

Measurement Efficiency Bank General Sharia in Indonesia Uses Data Envelopment Analysis (DEA)

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Abstract : This study aims to measure the efficiency value of Islamic Commercial Banks in Indonesia using Data Envelopment Analysis (DEA) for 2021-2023. The research sample was determined using the purposive sampling method. The selected sample was 11 Islamic Commercial Banks. This study uses secondary data from the annual reports of each Islamic Commercial Bank. The variables are determined using the intermediation approach. The input variables used are total assets and third-party funds, while the output variables used are operating income and total financing. The measurement of the efficiency of Islamic Commercial Banks uses MaxDEA 12 Lite software with the input-oriented Variable Return to Scale (VRS) model. The findings showed the increasing number of banks achieving full efficiency from three (3) banks in 2021 to six (6) banks in 2023 indicates an overall improvement in operational performance and resource utilisation within the Islamic banking sector. Hence, the results offer practical benchmarks for improving operational efficiency and support decision-making among bank managers and regulators.

Keywords: *Efficiency, Islamic Commercial Bank, Data Envelopment Analysis (DEA)*

INTRODUCTION

Banking plays a vital role in the economy as a financial institution providing services to the public, businesses, and the government. Its primary function is to collect funds from surplus funds and channel them to deficit funds through credit. In Indonesia, conventional banks were present before Islamic banks, which only began operating in 1992. Following the enactment of Law No. 10 of 1998, conventional banks were also permitted to offer Islamic services. Even though Islamic banking in Indonesia is growing rapidly, OJK notes that its market share is still small, approximately 7.3% of total national banking assets in June 2023, with the remainder controlled by conventional banks

(Sharia.republika.co.id, 2023). This creates a gap, given that Indonesia has the largest Muslim population in the world, at 240.62 million, or 86.7% of the total population. In comparison, Malaysia, with a Muslim population of 20.6 million (61.3% of the total population), has a larger Islamic banking market share, at 46% in May 2023 (Media Indonesia).

The contributing factors include product limitations, less competitive prices, public preference for conventional banks (Cnbcindonesia.com, 2021) and expanding market share. There is a need for Islamic banking to measure its efficiency to reduce operational risk. Efficiency is a crucial component in achieving performance finance health and sustainable (Khuzaimah, 2021). Thus, this study aims to measure the operational

efficiency of Islamic Commercial Banks in Indonesia using the Data Envelopment Analysis (DEA) approach for the period 2021–2023.

LITERATURE REVIEW

Introduction to Efficiency in Banking

Efficiency in banking refers to the ability of financial institutions to utilise their available resources effectively in producing the maximum possible outputs while minimising the use of inputs (Berger & Humphrey, 1997). In the banking industry, efficiency is a critical indicator of operational performance because it reflects how well banks manage their financial resources, such as assets and deposits, to generate income and provide financing services. An efficient bank is capable of optimising resource allocation, reducing operational costs, improving profitability, and enhancing its competitiveness in an increasingly dynamic financial environment.

Unlike profitability, which measures financial outcomes, efficiency evaluates the effectiveness of the resource transformation process and determines whether a bank is operating close to its optimal production frontier. Consequently, efficiency measurement has become an important performance evaluation tool for bank managers, regulators, and policymakers, as it provides valuable insights into resource utilisation and operational improvement. In banking studies, efficiency is commonly assessed using frontier analysis techniques, particularly Data Envelopment Analysis (DEA), which measures the relative efficiency of decision-making units by comparing multiple inputs and outputs simultaneously (Farrell, 1957 and Cooper, Seiford, & Tone, 2007).

Islamic Commercial Banks

PT Bank Muamalat Indonesia (BMI) is a sharia bank the first in Indonesia which was founded in year 1992 on initiative Assembly the Indonesian Ulema Council (MUI) and support from various parties. The development of Islamic banking has increased rapidly since the enactment of Law No. 21 of 2008, which regulates its operations and principle banking sharia. The government is also actively encouraging the growth of this sector, including through the merger of Bank Syariah Indonesia (BSI) in 2021, which united three state-owned sharia banks, namely Bank BRI syariah, Bank Sharia Mandiri, and Bank BNI Syariah.

Based on the data from the Financial Services Authority (OJK), until June 2024 there is 14 Islamic Commercial Banks (BUS), 19 Units Sharia Business Units (UUS), as well as 173 Sharia People's Financing Banks (BPRS) operating in Indonesia.

Table 1. Development Asset, DPK, And PYD Banking Sharia

Indicator	2020	2021	2022	2023
Asset (in billion)	397,073	441,789	531,860	594,709
Growth Asset (yoy)		11 26%	20 39%	11 82%
DPK (in billion)	322,853	365,421	429,029	465,932
Growth DPK (yoy)		13 18%	17 41%	8 60%
PYD (in billion)	246,532	256,219	322,599	368,376
Growth PYD (yoy)		3 93%	25 91%	14 19%

Source: OJK Sharia Banking Statistics (2024)

Main indicators of sharia banking for increase Power competition experienced significant but fluctuating growth rates. Total assets increased from 441,789 in 2021 become 531,860 (20.39%) on 2022 And 594,709 (11.82%) on 2023, with the highest

growth in 2022. Funds Party Third (DPK) Also go on from 365,421 on 2021 become 429,029 (17.41%) on 2022 And 465,932 (8.60%) in 2023, although the rate growth is slowing. Financing Distributed (PYD) increase from 256,219 on 2021 become 322,599 (25.91%) in 2022 and 368,376 (14.19%) on 2023, with growth highest on 2022

Theory Efficiency

Efficiency is a measure organizational performance that compares input and output. This concept was first introduced by Farrel in 1957, based on the Debreu and Koopmans model. Farrel's efficiency measurement can consider more than one type of input. In a corporate context, efficiency studies are important for maximizing output from limited resources.

Three factors that influence efficiency include: (1) producing large output with the same input, (2) producing the same output with smaller input, and (3) producing much larger output with large input (Mulyadi et al., 2021). Efficiency is defined as "doing matter "the right thing" which relates to how a company achieves its goals. This concept is often viewed from the perspective of costs as input and profits as output (Rusydiana et al., 2019).

The BOPO ratio is often used to measure efficiency, but is considered less accurate (Sari & Widaninggar, 2018). Therefore, other approaches such as parametric (SFA, TFA, DFA) and non-parametric (DEA, FDH) methods are used for efficiency measurement (Fitri, 2018).

Data Envelopment Analysis (DEA)

In this study, the DEA method was used to measure the efficiency of Islamic Commercial Banks. DEA is a mathematical model that measures the efficiency of economic activity units by considering all inputs and outputs without any specific conditions in its

measurement (Firdaus, 2013). This provides a clear picture of the causes of suboptimal efficiency levels. The approach used This study uses an intermediation approach, which aligns with the primary function of banks as financial intermediary institutions (Koiri & Erdkhadifa, 2022). Based on the background presented, the researcher is interested in conducting a study entitled "Measuring the Efficiency of Islamic Commercial Banks in Indonesia Using *Data Envelopment Analysis* (DEA)."

Data Envelopment Analysis (DEA) is a mathematical programming method used to evaluate the effectiveness of a decision-making unit or work unit in producing a desired output. DEA is used in a non-parametric approach using linear programming techniques that assume the absence of random error (Farchah & Kusmargiani, 2020). DEA was first developed by Farrel (1957) to measure the efficiency of techniques from one input and one output to multiple inputs and multiple outputs. output using the input-output ratio (Novandra, 2014).

This method was later further introduced by Charnes, Cooper, and Rhodes (1978) as an approach to overcome the limitations of partial ratio analysis and multiple regression. DEA compares input and output on the efficiency of Economic Activity Units (UKE) or Decision-Making Units. (DMU) which can be a bank, hospital, retail store, and other units with similar operational characteristics (Mustainah et al., 2017).

There are two main models in DEA, namely the 1978 Charnes, Cooper, and Rhodes (CCR) model and the Banker, Charnes, and Cooper (BCC) model. 1984 (Munawan et al., 2022).

1. Constant Return to Scale (CRS) Model

This developed by Charnes, Cooper, and Rhodes (1978) assumed that a proportional increase in input would increase output by the same percentage. This assumption applies if the business unit operating on scale Which optimal.

2. *Variable Return to Scale* (VRS) Model

This developed by Banker, Charnes and Cooper in 1984 develop CCR model assuming that the relationship between input and output is not always proportional. A 1% increase in input does not always result in a 1% increase in output, and allows for conditions where the company Not yet reach optimal scale.

METHODS

This study employs the quantitative approach using secondary data from Islamic Commercial Banks in Indonesia from the year 2021 until the year 2023. The population in this study is the Bank General Sharia in Indonesia,

Data Collection

The sample in this study was 11 Islamic Commercial Banks in Indonesia over a three-year period, with a total of 33 data points. Sampling technique using purposive sampling, that is sampling with certain criteria. As for sample criteria on study This is as following:

1. Sharia Commercial Banks that operate in Indonesia year 2021- 2023.
2. Bank General Sharia Which No registered in a way consecutive year 2021-2023.
3. Banks that do not have the required data for 2021-2023 respectively.

The type of data used in this study is quantitative data, namely data in the form of number, data which can calculated and measured. The data source in this study is secondary data, namely data obtained from the annual financial reports *published* by each Islamic Commercial Bank. Variables in the study This is efficiency. To obtain the efficiency value, input variables are used, namely total assets and third-party funds, and output variables are used,

namely operating income and total financing.

Data Analysis

The technique analysis for this study is analysis descriptive statistics and Data Envelopment Analysis (DEA) using MaxDEA 12 Lite *software* with input-oriented model Banker, Cooper, Charles (BCC) or *Variable Return to Scale* (VRS). DEA will calculate the bank that uses n inputs to produce n outputs. m which different. efficiency bank measured as follows (Miller and Noulas, 1996) in (Kadirisman, 2021):

$$h_s = \frac{\sum_{i=1}^m u_i y_{is}}{\sum_{j=1}^n v_j x_{js}} \quad \dots\dots(1)$$

Equality the show use one input variable and one output variable. The efficiency ratio (h_s) is then maximized with the following constraints:

$$h_s = \frac{\sum_{i=1}^m v_j y_{is}}{\sum_{j=1}^n v_j x_{js}} \leq 1 \quad \text{untuk } r = 1, \dots, N \dots\dots(2)$$

Where: u_i And $v_j \geq 0$ (3)

The equation states that N is amount bank in sample, and r is the type of bank sampled. The first inequality shows that the risk for other UKEs is not more from 1, whereas the second inequality is positively weighted. The efficiency ratio ranges from 0 to 1, where the bank is said to be efficient if the ratio is close to 1 and becomes less efficient as it approaches 0. In DEA, each bank can determine its own weight to obtain the best performance measure (Sagantha, 2020).

RESULTS AND DISCUSSION

Descriptive Analysis

According to (Ghozali, 2018;19) analysis statistics descriptive used to describe research data without generalizing. The descriptive statistical analysis used includes the minimum value, maximum value, average value (mean), and standard deviation of each variable studied. Details

of the results of the descriptive statistical analysis can be seen in Table 2.

Table 2. Results Statistics Descriptive (in millions)

Variables	N	Mini mum	Maxim um	Mean	Std. Deviation
Total Asset	33	1,661,000	353,624,124	45,223,767 45	86,587,635 04
Funds Party Third	33	813,000	47,559,000	14,314,189 48	12,238,619 36
Income Operational	33	37,330	16,258,575	2,306,258 27	4,329,149 349
Total Financing	33	623,000	67,511,016	13,948,615 42	15,254,424 63

Source: SPSS 26, processed researchers (2025)

Table 2. presents a summary of descriptive statistics of the input and output variables of Commercial Banks. Sharia period 2021–2023. Total Assets have a minimum value of Rp1,661,000 million and a maximum of Rp353,624,124 million, with an average of Rp45,223,767.45 million and a standard deviation of Rp86,587,635.04 million. There is a large variation in assets between banks. Meanwhile, Third Party Funds varied from Rp813,000 million to Rp47,559,000 million, with an average of Rp14,314,189.48 million and a standard deviation of Rp12,238,619.36 million, reflecting differences in banks' ability to collect funds from customers.

Operating Income shows a fairly wide distribution, with a minimum value of Rp37,330 million and a maximum of Rp16,258,575 million. The average income of Rp2,306,258.27 million and standard deviation of Rp4,329,149.35 million indicate that most banks own income more low from the highest average. Meanwhile, Total Financing range between Rp. 623,000 million to Rp67,511,016 million, with an average of Rp13,948,615.42 million and a standard deviation of Rp15,254,424.63 million, which shows a significant difference in

the scale of financing distribution between the banks studied.

Efficiency Analysis of Islamic Commercial Banks

Table 3 show that on average, Islamic commercial banks have not yet achieved full efficiency (100%). In 2021, the average efficiency was 89.45%, decreasing slightly in 2022 to 89.20%, and increasing again to 94.15% in 2023. In 2021, three banks achieved full efficiency, namely PT. Bank Victoria Syariah, PT. Bank Panin Dubai Syariah Tbk, and PT. Bank Tabungan Pensiun Nasional Syariah Tbk, while eight other banks recorded values below 100%.

In a year 2022, third bank the remains efficient, and two other banks are added, namely PT. Bank Syariah Bukopin and PT. Bank Syariah Indonesia Tbk. Several other banks experienced an increase, but have not yet reached maximum efficiency values, while three banks have actually experienced a decline in efficiency. In 2023, six banks achieved 100% efficiency: the four banks from the previous year, plus PT. Bank Aceh Syariah and PT. BPD Nusa Tenggara Barat Syariah.

Meanwhile, PT. Bank Muamalat Indonesia, PT. Bank Jabar Banten Syariah, PT. Bank Mega Sharia, And PT. BCA Syariah recorded an increase in efficiency, although it did not reach 100%. PT Bank Syariah Bukopin experienced a slight decline compared to the previous year. The table also shows that only three banks achieved full efficiency in a row, namely PT. Bank Victoria Syariah, PT. Bank Panin Dubai Syariah Tbk, and PT. Bank Tabungan Pensiun Nasional Syariah Tbk, while other banks need to make improvements to achieve and maintain optimal efficiency.

Table 3. Results of Efficiency Values

No .	Name Bank	2021	2022	2023
1.	PT. Bank Aceh Sharia	93.25 %	97.85%	100%
2.	PT BPD Nusa Southeast West Sharia	95.12 %		
3.	PT. Bank Transactions Indonesia	49.83 %	52.38%	82.85%
4.	PT. Bank Victoria Syariah	100%	100%	100%
5.	PT. Bank West Java Banten Sharia	87.49 %	85.62%	91.30%
6.	PT. Bank Mega Sharia	74.41 %	64.68%	74.26%
7.	PT. Bank Panin Dubai Sharia Tbk	100%	100%	100%
8.	PT. Bank Bukopin Sharia	99.11 %	100%	98.97%
9.	PT. BCA Syariah	85.55 %	85.13%	88.36%
10 .	PT. Bank Savings Pension National Sharia Tbk	100%	100%	100%
11 .	PT. Bank Sharia Indonesia Tbk	99.16 %	100%	100%
Average		89.45 %	89.20%	94.15 %

Source: MaxDEA 12 Lite, processed by researchers (2025)

Inefficiency Bank General Sharia Analysis

DEA also produces information on improvement efforts to increase the efficiency of inefficient DMUs. Proportionate Movement is the amount of input that can be reduced while maintaining output. constant. Slack Movement is the amount of output that can be added or the amount of input that can be reduced outside of the Proportionate Movement. Projection is the amount of input and output required for the DMU to operate efficiently (Susila et al., 2024).

Table 4. Inefficiency Bank General Sharia (in millions)

Year	Efficiency Value	Variables	Proportionate Movement	Slack Movement	Projection
PT. Bank Aceh Syariah					
2021	93.25 %	Total Asset	- 1,900,073	0	26,270,752
		Funds Party Third	- 1,619,973	- 1,725,671	20,672,364
2022	97.85 %	Total Asset	- 618,088	0	28,149,008
		Funds Party Third	- 493,662	- 232,381	22,249,991
PT BPD Nusa Tenggara Barat Syariah					
2021	95.12 %	Total Asset	- 547,231	0	10,667,948
		Funds Party Third	- 397,327	0	7,745,672
2022	95.57 %	Total Asset	- 575,935	0	12,425,705
		Funds Party Third	- 433,225	- 69,414	9,277,359
PT. Bank Muamalat Indonesia					
2021	49.93 %	Total Asset	- 29,547,286	0	29,351,713
		Funds Party Third	- 23,513,317	0	23,357,682
		Income Operational	0	969,681	1,722,681
		Total Asset	- 29,217,663	0	32,146,336
2022	52.38 %	Funds Party Third	- 21,970,384	0	24,172,615
		Income Operational	0	1,584,978	1,914,978
2023	82.85 %	Total Asset	- 11,477,811	0	55,475,188
		Funds Party Third	- 8,153,080	- 14,561,246	24,844,672
		Income Operational	0	2,755,043	2,960,043

PT. Bank Jabar Banten Syariah					
2021	87.49 %	Total Asset	- 1,295,224	0	9,064,775
		Funds Party Third	- 985,171	0	6,894,828
2022	85.62 %	Total Asset	- 1,790,152	0	10,659,847
		Funds Party Third	- 1,311,340	0	7,808,659
2023	91.30 %	Total Asset	- 1,187,457	0	12,462,542
		Funds Party Third	- 881,763	0	9,254,236
PT. Bank Mega Syariah					
2021	74.41 %	Total Asset	- 3,593,000	0	10,448,750
		Funds Party Third	- 2,914,470	- 739,679	7,735,850
2022	64.68 %	Total Asset	- 5,674,627	0	10,395,946
		Funds Party Third	- 4,653,946	- 802,536	7,723,517
2023	74.26 %	Total Asset	- 3,749,476	0	10,817,237
		Funds Party Third	- 2,494,209	0	7,195,790
PT. Bank Bukopin Syariah					
2021	99.11 %	Total Asset	- 55,037	0	6,165,183
		Funds Party Third	- 40,657	0	4,554,410
		Income Operati onal	0	65,298	151,752
2023	98.97 %	Total Asset	- 81,578	0	7,838,895
		Funds Party Third	- 62,378	0	5,993,969
		Income Operati onal	0	8,542	198,433
PT. BCA Syariah					

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2021	85.55 %	Total Asset	- 1,536,897	0	9,105,402
		Funds Party Third	- 1,108,796	0	6,569,103
2022	85.13 %	Total Asset	- 1,883,888	0	10,786,011
		Funds Party Third	- 1,409,819	0	8,071,780
2023	88.36 %	Total Asset	- 1,683,600	0	12,788,099
		Funds Party Third	- 1,273,837	- 98,732	9,576,930
PT. Bank Indonesia Syariah Tbk					
2021	99.16 %	Total Asset	- 2,223,359	0	263,065,722
		Funds Party Third	- 107,335	0	12,699,838

Source: MaxDEA 12 Lite, processed researchers (2025)

Based on Table 4 presented above, in 2021, PT. Bank Aceh Syariah recorded an efficiency value of 93.25%, indicating that the bank was in an inefficient condition or experiencing inefficiency. For To achieve full efficiency with a value of 1 or 100%, PT. Bank Aceh Syariah needs to make a number of significant improvements, including reducing total assets by Rp1,900,073. million through Proportionate Movement so that the total Projection value asset can reach Rp26,270,752 million. This explanation applies to Islamic Commercial Banks that experience inefficiency caused only by Proportionate Movement.

The bank also needs to reduce the amount of third party funds by Rp1,619,973. million through Proportionate Movement as well as addition reduction of Rp1,725,671 million through Slack Movement so that mark Projection funds third parties can reach Rp20,672,364 million. This explanation applies to Sharia

Commercial Banks Which experience inefficiency caused only by Proportionate Movement and Slack Movement.

Research on the efficiency of Islamic Commercial Banks (BUS) in Indonesia uses the Data Envelopment Analysis (DEA) method with input in the form of total assets and third-party funds (DPK), as well as output in the form of operational income and total financing. The results show that in 2021, the average efficiency of BUS reached 89.45%, indicating part Most banks have managed resources near-optimally.

However, in 2022, efficiency declined to 89.20%, indicating a decline in operational performance due to third-party fund utilization and productivity. financing Which not enough optimal. In 2023, efficiency increased significantly become 94.15% blessing BUS success in overcome constraint previously through asset optimization and increased financing productivity. This improvement aligns with efficiency theory, which emphasizes the importance of balancing input and output to achieve maximum performance.

Input inefficiency indicates excessive use of resources, while output inefficiency only occurs in some banks. reach efficiency which is higher, BUS recommended reduce the total asset use avoid high costs operational and risk finance (Sahrullah & Suprayogi, 2022), and reduce DPK so that efficiency and productivity increase with greater risk low (Katuuk et al., 2018).

The results of this study are supported by previous findings from Andriansyah & Julia (2023); Khalimah & Gunanto (2022); Riani & Hendrawan (2020) also noted that BUS efficiency was above 85%. However, this result differs from the research by Nailah & Rusydiana (2020), which recorded BUS efficiency at only 68%, a difference caused by different variables and research periods. To maintain sustainable efficiency improvements, BUS in Indonesia need to

consistently evaluate their strategies using DEA approaches such as Proportionate Movement, Slack Movement, and Projection to improve operational quality and strengthen competitiveness in the national Islamic banking industry. Table 5 presents te summary of findings on the efficiency of Islamic Commercial Banks in Indonesia from year 2021 until year 2023.

Table 5. Summary of Key Findings on the Efficiency of Islamic Commercial Banks in Indonesia (2021-2023)

No.	Key Finding	Supporting Evidence
1	Overall efficiency fluctuated during 2021–2023.	Average efficiency was 89.45% (2021), 89.20% (2022), and 94.15% (2023), with an overall average of 90.93%.
2	Three banks achieved full efficiency in 2021.	PT Bank Victoria Syariah, PT Bank Panin Dubai Syariah Tbk, and PT Bank Tabungan Pensiun Nasional Syariah Tbk achieved 100% efficiency. PT Bank Muamalat Indonesia recorded the lowest efficiency score (49.83%).
3	Efficiency improved in 2022.	Five Islamic Commercial Banks achieved 100% efficiency. PT Bank Aceh Syariah, PT BPD Nusa Tenggara Barat Syariah, and PT Bank Muamalat Indonesia improved, while PT Bank Jabar Banten Syariah, PT Bank Mega Syariah, and PT BCA Syariah recorded lower efficiency than in 2021.
4	Efficiency performance further improved in 2023.	Six Islamic Commercial Banks achieved 100% efficiency. PT Bank Aceh Syariah and PT BPD Nusa Tenggara Barat Syariah reached

		full efficiency for the first time. PT Bank Muamalat Indonesia improved to 82.85%, although it remained below 100%.
5	Three banks consistently maintained full efficiency.	PT Bank Victoria Syariah, PT Bank Panin Dubai Syariah Tbk, and PT Bank Tabungan Pensiun Nasional Syariah Tbk consistently achieved 100% efficiency from 2021–2023. Other banks require further improvement to achieve consistent optimal efficiency.

Source: Researchers (2025)

CONCLUSION

This study contributes to the Islamic banking literature by providing updated evidence on the efficiency performance of Islamic Commercial Banks in Indonesia during the 2021–2023 period using the DEA approach. The findings provide valuable insights for bank management, regulators, and policymakers in identifying performance gaps and formulating strategies to improve the operational efficiency and long-term sustainability of Islamic Commercial Banks in Indonesia.

Future research is encouraged to extend the analysis by incorporating a longer observation period, comparing Islamic and conventional banks, or employing a two-stage DEA approach to examine the determinants of bank efficiency, thereby providing a more comprehensive understanding of the factors influencing operational performance.

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