

An Analysis of the Efficiency of Islamic Commercial Banks in Indonesia during the 2021–2025 Period

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Abstract

This study aims to examine the efficiency level of Islamic Commercial Banks in Indonesia during the 2021–2025 period. The study uses secondary data obtained from the financial statements of Islamic banks. An output-oriented approach is employed, while Data Envelopment Analysis (DEA) is used to measure the efficiency level. The data were processed using Microsoft Excel for data tabulation and MaxDEA 12.2 to calculate efficiency scores. The results show that Bank Syariah Indonesia was the most efficient bank and remained relatively stable throughout the 2021–2025 period. Bank Victoria Syariah and Bank Panin Dubai Syariah achieved efficiency in four years during the same period, while Aladin Syariah was efficient in only three years. Bank Muamalat Indonesia and Bank Bukopin Syariah were efficient in only two years. Meanwhile, Bank Aceh Syariah and BTPN Syariah achieved efficiency only in 2025. The banks that remained inefficient during the 2021–2025 period were Bank NTB Syariah, Bank Nano Syariah, Bank Jabar Banten Syariah, and BCA Syariah. Inefficient Islamic Commercial Banks can improve their efficiency by increasing financing and other operating income. This study contributes to the Islamic banking literature by providing updated evidence on the efficiency performance of Islamic Commercial Banks during the post-merger and post-pandemic period in Indonesia. This study employed panel data from 13 Islamic Commercial Banks operating in Indonesia during the 2021–2025 period, thereby providing comprehensive evidence regarding the recent efficiency performance of the Islamic banking industry.

Keywords: *Efficiency; Islamic Commercial Banks; Data Envelopment Analysis*

1. Introduction

Islamic banks in Indonesia play an important role in supporting national financial stability. They not only contribute to improving financial inclusion at the national level, but also support economic equity through the implementation of sharia principles. This role is reflected in their main function as financial intermediaries, namely collecting and distributing funds to the public, complemented by financial services that are aligned with the needs of Indonesian society. The year 2021 marked an important milestone in the development of Islamic banking with the establishment of Bank Syariah Indonesia (BSI), which was formed through the merger of three state-owned Islamic banks. This merger significantly transformed the structure and scale of the Islamic banking industry, followed by increases in assets,

financing, customer deposits, and overall business scale. Following the merger, BSI recorded total assets of IDR 214.5 trillion, financing of IDR 157 trillion, and customer deposits of IDR 210 trillion (OJK, 2021).

Nevertheless, such growth does not necessarily indicate that these institutions have operated efficiently. Business expansion must be accompanied by the ability of banks to manage their resources or inputs optimally. If the growth of inputs, such as labor, customer deposits, assets, and other resources, is not balanced by proportional outputs, banks may operate suboptimally. Therefore, efficiency is an important indicator in assessing the performance of Islamic banks. Efficiency reflects the extent to which banks are able to utilize their inputs to generate maximum outputs, as this is closely related to institutional profitability and competitiveness within the Indonesian banking industry (Fauzukhaq & Kurnia, 2025).

Efficiency measurement can be conducted using the intermediation approach. This approach views banks as financial intermediary institutions that collect funds from the public and channel them in the form of financing or investment. The intermediation approach is highly relevant to the banking sector because it reflects the primary function of banks in collecting, managing, and distributing funds to the public, particularly for financing productive economic activities. In Islamic banking, efficiency measurement becomes increasingly important because the intermediation process must consistently adhere to sharia principles, such as avoiding *riba* and using financial products based on contracts that comply with Islamic law (Ascarya & Yumanita, 2008).

One of the most widely used methods for measuring banking efficiency is Data Envelopment Analysis (DEA). DEA is a non-parametric method that measures relative efficiency by considering inputs and outputs simultaneously. This method is suitable for banking research because it enables comparisons of efficiency levels among banks without requiring the specification of a particular production function. In addition, DEA can identify inefficient banks and indicate potential improvements based on the selected orientation, whether input-oriented or output-oriented (Cooper et al., 2007).

Research on the efficiency of Islamic Commercial Banks in Indonesia remains relevant, particularly for the 2021–2025 period. This period reflects the condition of the Islamic banking industry after the establishment of BSI, the post-COVID-19 economic recovery, and the increasing digital transformation of banking services. These changes may affect operational patterns, fund collection, financing distribution, and asset management. Therefore, efficiency measurement in the most recent period is necessary to determine whether the development of the Islamic banking industry has been accompanied by improvements in efficiency.

Several previous studies have shown that the intermediation approach is highly relevant for measuring banking efficiency because it corresponds to the main role of banks as financial intermediaries. Nurlala (2015) found that, based on the intermediation approach during the 2011–2013 period, Bank Panin Syariah and Bank Victoria Syariah achieved perfect

efficiency, while several other banks remained inefficient. Miranti & Sari (2016) found that Maybank Syariah and Bank Panin Syariah demonstrated optimal efficiency, whereas other banks did not show consistent efficiency levels. Putri & Latifah (2025) analyzed the efficiency of Islamic Commercial Banks during the 2021–2023 period and found that their efficiency levels fluctuated due to asset scale, operational strategies, technological innovation, and post-pandemic economic conditions. However, most previous studies were conducted before the establishment of Bank Syariah Indonesia or have not specifically examined the condition of Islamic Commercial Banks in the most recent period up to 2025. Therefore, this study is important in providing an overview of the intermediation efficiency of Islamic Commercial Banks after changes in industrial structure, economic recovery, and the development of banking digitalization.

Although previous studies have examined the efficiency of Islamic Commercial Banks using the Data Envelopment Analysis (DEA) approach, most of them focused on periods before the establishment of Bank Syariah Indonesia (BSI), limited samples of Islamic banks, or observation periods ending in 2023. Consequently, empirical evidence regarding the efficiency performance of all Islamic Commercial Banks during the 2021–2025 period remains limited. Moreover, few studies have considered the post-pandemic recovery and the acceleration of banking digitalization as the new context of efficiency measurement. Therefore, this study offers novelty by evaluating all Islamic Commercial Banks operating in Indonesia during the 2021–2025 period using an output-oriented DEA under the Variable Returns to Scale (BCC) model. This research provides updated empirical evidence regarding banking efficiency after the structural transformation of the Islamic banking industry.

Accordingly, this study seeks to answer the following research question: How efficient were Islamic Commercial Banks in Indonesia during the 2021–2025 period when evaluated using the output-oriented Data Envelopment Analysis (DEA) approach? This study aims to analyze the efficiency level of Islamic Commercial Banks using the intermediation approach during the 2021–2025 period with the Data Envelopment Analysis (DEA) method. This period is important because it reflects the condition of Islamic Commercial Banks after the establishment of BSI, the post-pandemic economic recovery, and the increasing digitalization of banking services. This study is expected to provide a theoretical contribution by enriching the literature on Islamic banking efficiency measurement through the intermediation approach in the most recent period. Practically, the findings of this study are expected to serve as evaluation material for Islamic Commercial Banks, regulators, and stakeholders in improving the intermediation function, particularly in managing customer deposits and distributing financing to the public.

2. Literature Review

Efficiency originates from microeconomic concepts, particularly consumer and producer theory. Consumer theory assumes that consumers seek to increase satisfaction and maximize

their utility, while producer theory assumes that producers aim to maximize profit while minimizing costs (Ascarya & Yumanita, 2007).

Efficiency serves as a benchmark for assessing performance. The measurement of efficiency performance is generally conducted through two approaches: using fewer inputs while maintaining the same level of output, or using the same amount of input to generate a greater level of output (Huri & Susilowati, 2004). According to Hidayat (2014), efficiency can be measured through two main concepts, namely allocative efficiency and technical efficiency. Technical efficiency refers to the capacity and ability of an economic unit to produce output from available inputs with the support of technology (Tanjung & Devi, 2013). From an operational perspective, however, efficiency can be classified into three categories: cost efficiency, revenue efficiency, and profit efficiency. In the banking sector, efficiency is generally measured based on cost; therefore, Islamic Commercial Banks can also be assessed within this category (Hidayat, 2014).

According to Muharam & Pusvitasari (2007) banking efficiency can be identified through scale efficiency, allocative efficiency, technical efficiency, and scope efficiency. A bank can be considered efficient when its operations are able to run at a constant scale, which reflects scale efficiency. Meanwhile, scope efficiency can be achieved when a bank is able to diversify its allocation effectively. Technical efficiency focuses on the relationship between inputs and outputs in the production process. This process is considered efficient when the same amount of input can produce greater output, or when a targeted level of output can be achieved with minimum input. Furthermore, allocative efficiency is achieved when a bank is able to determine the desired combination of outputs in order to maximize profit (Hidayat, 2014).

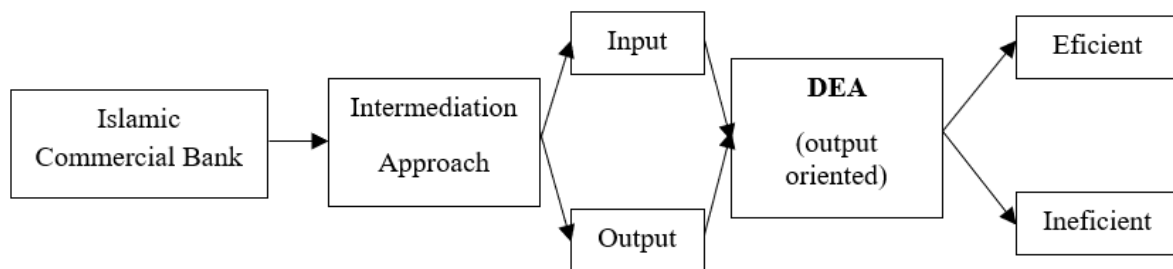
The efficiency of Islamic Commercial Banks has been discussed in several previous studies. Putri & Latifah (2025) examined the efficiency of Islamic Commercial Banks during the 2021–2023 period. Their findings indicate that the efficiency of these banks fluctuated, influenced by several factors such as asset scale, technological innovation, operational strategies, and economic conditions, particularly in the post-pandemic period.

Rizal et al. (2023) analyzed the efficiency of Bank Syariah Indonesia before and after the merger in 2021. The results showed that Bank Syariah Indonesia had a good level of efficiency, which improved further after the merger. Meanwhile, Mukti (2024) analyzed the efficiency level of 13 Islamic Commercial Banks in 2023. The findings revealed that several banks achieved good efficiency levels, while others did not operate efficiently. Previous studies consistently indicate that the efficiency of Islamic Commercial Banks varies across institutions and observation periods. Nurlala (2015) and Miranti & Sari (2016) emphasized differences in efficiency among Islamic banks before the establishment of Bank Syariah Indonesia. Meanwhile, Rizal et al. (2023) focused only on Bank Syariah Indonesia after the merger, whereas Putri and Latifah (2025) analyzed the 2021–2023 period. Compared with these studies, the present research extends the observation period until 2025 and includes all

Islamic Commercial Banks operating in Indonesia. Therefore, this study provides more comprehensive and updated empirical evidence regarding the efficiency performance of Islamic Commercial Banks after the structural transformation of the Islamic banking industry.

Research on efficiency analysis remains relevant because Islamic Commercial Banks continue to develop from year to year. Previous studies have generally been limited to certain periods or have focused only on Bank Syariah Indonesia. Therefore, this study focuses on the efficiency level of Islamic Commercial Banks in Indonesia during the 2021–2025 period using the intermediation approach through the Data Envelopment Analysis (DEA) method. This study is expected to provide an up-to-date overview of the ability of Islamic Commercial Banks to collect funds and distribute them to the public through financing. The conceptual framework of this study is based on the intermediation approach, which considers Islamic Commercial Banks as financial intermediaries. Customer deposits, other operating expenses, and total assets are treated as input variables, while financing and other operating income are treated as output variables. The efficiency of each bank is then evaluated using Data Envelopment Analysis (DEA).

Figure 1. Conceptual Framework of the Study



Sources: Developed for this study

3. Research Method

This study employed a quantitative descriptive research design to evaluate the efficiency level of Islamic Commercial Banks in Indonesia. Panel data covering the 2021–2025 period were analyzed using the Data Envelopment Analysis (DEA) approach with an output-oriented orientation under the Variable Returns to Scale assumption. This study uses secondary panel data derived from the annual reports of 13 Islamic Commercial Banks for the 2021–2025 period. The data used in this study are secondary data obtained from the official website of the Financial Services Authority (Otoritas Jasa Keuangan/OJK), consisting of balance sheets and income statements of each Islamic Commercial Bank. However, Bank Nano Syariah is only analyzed for the 2024–2025 period, as the bank's data for 2021–2023 are not available for the respective variables. The operational definitions of the variables are presented to clarify how each input and output variable is measured. These variables were selected based on the intermediation approach commonly applied in previous Islamic banking efficiency studies.

The population of this study consists of all Islamic Commercial Banks operating in Indonesia during the observation period. Since all banks meeting the research criteria were included in the analysis, this study employed a census sampling technique. Each Islamic Commercial Bank represents one Decision Making Unit (DMU) in the DEA model.

Table 1. List of Islamic Commercial Bank in Indonesia

No	Name
1	Bank Aceh Syariah
2	Bank NTB Syariah
3	Bank Muamalat Indonesia
4	Bank Nano Syariah
5	Bank Victoria Syariah
6	Bank Jabar Banten Syariah
7	Bank Syariah Indonesia
8	Bank Mega Syariah
9	Bank Panin Dubai Syariah
10	Bank Bukopin Syariah
11	BCA Syariah
12	BTPN Syariah
13	Bank Aladin Syariah

Sources: OJK (2026)

analysis is used to explore and clarify the phenomenon under investigation by describing several variables related to the research problem and the units of analysis. Meanwhile, quantitative analysis is conducted using Data Envelopment Analysis (DEA). The data processing is carried out using Microsoft Excel to classify and organize the data, while MaxDEA 12.2 is used to analyze the efficiency level of each Islamic Commercial Bank using the DEA method.

Data Envelopment Analysis (DEA) is used to evaluate Decision Making Units (DMUs). A DMU is considered technically efficient when it demonstrates an optimal ratio between inputs and outputs. Therefore, the relationship between outputs and inputs becomes the main aspect measured in this analysis.

$$Efficiency\ of\ DMU_0 = \frac{\sum_{k=1}^n \mu_k y_{rj}}{\sum_{i=1}^m v_i x_{ij}}$$

K = the DMU to be evaluated

m = the number of inputs

- n = the number of outputs
 X_{ij} = the value of input (i) for DMU (j)
 Y_{rj} = the value of output (r) for DMU (j)
 μ_k = the weight of DMU (k) for the evaluated DMU
 V_i = the weight assigned to input (i) for the DMU being assessed

DEA studies generally employ two main models, namely the CCR and BCC models. The Charnes, Cooper, and Rhodes (CCR) model is based on the Constant Returns to Scale (CRS) assumption, which implies that an increase in inputs will result in a proportional increase in outputs under an output-oriented approach. This model evaluates scale efficiency and technical efficiency simultaneously, assuming that a given amount of input will produce output in the same proportion. In contrast, the Banker, Charnes, and Cooper (BCC) model introduces the Variable Returns to Scale (VRS) assumption, which allows technical efficiency and scale efficiency to be measured separately. This model assumes that changes in input proportions do not necessarily result in outputs increasing in the same proportion (Tanjung & Devi, 2013). This study employs the BCC model with the VRS assumption because Islamic Commercial Banks have diverse scales of operation. Some banks operate on a relatively smaller scale, while others possess larger assets and greater resources (Hidayah et al., 2020).

Efficiency can be identified when a unit is able to generate maximum output from a given level of input, as indicated by an efficiency score of 100% or 1 in the MaxDEA analysis results. Conversely, inefficiency is indicated when the resulting score is below 100% or less than 1. Therefore, Islamic Commercial Banks with efficiency scores approaching 100% or 1 can be considered to have better operational performance (Setyono et al., 2021).

This study also applies an output-oriented approach in assessing efficiency, using the intermediation approach as the analytical framework (Kusumaningsih et al., 2023). The variables used in this study consist of customer deposits, other operating expenses, total assets, financing, and other operating income (Firdaus & Hosen, 2014; Rizal et al., 2023).

Table 2. Operational Definition of Variables

Variable		Definition	Indicator	Source
Input	Customer deposits (X1)	Funds collected by banks from customers	Total customer deposit (demand, saving, and time deposits)	Institutional report
	Other operating expenses (X2)	Expenses incurred from bank operational activities other than the main financing or funding costs.	Total other operating expenses	Institutional report
	Total Asset (X3)	Total assets owned by Islamic commercial banks.	Nominal value of total asset	Institutional report
Output	Financing (Y1)	Funds distributed by Islamic banks to customers through sharia-compliant		Institutional report

Variable	Definition	Indicator	Source
	contracts		
Other operating income (Y2)	Income earned from bank operational activities other than the main income from financing	Total other operating income	Institutional report

4. Results

In this study, the efficiency level of Islamic Commercial Banks in Indonesia can be determined based on their ability to maximize outputs, namely financing and other operating income, using the available inputs, namely third-party funds, total assets, and other operating expenses.

Table 3. Data Envelopment Analysis Results

No	Islamic Commercial Bank	2021	2022	2023	2024	2025
1	Bank Aceh Syariah	0,319	0,766	0,789	0,799	1
2	Bank NTB Syariah	0,823	0,76	0,823	0,819	0,824
3	Bank Muamalat Indonesia	0,483	0,676	1	0,958	1
4	Bank Nano Syariah	-	-	-	0,756	0,874
5	Bank Victoria Syariah	1	1	0,928	1	1
6	Bank Jabar Banten Syariah	0,408	0,393	0,505	0,641	0,681
7	Bank Syariah Indonesia	1	1	1	1	1
8	Bank Mega Syariah	0,411	0,556	0,934	1	1
9	Bank Panin Dubai Syariah	1	1	1	0,988	1
10	Bank Bukopin Syariah	0,943	0,931	1	1	0,952
11	BCA Syariah	0,813	0,756	0,878	0,856	0,981
12	BTPN Syariah	0,551	0,567	0,738	0,944	1
13	Bank Aladin Syariah	1	1	1	0,979	0,652

Sources: DEA (2026)

Based on table 3, the efficiency levels of Islamic Commercial Banks during the 2021–2025 period show a fluctuating pattern across banks and across years. In general, the efficiency scores range from 0.319 to 1, where a score of 1 indicates perfect efficiency, while a score below 1 indicates inefficiency.

Bank Syariah Indonesia was the only bank that consistently achieved a perfect efficiency for five consecutive years. This indicates that BSI had the most stable efficiency performance during the study period. In addition, Bank Victoria Syariah and Bank Panin Dubai Syariah also demonstrated strong performance, as each achieved perfect efficiency in four out of the five years.

In terms of annual development, several banks showed an increasing efficiency trend. For example, Bank Aceh Syariah improved from 0.319 in 2021 to 1 in 2025, while BTPN Syariah increased from 0.551 in 2021 to 1 in 2025. This indicates an improvement in the banks' ability to manage their inputs in order to generate outputs.

However, several banks did not achieve perfect efficiency throughout the study period, including Bank NTB Syariah, Bank Jabar Banten Syariah, and BCA Syariah. Nevertheless, some of these banks showed improvement, particularly Bank Jabar Banten Syariah, whose efficiency score increased from 0.408 in 2021 to 0.681 in 2025, and BCA Syariah, whose score increased to 0.981 in 2025.

This findings indicate that the efficiency of Islamic Commercial Banks in Indonesia remains uneven. Some banks were able to achieve optimal efficiency, while others still need to improve their output performance, particularly in financing and other operating income, in order to achieve a higher level of efficiency.

5. Discussion

The results of this study indicate that the efficiency levels of Islamic Commercial Banks generally fluctuated during the observation period. Bank Syariah Indonesia was the only bank that achieved perfect efficiency throughout the 2021–2025 period. This finding indicates that BSI managed its resources optimally, allowing the available inputs to generate maximum outputs. Following the merger, BSI possessed stronger assets and resources, which enabled the bank to expand its financing management and distribution more effectively (Rizal et al., 2023).

The consistently high efficiency achieved by Bank Syariah Indonesia also reflects the successful realization of economies of scale following the merger of the three state-owned Islamic banks. A larger asset base and broader customer deposits enabled the bank to allocate financial resources more effectively while maintaining operational efficiency. This condition demonstrates that larger banking institutions tend to possess stronger capabilities in managing costs, expanding financing portfolios, and improving operational productivity. Consequently, Bank Syariah Indonesia was able to transform available inputs into optimal outputs throughout the observation period.

From a theoretical perspective, these findings support the intermediation theory, which explains that banks function as intermediaries between surplus and deficit economic units. Efficient financial intermediation is achieved when customer deposits are effectively transformed into productive financing while maintaining sustainable operational performance. Therefore, the consistently high efficiency of Bank Syariah Indonesia indicates that the bank successfully optimized its intermediary role through better resource allocation, digital integration, and financing expansion after the merger. This finding is also consistent with previous studies reporting that larger Islamic banks generally exhibit higher efficiency due to stronger capital structures and economies of scale.

Several banks also demonstrated relatively good efficiency levels. Bank Victoria Syariah was efficient in 2021–2022 and 2024–2025. In 2023, the bank operated less efficiently; however, its efficiency score remained relatively high at 0.928. This condition may have occurred because the increase in operating expenses was not yet proportional to the bank's operating income (Rizal et al., 2023).

Although Bank Victoria Syariah experienced a slight decline in efficiency during 2023, its efficiency score remained close to the efficiency frontier. This suggests that the bank maintained relatively effective operational management despite temporary fluctuations in financing performance. Minor reductions in financing growth or increases in operating expenses may have contributed to this condition. Nevertheless, the bank demonstrated the ability to recover its efficiency in the following years, indicating effective managerial adaptation and continuous operational improvement.

Bank Panin Dubai Syariah was efficient in 2021–2023 and in 2025. In 2024, the bank was inefficient, with an efficiency score of 0.988, which was still relatively high and close to the efficient score of 1. This inefficiency may have been caused by a decline in financing. In that year, Bank Panin Dubai Syariah distributed financing amounting to IDR 11.424 trillion, decreasing by approximately IDR 79 billion from IDR 11.498 trillion in 2023. Similarly, other operating income also declined from IDR 183.704 billion in 2023 to IDR 181.175 billion in 2024. This finding is consistent with Rizal et al. (2023), who argued that financing performance and operating income significantly affect the efficiency level of Islamic Commercial Banks. The decline in financing and operating income indicates that maintaining efficiency requires not only controlling operational costs but also sustaining financing growth. Islamic Commercial Banks that experience declining financing portfolios may encounter difficulties in generating sufficient operating income to offset the utilization of available resources. Therefore, continuous financing expansion remains essential for preserving operational efficiency in Islamic banking institutions.

Bank Aladin Syariah was efficient in 2021–2023 but became inefficient in 2024–2025. This may be attributed to the bank's focus on expansion, particularly through an overall increase in customer deposits and total assets (Fauzukhaq & Kurnia, 2025). The bank's customer deposit increased from IDR 5.41 trillion in 2024 to IDR 10.4 trillion in 2025. Its assets also increased from IDR 2.13 trillion in 2024 to IDR 4.49 trillion in 2025. However, financing only increased slightly, from IDR 4.1 trillion in 2024 to IDR 4.6 trillion in 2025.

The experience of Bank Aladin Syariah illustrates that rapid asset expansion does not automatically lead to higher efficiency. As a digital Islamic bank, Bank Aladin focused heavily on expanding customer deposits and strengthening its technological infrastructure. However, the relatively modest increase in financing indicates that asset growth was not immediately transformed into productive financing activities. Consequently, the bank experienced declining technical efficiency despite significant growth in assets and deposits.

This finding highlights the importance of balancing digital transformation with effective financing strategies. Digital banking investments should ultimately support improvements in financing allocation and revenue generation rather than merely increasing operational capacity. Therefore, Islamic digital banks should ensure that technological innovation is accompanied by sustainable financing expansion to achieve long-term operational efficiency.

Several banks achieved efficiency in two years of the observation period, namely Bank Muamalat Indonesia in 2023 and 2025, Bank Mega Syariah in 2024–2025, and Bukopin Syariah in 2023–2024. Meanwhile, Bank Aceh Syariah and BTPN Syariah achieved perfect efficiency only in 2025. The main factor contributing to this inefficiency is the suboptimal distribution of third-party funds into financing, which indicates that the bank has not yet maximized its intermediation function (Fauzukhaq & Kurnia, 2025).

In contrast, Bank NTB Syariah, Bank Jabar Banten Syariah, and BCA Syariah remained inefficient throughout the 2021–2025 period. This finding indicates that, from the output perspective, these three banks had not yet managed their resources optimally, resulting in financing and other operating income that had not been maximized (Mukti, 2024).

Table 4. Potential Improvement

No	Islamic Commercial Bank	Financing	Other Operational Income
1	Bank NTB Syariah	21.28%	21.28%
2	Bank Nano Syariah	60.71%	14.3%
3	Bank Jabar Banten Syariah	46.69%	46.69%
4	Bank Bukopin Syariah	5.01%	13.6%
5	BCA Syariah	1.87%	1.87%
6	Bank Aladin Syariah	53.62%	52.62%

Source: DEA (2026)

Referring to Table 4. The potential improvements can be achieved by increasing the two main output variables used in this study, namely financing and other operating income. Inefficient Islamic Commercial Banks in 2025 were selected because they can provide a reference or target for output improvement, allowing them to operate efficiently in the following year.

Bank NTB Syariah needs to increase its financing by 21.28% and its other operating income by 21.28%. To achieve efficiency, Bank Nano Syariah needs to increase its financing by 60.71% and its other operating income by 14.3%. Bank Jabar Banten Syariah needs to increase its financing by 46.69% and its other operating income by 46.69%. Bank Bukopin Syariah should also implement similar improvements to achieve a perfect efficiency score by increasing its financing by 5.01% and its other operating income by 13.6%. Furthermore, BCA Syariah needs to increase its financing by 1.87% and its other operating income by 1.87%. Bank Aladin Syariah also needs to increase its financing by 52.62% and its other operating income by 51.62% in order to achieve efficiency.

6. Conclusion

Islamic Commercial Banks generally need to improve their efficiency levels so that the outputs generated can be maximized. Based on the findings of this study, Bank Syariah Indonesia was the most efficient bank during the 2021–2025 period. It was followed by Bank Victoria Syariah, which achieved efficiency in 2021–2022 and 2024–2025, and Bank Panin Dubai Syariah, which was efficient in 2021–2023 and 2025. Both banks achieved efficiency in four years during the 2021–2025 period. Furthermore, Bank Aladin Syariah was efficient in the first three years of the same period. Bank Mualamat Indonesia and Bank Mega Syariah were efficient for only two years during the observed period. Meanwhile, Bank Aceh Syariah and BTPN Syariah were efficient only in 2025. Three Islamic Commercial Banks, namely Bank NTB Syariah, Bank Jabar Banten Syariah, and BCA Syariah, remained inefficient throughout the 2021–2025 period.

Inefficient Islamic Commercial Banks, particularly in 2025, can improve their efficiency levels by focusing on significantly increasing financing and other operating income. Efficient Islamic Commercial Banks are able to perform their intermediation function effectively, allowing the funds collected from the public to be distributed more optimally and equitably to those in need.

Future research may apply an input-oriented approach to examine how optimally Islamic Commercial Banks in Indonesia utilize their inputs. In addition, future studies may consider using more recent datasets, as the Islamic banking industry in Indonesia is expected to continue developing in the coming years. Future research may also employ a parametric efficiency method, such as Stochastic Frontier Analysis (SFA), to provide more diverse empirical findings on banking efficiency. This study enriches the literature on Islamic banking efficiency by providing updated empirical evidence using the intermediation approach and output-oriented DEA model. This study enriches the Islamic banking efficiency literature by providing updated empirical evidence regarding the efficiency performance of Islamic Commercial Banks using the intermediation approach and the DEA model.

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Author Contributions

Ahmad Azhari Pohan: Conceptualization, methodology, data collection, data curation, formal analysis, investigation, visualization, writing – original draft preparation. Yeni Hanisah

Piliang: Supervision, validation, methodology review, writing – review and editing, project administration, and final approval of the manuscript.

Data Availability Statement

The datasets analyzed during this study are publicly available through the official website of the Financial Services Authority (OJK). Additional information may be obtained from the corresponding author upon reasonable request.

References

- Ariana Putri, R., & Nur Latifah, F. (2025). *Analisis Efisiensi Bank Umum Syariah dengan Metode Dea: Data Envelopment Analysis Periode 2021-2023*. 6, 1498.
- Ascarya, A., & Yumanita, D. (2007). Mencari Solusi Rendahnya Pembiayaan Bagi Hasil Di Perbankan Syariah Indonesia. *Buletin Ekonomi Moneter Dan Perbankan*, 8(1), 7–43. <https://doi.org/10.21098/bemp.v8i1.127>
- Ascarya, A., & Yumanita, D. (2008). Comparing the Efficiency of Islamic Banks in Malaysia and Indonesia. *Bulletin of Monetary Economics and Banking*, 11(2), 95–196.
- Cooper, W. W., Seiford, L. M., & Tone, K. (2007). *Data Envelopment Analysis*. Springer US. <https://doi.org/10.1007/978-0-387-45283-8>
- Fauzukhaq, M. F., & Kurnia, Y. (2025). Analysis of the Efficiency Level of Islamic Commercial Banks in Indonesia using Data Envelopment Analysis (2019-2023 Period). *Journal of Economics, Finance And Management Studies*, 08(02). <https://doi.org/10.47191/jefms/v8-i2-08>
- Firdaus, M. faza, & Hosen, M. N. (2014). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. *Buletin Ekonomi Moneter Dan Perbankan*, 16(2), 167–188. <https://doi.org/10.21098/bemp.v16i2.31>
- Hidayah, U., Alfie, A. A., & Ayuningtyas, R. D. (2020). Analisis Efisiensi Bank Pembiayaan Rakyat Syariah (BPRS) Wilayah Jawa Tengah & DIY dengan Metode Data Envelopment Analysis (DEA) Periode 2016–2018. *Ihtiyath: Jurnal Manajemen Keuangan Syariah*, 4(2), 1–13. <https://doi.org/10.32505/ihtiyath.v4i2.2041>
- Hidayat. (2014). *Efisiensi Perbankan Syariah: Teori dan Praktik*. Gramata Publishing.
- Huri, M. D., & Susilowati, I. (2004). Pengukuran Efisiensi Relatif Emiten Perbankan Dengan Metode Data Envelopment Analysis (DEA) (Studi Kasus: Bank-Bank yang Terdaftar di Bursa Efek Jakarta Tahun 2002). *Jurnal Dinamika Pembangunan*, 2.
- Kusumaningsih, R. P., Mulyadi, J., Sihite, M., & Djaddang, S. (2023). Analisis Efisiensi Bank Pemerintah Indonesia Dengan Data Envelopment Analysis - DEA. *JURNAL AKUNIDA*, 9(2), 137–150. <https://doi.org/10.30997/jakd.v9i2.11512>

- Miranti, D. A., & Sari, K. (2016). Efisiensi Bank Umum Syariah Di Indonesia Menggunakan Pendekatan Data Envelopment Analysis (DEA). *Jurnal Ekonomi Bisnis*, 21(3).
- Muharam, H., & Pusvitasari, R. (2007). Analisis Perbandingan Efisiensi Bank Syariah di Indonesia Dengan Metode Data Envelopment Analysis (Periode Tahun 2005). *Jurnal Ekonomi Dan Bisnis Islam*, II(3), 80–166.
- Mukti, T. (2024). Komparasi Efisiensi Kinerja Bank Umum Syariah Di Indonesia Tahun 2023. *El-Amwal: Jurnal Ekonomi Dan Keuangan Syariah*, 7(1), 19–32.
- Nurlela. (2015). Analisis Tingkat Efisiensi Bank Umum Syariah di Indonesia dengan Metode Data Envelopment Analysis (DEA). *TEKUN: Jurnal Telaah Akuntansi Dan Bisnis*, VI(1), 151–171.
- OJK. (2021). *Statistik Perbankan Syariah 2021*.
- Rizal, A., Ismal, R., & Indra. (2023). Analisa Efisiensi Bank Syariah Indonesia (BSI) Sebelum dan Sesudah Merger. *PJIEFAS | Postgraduated Journal of Islamic Economics, Finances and Accounting Studies*, 2(2), 320–371.
- Setyono, F., Istiqomah, Y. N. A., Ilmundhita, S., & Mujib, A. (2021). Analisis efisiensi perbankan syariah pada masa pandemi Covid-19 menggunakan Data Envelopment Analysis (DEA). *I-Finance: A Research Journal on Islamic Finance*, 7(1).
- Tanjung, H., & Devi, A. (2013). *Metodologi Penelitian Ekonomi Islam*. Gramata Publishing.