; Donthu et al., 2021; Khan et al., 2021). The increasing popularity of bibliometric methodology in social sciences research is not seasonal or due to trends but indicates the importance of constructing high research impact involving excessive scientific data (Donthu et al., 2021). The bibliometric analysis handles data ranging from hundreds to thousands, which are unbiased in nature in terms of publications and citation numbers, keyword occurrences and topics. Systematic literature reviews use qualitative reviews and require a narrow scope of study, while bibliometric analysis relies on quantitative methods, which can avoid interpretation bias (Donthu et al., 2021).

This study applied bibliometric analysis to examine the general perspective of banking efficiency. This study is aimed at studying trends in academic literature with regard to bank efficiency by using bibliometric analysis. The steps include the evaluation of databases with a specific emphasis on indicators related to publications, such as authors, keywords, sources, geographical distributions, and others. This study also looked into certain trends that have been studied by Kakati and Roy (2021), such as number of publications, most active publishers and most cited articles.

In analysing the development of bank efficiency research, this study follows a systematic bibliometric research protocol, starting from (i) data retrieval, (ii) data enrichment and screening, (iii) data cleaning and preparation, and the final step is (iv) bibliometric mapping. An extensive search was done on December 31st, 2024. Bibliographic data is retrieved from Scopus database using multiple keywords related to bank efficiency. Among the inclusion criteria is to select the language as English, and the year of publications is between 2002 until 2024. The retrieved dataset is then exported to LENS.ORG, where additional metadata fields were edited, enriched, and verified. LENS.ORG refines document attributes, standardise fields, and improves the overall quality of the bibliographic dataset prior to analysis. The study is satisfied with the keywords of “efficiency”, “data envelopment analysis” and “Islamic and conventional banks” and obtained 111 scholarly works. Prior to bibliometric mapping, a systematic data cleaning procedure was conducted to ensure the accuracy and reliability of the

analysis. Duplicate records were identified and removed, resulting in 93 scholarly works being selected. Finally, the cleaned and refined dataset was imported into VOSviewer for bibliometric mapping and visualisation based on text data. VOSviewer is developed to generate and visualize network relationships, and access how the relationships are connected (Van Eck & Waltman, 2010). VOSviewer also supports mapping citation data extracted from the established databases (Williams, 2020). Combining both VOSviewer (vosviewer.com) and LENS.ORG (https://www.lens.org), this study strengthens its methodological robustness and provides a unique perspective on the banking efficiency studies conducted before this.

Result and Discussion

The aim of the study is to investigate the trend of academic literature on the research of bank efficiency. Efficiency is one of the most discussed topics by researchers. According to Edgeworth (1881), efficiency is a general indicator for performance in all types of businesses. Despite various research that has been done in the past on banking efficiency, there are still substantial gaps that need to be addressed to. The nature of the banking business is fragile. Banks are exposed to multiple risks that can affect the bank's performance. The bank's failure to allocate the resources it has and transforming these resources into optimum level of output may affect the bank's performance. Not only will an inefficient bank cause bank profitability to decrease but it may also affect the financial system's stability as well as the economics health (Istaiteyeh et al., 2024; Maji & Saha, 2024; Mateev et al., 2024). Due to that, the study of banking efficiency remains relevant.

This study was not only to understand the trend of academic literature on bank efficiency but also intends to see the trend of bank efficiency research incorporating data envelopment analysis (DEA) as the approach of obtaining the efficiency score. Although widely used ratio analysis was preferred in the past, ratio analysis is said to produce misleading measures of efficiency. Ratio analysis is unable to detect components that are unproductive. The method is also incapable of identifying the unit that performs the best in an identical set, as well as not capable of explaining complicated input and output. Thus, past researchers agreed that ratio analysis may not be suitable to access bank's efficiency (Berger et al., 1993; Paradi et al., 2011). One of the earliest attempts at using data envelopment analysis (DEA) in the banking industry is through the research of Sherman and Gold (1983), on the operating efficiency of 14 bank branches in US saving banks. Over the years, DEA has been used widely to investigate the efficiency of banks in general and was found to be the vastly used method in measuring bank efficiency (Ahmad, 2020). As DEA allows the use of multiple inputs and outputs in calculating efficiency, this is very relevant to the banking industry. This is because bank does not rely on only one input, but multiple inputs such as fixed assets and employees. Bank also have multiple outputs such as loans and investments. Apart from that, DEA measures the relative efficiencies and not absolute efficiencies. Relative efficiency is suitable to compare efficiencies between banks of different sizes and characteristics.

Finally, this study incorporates Islamic and conventional banking efficiency. As reported by the State of the Global Islamic Economy Report (2023), Islamic finance rose at an exponential yearly pace at an average of 10% over the past ten years. Despite conventional and Islamic banks being said to have technical similarities (Izzeldin, 2021; Safiullah, 2020) such as in terms of money receiving and general financing requirements, both Islamic and conventional banks differ in principles. Islamic banks are considered still new in the industry as compared to

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
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Volume: 8 Issue: 27 (March 2026) PP. 469-487

conventional banks and need to compete with conventional banks to sustain in the business. One of the ways to compete is to ensure that they are efficient in allocating their resources.

Number of Publications (by Documents and Source Type)

Two main source type of publications is journal article and conference proceedings. However, journal article outnumbered conference proceedings. Journal article is a report on research conducted that includes literature reviews, methodologies, and analyses, while conference proceedings are papers that present new research ideas, or ongoing research, as well as mini reviews of completed work. Journal articles give insight into research, and academia and published in journals with archival function. On the other hand, conference proceedings provide a platform for researchers to present their work and receive feedback for future improvement. Because of this, it is not surprising that journal articles are more referred to as compared to conference proceedings. Multiple journal publishers are available online, furthermore, the number of published articles is also multitudinous. This type of publication being easily accessible and available resulted in journal article contributing 87% of the publication type, while the remaining 13% comes from conference proceedings. Although not as much as journal article, this percentage indicates the relevancy of conference proceedings in obtaining information regarding bank efficiency.

Table 1: Number Of Publications by Document And Source Type.

Publication Type	Number (%)
Journal Article	77 (87)
Conference Proceedings	12 (13)

Source: Own Work.

Number of Publications (by Year)

The next step is to investigate the number of publications by year. Even though the study on bank efficiency was done back in late 1980s, this study collected the number of studies from the year 2002 until 2024 and focused on the recent past nine years to understand the current trend. As shown in figure 1, the number of studies done on bank efficiency varies depending on the year. The global economy deteriorated from the European debt crisis and the Global Financial Crises (GFC) caused an increasing number in bank efficiency publications in 2012. Years 2021 and 2022 showed an increase in numbers for research on bank efficiency, with 10 and 9 publications respectively. This may be due to the COVID-19 pandemic that affected the economy and the lifestyle of people around the world in 2020. As the World Health Organisation (WHO) declared COVID-19 as a global pandemic that resulted in lockdown and a sudden shift to remote working, banks were required to invest in digital infrastructure to accommodate the needs of their customers as well as for their staff who were required to work from home. The increase in cost due to the above, and economic slowdown caused many loans to become defaulted may affect the efficiency in banks. This caused an increase in interest among researchers in finding the effect of COVID-19 on bank efficiency, reflecting the higher amount of research being done in both years. Despite the decrease in publications in 2023, the number increased back in 2024 indicating the importance of research in bank efficiency to continue so banks can improve their efficiency under different circumstances that may occur. From the data collected from 2002, the number of publications fluctuated due to various factors

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

that emerged over the years that affected bank efficiency. This has triggered interest in bank efficiency studies. As banks operate under vulnerable environments, future events may affect their efficiency, thus concluding that the publications of research pertaining to bank efficiency will continue in upcoming years.

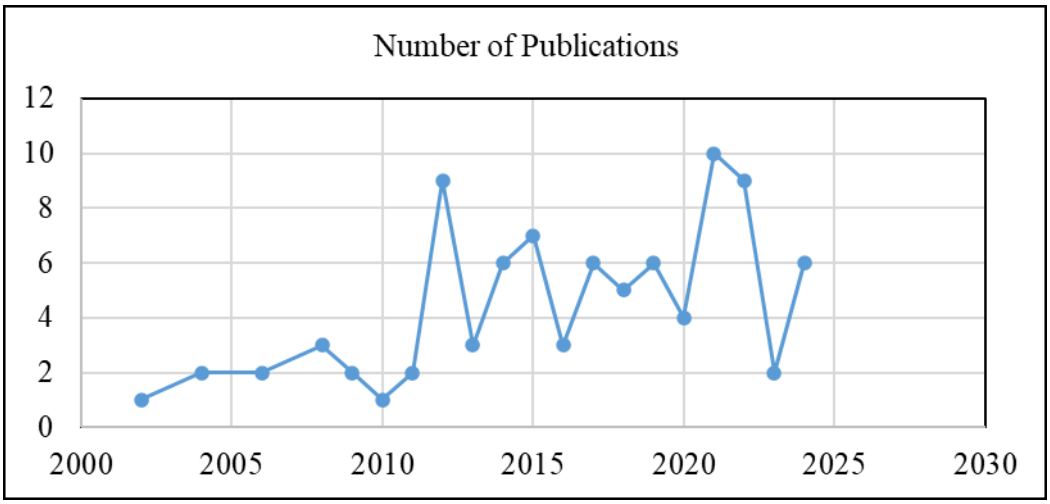

Figure 1: Number of Publications by Year.

Source: Own Work.

Most Active Publishers

Table 2 shows the three most active publishers for bank efficiency research. Social Science Research Network (SSRN) became the most active publisher with 9 publications. SSRN may be widely chosen by many researchers researching banking efficiency due to the free access provided, and as it covers a number of specialized research networks in social science such as in finance and economics. Furthermore, the popularity of SSRN increased after it is bought by Elsevier in 2016. Elsevier is a reliable and one of the most referred to academic publishing companies by scholars obtaining trusty published articles.

Table 2: Most Active Publishers.

No	Source Title	Quantity
1	Social Science Research Network	9
2	Ekonomi Islam Indonesia	4
3	SSRN Electronic Journal	4

Source: Own Work.

The second most active publisher is Ekonomi Islam Indonesia (EII), a scientific publication under Sharia Economic Applied Research and Training (SMART), Indonesia. The reason behind this may be due to EII's focus on the research of Islamic economics and finance. As this study is also aimed to study the trend on Islamic banking efficiency, many of the sources come from this publisher. The third most active publisher, having the same number of publications with EII with 4 publications, is SSRN Electronic Journal. SSRN Electronic Journal is a

subscription journal that is published by Elsevier BV, covering many areas of research in the social science field and is a reliable source, making it popular among the scholars.

Most Cited Articles

The next finding is on the most cited articles on bank efficiency. The study of Bader et al. (2008) became the most cited with 154 citations in studies pertaining to bank efficiency. A reason for this is because their study covers three types of efficiencies which are cost, revenue and profit efficiency, and are referred to by scholars doing research on either of the efficiency. Apart from that, their research is a comparative study between Islamic and conventional banks, one of the current interests in the study of banking efficiency. The study also uses DEA, one of the most widely used methods in determining bank efficiency. Thus, there is no doubt that their study became the most cited by other researchers. The second most cited is the study of Saen, R.F. (2010) with 86 citations. Even though the study is not directly related to bank efficiency, it became a basis of understanding data envelopment analysis (DEA) as one of the methods in measuring bank efficiency. Lastly, the third most cited article is from the work of Wasiaturrahma et al. (2020). Their study on the bank performance using two-stage DEA was cited 48 times.

Table 3: Most Cited Articles.

No	Authors (Year)	Title Source	Journal	Frequency
1	Bader, Mohammed Khaled I. and Mohamad, Shamsher and Ariff, Mohamed and Shah, Taufiq Hassan (2008).	Cost, Revenue, and Profit Efficiency of Islamic versus Conventional Banks: International Evidence Using Data Envelopment Analysis	Islamic Economic Studies, Vol. 15, No. 2	154
2	Saen, R.F. (2010)	A new model for selecting third-party reverse logistics providers in the presence of multiple dual-role factors.	The International Journal of Advanced Manufacturing Technology	86
3	Wasiaturrahma, Sukmana, R., Ajija, S. R., Salama, S. C. U., & Hudaifah, A. (2020).	Financial performance of rural banks in Indonesia: A two-stage DEA approach.	Heliyon, 6(7).	48

Source: Own Work.

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

Field of Study

Figure 2 shows the field of study in bank efficiency from 2002 until 2024. During the 23 years of study, data envelopment analysis (DEA) appeared to be most researched topic under bank efficiency, with a frequency of 78. This is because, in determining bank efficiency, the traditional ratio analysis is not suitable to determine a bank's efficiency, and other frontier analysis techniques such as stochastic frontier analysis (SFA) requires a large sample of data in measuring efficiency, making DEA one of the most favourable techniques to measure efficiency.

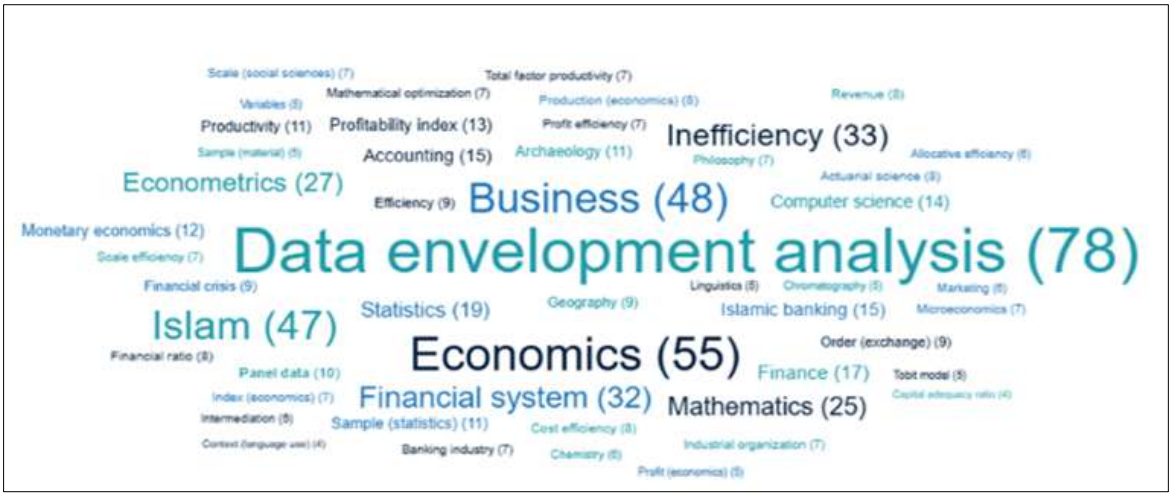

Figure 2: Field of Study of Bank Efficiency.

Source: Own Work.

Apart from that, topics such as economics appeared 55 times, being the second top field of study in bank efficiency. This is due to banking efficiency studies under finance and economics. Other topics such as business (48), Islam (47), inefficiency (33) and financial system (32) are among the top related fields in the study of bank efficiency. The word 'business' can be explained as the study of bank efficiency that comes under the field of social science which is business. The topic of Islam appeared frequently as this study intended to see the literatures pertaining Islamic banks. Inefficiency, the opposite of efficiency, has also been among a favorite areas of study when looking into bank efficiency. Finally, financial system is related as banks are considered one of the entities under the financial system, and banks that face efficiency problems can cause damage to the financial system. This proves that within the keywords chosen, the distribution of topics under bank efficiency studies can be said to be well-distributed and is a representation of several interrelated disciplines. Thus, it can be concluded that the selected keywords are able to produce a significant field of study for bank efficiency.

Research Publication: Co-Occurrence Results for Bank Efficiency

Figure 3 shows the co-occurrence results for bank efficiency. Co-occurrence analysis is a technique that investigates and visually represents the relationship among publications in the dataset. This analysis gives greater understanding of the knowledge framework within a certain

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

field, which in this case is bank efficiency. The analysis also investigates the interconnection between the terms used.

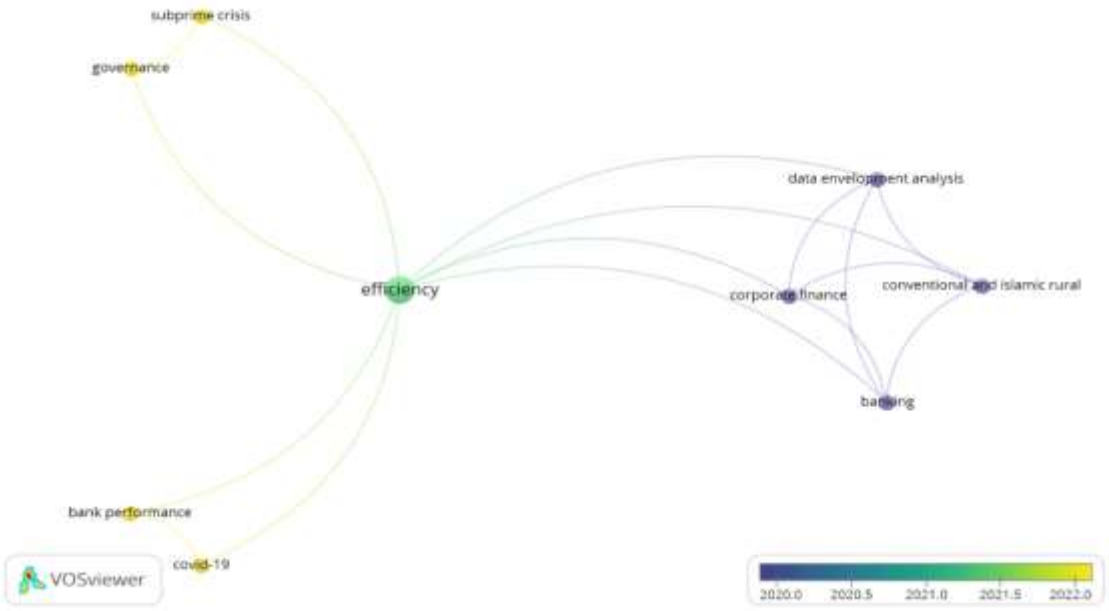

Figure 3: Co-occurrence Map for Bank Efficiency.

Source: Own Work.

As shown in Figure 3, efficiency is the central theme that connects several themes from the dataset. From the central theme, three clusters have emerged, which will be discussed below:

Cluster 1: Efficiency in the banking sectors using Data Envelopment Analysis (DEA)

For cluster 1, four keywords that have co-occurred are 'banking', 'Islamic and conventional rural', 'data envelopment analysis' and 'corporate finance'. According to this cluster, efficiency measurement is a popular performance indicator used in the banking industry. The method used to measure the efficiency score is data envelopment analysis (DEA). This does not come as a surprise as the keywords selected were 'efficiency', 'Islamic bank and conventional banks' and 'data envelopment analysis', resulting which become the first three keywords appeared in this cluster. However, this cluster introduces an additional keyword which is Islamic rural as part of the 'Islamic and conventional' keyword. Previous literature agreed on the use of data envelopment analysis being one of the popular methods in measuring bank efficiency score (Ahmad et al., 2020; Bhatia et al., 2018). These studies emphasize efficiency in banks in certain countries or regions. Along the years, as the Islamic banking sectors grew, studies on the efficiency of Islamic banks became popular (Fakhrunnas et al., 2024; Mezzi, 2018). The difference in impact of the Global Financial Crisis had on Islamic banks resulted in many comparative studies being done on the efficiency between the Islamic and conventional banks (Abdul-Majid et al., 2010; Ahmad, 2020; Miah & Uddin, 2017). However, most studies focused on commercial banks while not much studies researched the efficiency of rural banks. Rural banks bring significant contributions to a country's economy, as their business mainly targets rural society and small-medium enterprises (SME) as customers. According to Irfan (2020)

rural banks assist in the development of the social and economic aspects of society, strongly believing that the performance of rural banks is worth studying. Several studies have been done on bank efficiency and performance of rural banks (Adusei, 2016; Fithria et al., 2021), and from this cluster, it can be suggested that future studies can consider rural banks to be their scope of study as this type of bank brings weight to economic development. Comparing between Islamic and conventional rural bank efficiencies will help these banks maintain their efficiencies and focus on the factors that promote efficiencies.

Another keyword that appeared in this cluster is 'corporate finance'. Corporate finance is a field that focuses on how businesses make financial decisions to maximise shareholder value, encompassing areas like funding, capital structure, investments, and accounting. This is interesting as efficiency is the measurement of how well a company or bank uses its input to produce output. Thus, in order to become efficient, a bank must make the right decision to generate income. Failing to do so will result in the bank becoming insufficient. Banks provide a substantial proportion of external finance to corporations around the globe (Mayer, 1988). Therefore, banks should exercise good financial decisions on the financing they provide to their customers, as it will affect the bank's efficiency.

Cluster 2: Banking Efficiency and the Subprime Crisis.

This cluster discusses bank efficiency and the subprime crisis. The subprime crisis originated in the US in 2007 and spread around the world via globalisation. The huge scale impact of the crisis had turned into the Global Financial Crises (GFC) and had unexpected consequences on a scale unseen since the Great Depression of 1930. This had caused an unusual strain that affected performance and efficiency of various financial systems. The difference in impact between Islamic and conventional banks, and how these banks reacted to the crises were followed by an increase in studies done on the bank efficiencies between these two types of banks (Alexakis et al., 2019; Alqahtani et al., 2017), explaining how the crisis relates to efficiency. According to Alqahtani et al. (2017), during the GFC, Islamic banks were more cost efficient as compared to conventional banks, but in after GFC, Islamic banks suffered more than conventional banks in terms of profit efficiency and lost their cost efficiency. The subprime crisis increased the study on bank efficiency not only during the period of crisis but also the period before and after the crisis. Goswami (2019) suggested that the decline in technical efficiency in the Indian banks after the GFC may be due to insufficient credit valuation during the economic upswing of 2003–2007, coupled with unfavourable economic conditions in the domestic and external fronts caused hoarded non-performing loans (NPLs). All this triggered the studies on bank efficiency after the subprime crisis occurred.

Another keyword that came together with subprime crisis is 'governance'. Governance, or corporate governance became one of the most researched areas in bank efficiency after the subprime crisis or the Global Financial Crises. Chen (2024) stated that the root cause of this crisis lies in the failure of corporate governance. Thus, after the GFC, instead of looking at the performance ratio as the factor that affects bank efficiency, many studies incorporated governance in their study on bank efficiency. Factors such as board and gender diversity, (Adeabah et al., 2019; Boadi et al., 2022), board of directors' characteristics (Doğan & Ekşi, 2020; Haddad, 2022) and ownership structure (Sarkar et al., 2019) are studied to see their relationship with bank efficiency.

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

Cluster 3: Banking Efficiency and the COVID-19 Pandemic.

The subprime crisis and GFC had become the topic of interest for many years, until the recent COVID-19 took over. This brings us to the third cluster developed by VOSviewer. The keywords 'covid-19' and 'bank performance' emerge from the main cluster, efficiency'. COVID-19, which started at the end of 2019 hit every corner of the world, causing a damaging impact on world health and economic. The pandemic caused an increase in both public and private debt in the world economy. Economic activities became restricted due to the lockdown imposed. Banks were urged to invest heavily in digital infrastructure, to support the remote working of their staff, and to assist the needs of their customers which in result affected the bank's performance. The cost increased and the economic slowdown caused many loans to become problematic. This can affect bank efficiency. However, digital technology adopted by the bank may have also resulted in banks becoming more efficient. Many studies argued that the impact of the recent pandemic differs from the GFC, causing an increase in studies on bank efficiency after the COVID-19 pandemic (Berger & Demirgüç-Kunt, 2021; Boubaker et al., 2023).

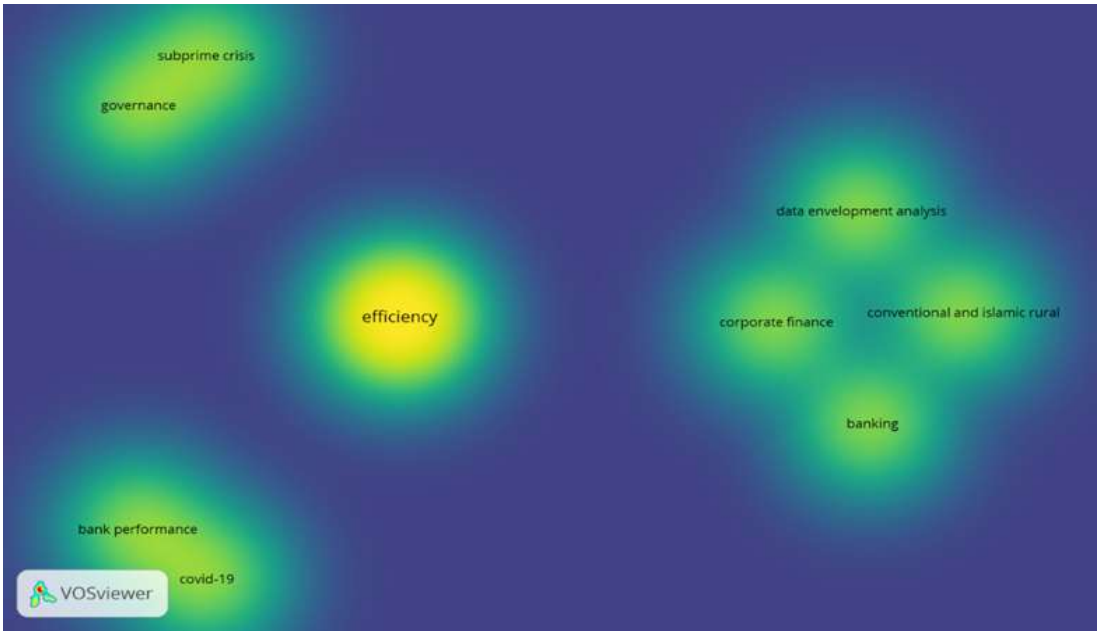

Figure 4: Co-occurrence Map for Bank Efficiency (Density Visualisation).

Source: Own Work.

This study also looks into the density visualization generated by VOSViewer to understand the area being most studied in order to identify the possible gaps of the study area in banking efficiency. This is shown in Figure 4. From the figure, it can be seen that the study on efficiency had been heavily done. But the clusters that emerge from efficiency have lighter density, indicating these clusters can still be explored in future studies. Future studies may consider expanding the scope of banking efficiency studies in comparing the performance of rural Islamic and conventional and also incorporate corporate finance, corporate governance and crises as factors affecting bank efficiency.

Advanced International Journal of Business, Entrepreneurship and SME's
AIJBES
EISSN: 2682-8545
Volume: 8 Issue: 27 (March 2026) PP. 469-487

Conclusion

This study aims to achieve two main objectives, which are to investigate the trend of academic literature in the field of bank efficiency by using bibliometric analysis, and to understand the trend in the literatures pertaining the study on bank efficiency in the Islamic and conventional banks using data envelopment analysis (DEA).

The first objective is achieved by using the software LENS.ORG to search the trend and the research landscape in banking efficiency, using the keywords "efficiency", "data envelopment analysis" and "Islamic and conventional banks" resulting in 93 scholarly works. VOSviewer were then used to analyze this dataset and generate a network relationship between the datasets. The bibliometric analysis is used to collect the dataset using both LENS.ORG and VOSviewer software. It can be concluded that by using bibliometric analysis, a detailed overview of the research landscape regarding bank efficiency can be achieved.

In achieving the second objective, this study was conducted to understand the trend in the literatures pertaining to the study on bank efficiency. It can be seen that despite being a topic researched for so many years in the past, current literature shows no sign of the discussion slowing down in the academic world. The reliability of DEA as a method to calculate bank efficiency adds to ongoing interest among academic researchers. The emergence of Islamic banks operating side by side with conventional banks have initiated arguments among the scholars on the level of both banks portrayed. This leads to multiple comparative studies being done, comparing the efficiency of both types of banks.

This study systematically maps, structure, and interprets the evolution of bank efficiency research, with a specific focus on DEA-based studies, using enhanced data processing tools. By using LENS.ORG and VOSviewer software, this study enhances the existing bibliometric analysis. The integration of the two software helps in data refinement, which increases the accuracy and reliability of text-based bibliometric mapping. This study also provides a comprehensive and up-to-date bibliometric mapping of bank efficiency research, offering a structured overview of the field's intellectual foundations, thematic evolution, and research frontiers.

However, this study has limitations such as the selections of keywords. The results of bibliometric analysis are sensitive to the choice of keywords and search strings. There may be other relevant studies that contribute to the study of bank efficiency but are using alternative terminology, resulting in these studies being omitted during the search. Apart from that, as the researchers can apply filters in their search, the restriction to English-language, peer-reviewed journal articles may introduce language and publication bias.

Unlike prior bibliometric studies that examine bank efficiency broadly, this study explicitly highlights the dominance and evolution of Data Envelopment Analysis (DEA). Despite various methods being used in calculating efficiency, DEA remains suitable in the banking efficiency as it does not impose a specific production or cost function. DEA also allows multiple inputs and outputs measured in different units, which align well with the multi-product nature of banking operations. Although DEA is among the earliest efficiency measurement techniques, DEA framework has evolved considerably over time from traditional DEA to modern DEA such as network DEA, dynamic DEA, and bootstrapped DEA. This indicates that DEA remains a relevant and robust tool for contemporary bank efficiency analysis.

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From the dataset collected, it can be suggested that future research should consider doing studies on the efficiency of rural banks, comparing between Islamic and conventional rural banks. This study also found that corporate finance, corporate governance, and crises period can be further explored in studies on bank efficiency. The vulnerability of the business nature of banks exposes banks to multiple risks that can jeopardize their efficiency. The vulnerability of their business also makes banks very sensitive to even a slight change in the environment. Despite possible measures taken by banks' managements, regulators and governments, any economic shocks that may happen in the future can cause banks to become inefficient. The best defense to ensure bank maintain efficient is by fully understanding the key forces impacting the bank's efficiency. Continuous research on bank efficiency can help find new strategies in helping banks to remain efficient. Thus, the study of bank efficiency remains relevant, and it can be seen from the dataset collected that there is a promising future growth trend in the research of bank efficiency.

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