

# FINANCIAL EFFICIENCY IN INDONESIAN ISLAMIC BANKS: A DEA ASSESSMENT OF COST, REVENUE, AND PROFIT EFFICIENCY (2016–2022)

Irma Febriana Mimma Kebahyang<sup>1</sup>, Imbarine Bujang<sup>2\*</sup>, Norhayati Mohamed<sup>3</sup>, Mohd Shahrin Bahar<sup>4</sup>

<sup>1,3</sup> Accounting Research Institute, Universiti Teknologi MARA, Shah Alam, Malaysia

<sup>2</sup> Faculty of Business and Management, Universiti Teknologi MARA Cawangan Sabah, Kampus Kota Kinabalu, Malaysia

<sup>4</sup> Monitoring State Agencies and Investment, Ministry of Finance Sabah, Malaysia

\*Corresponding Author

Email: <sup>1</sup>irmaf\_mk@yahoo.co.id, <sup>2</sup>imbar074@uitm.edu.my, <sup>3</sup>norha614@uitm.edu.my, <sup>4</sup>mohdshahrin.bahar@sabah.gov.com.my

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## ABSTRACT

*Indonesia's Islamic banks have usually been judged on narrow yardsticks how cheaply they run or how well they convert inputs into outputs. We stepped back and looked at all three sides of the coin at once: how wisely they spend, how effectively they earn, and how much profit is left on the table. Using a standard DEA model that allows for variable returns to scale, we tracked nine full-fledged Islamic commercial banks from 2016 through 2022. The headline numbers are blunt: on average they waste 45 % of their inputs (cost efficiency 0.55), leave 28 % of revenue on the floor (revenue efficiency 0.72), yet still manage to keep 84 % of every rupiah of potential profit (profit efficiency 0.84). After the 2019 mega-merger that created Bank Syariah Indonesia and the accompanying push into mobile banking, all three scores ticked upward. The takeaway for OJK and KNKS is simple: Indonesian Islamic banks can stay profitable even while they remain sloppy on cost; regulators now have an integrated benchmark that ties financial survival to the Maqasid al-Shariah goal of protecting wealth.*

**Keywords:** Cost efficiency, Data Envelopment Analysis, Indonesia, Islamic banking, profit efficiency

## 1.0 INTRODUCTION

Indonesia's Islamic-banking laboratory offers a rare natural experiment. With the world's largest Muslim population and a state-driven roadmap (MEKSI 2019-2024) that treats sharia-compliant finance as strategic infrastructure, the archipelago channels regulatory energy, fiscal incentives and fast-moving fintech into a single sector. The outcome is an annual asset growth rate above 10 % even though the industry still commands only 7 % of total banking assets (OJK, 2023). These simultaneous realities rapid expansion yet modest market share raise an unresolved question: when digital platforms, post-merger scale and moral mandates collide, how efficiently do Indonesian Islamic banks transform deposits into sharia-endorsed profit?

Classical intermediation theory portrays banks as passive brokers that gather surplus funds and reallocate them to deficit units. Efficiency, in that world, is a scalar: maximal output per unit of input (Berger & Mester, 1997). Islamic intermediation, however, is intrinsically vector-valued. Trusteeship (*amanah*) and striving-for-excellence (*ihsan*) convert the production frontier into a moral boundary where *adl* (justice), *maslahah* (social benefit) and *hifz al-mal* (wealth protection) are co-produced alongside financial return (Chapra, 2016; Ascarya & Rahmawati, 2022). A bank that squeezes operating cost but finances projects that erode communal welfare is, by sharia standards, further from the frontier, not closer.

Data Envelopment Analysis (Farrell, 1957; Charnes et al., 1978) is uniquely suited to this dual mandate because it allows multiple, simultaneously optimised outputs. Yet the Islamic-finance literature has largely chained DEA to single-dimensional metrics either cost contraction (Yudistira, 2004) or technical expansion (Kamarudin et al., 2016; Rusydiana & As-Salafiyah, 2021). Such partial views can mask managerial trade-offs: a cost-efficient bank may still tolerate revenue leakage through non-asset-based instruments that violate sharia nomenclature, while a profit-maximising bank may ignore cost containment and crowd out small, welfare-enhancing deposits. Only a triadic model cost, revenue and profit efficiency estimated under the same sample and period can expose these inner contours.

Recent ethical-DEA hybrids (Hidayat & Aziz, 2024) begin to embed normative weights, but they remain embryonic and region-specific. Indonesia therefore supplies the missing empirical terrain. The 2021 forced merger that created Bank Syariah Indonesia (BSI) consolidated three separate Islamic licences into one regional titan, promising back-office synergies and scale-driven cost elasticity. At the same moment, regulator-sanctioned fintech sandboxes allowed branch-light platforms to intermediate through mobile wallets, equity-crowdfunding and P2P *sukuk*. Whether these twin shocks institutional consolidation and digital diffusion have shifted the cost, revenue and profit frontiers in morally coherent ways is still undocumented.

To close the gap, we observe nine full-fledged Islamic commercial banks from 2016-2022, a window that captures both pre- and post-merger regimes as well as the COVID-induced digital surge. A variable-returns-to-scale DEA is run three times for each year: input-oriented cost efficiency, output-oriented revenue efficiency and a directional-profit model that treats social-impact proxies (profit-sharing ratio, *qardh* volume, *zakat* throughput) as desirable outputs. The resulting scores are then interpreted through an Islamic-moral-economics lens: movement toward the profit frontier is read as *ihsan* (operational excellence), convergence of cost and revenue frontiers as *adl* (equitable pricing), and retention of social-impact outputs as *hifz al-mal* (stewardship). By nesting quantitative frontiers inside normative theology, the paper offers a conversational bridge between efficiency analysts and sharia scholars while supplying Indonesian regulators with a dashboard that tracks both financial and ethical productivity.

The subsequent sections of the paper are organised as follows. Section 2 examines the theoretical and empirical literature about Data Envelopment Analysis (DEA) and the efficiency of Islamic banking. Section 3 delineates the data and variables, whilst Section 4 articulates the methodological framework. Section 5 delineates and examines empirical findings, Section 6 addresses theoretical and policy ramifications, and Section 7 ends with suggestions for regulators and avenues for future research.

## **2.0 LITERATURE REVIEW**

### **2.1 DEA in Banking Efficiency Studies**

For decades, banking research has obsessed over one question: how much waste happens between the moment a bank swallows capital, labor, and deposits and the moment

it spits out loans and fee income? Farrell (1957) sketched the first real answer, and Charnes et al. (1978) gave it teeth with Data Envelopment Analysis a method that builds an empirical frontier from the best performers without forcing data into a pre-shaped statistical box. That flexibility still outruns parametric alternatives like Stochastic Frontier Analysis today.

Banker et al. (1984) stretched DEA across technical, scale, cost, revenue, and profit dimensions, while Berger and Mester (1997) welded those pieces into a single operational dashboard. Berger and Humphrey (1997) proved the tool could travel: cross-country comparisons suddenly became practical, not theoretical. Cooper et al. (2011) added time itself to the mix, showing how banks slide toward or away from the frontier year by year. That evolution turned DEA into the default lens for both conventional and Islamic finance though, as later sections show, the Islamic lens needs a different filter.

## **2.2 DEA and Islamic Banking Efficiency: Global and Regional Evidence**

Efficiency assessment has consistently been a crucial component of banking performance analysis, particularly in determining how banks convert capital, labour, and deposits into loans and income. Data Envelopment Analysis (DEA) has become the most prevalent non-parametric method among several frontier techniques, evolving from the foundational studies of Farrell (1957) and Charnes, Cooper, and Rhodes (1978). The DEA constructs an empirical best-practice frontier that illustrates the efficiency of various decision-making units without requiring a predetermined functional form.

This is a huge plus over parametric methods like Stochastic Frontier Analysis (SFA). Subsequent studies enhanced DEA to assess many dimensions of banking efficiency, including technical, scale, cost, revenue, and profit efficiency (Banker, Charnes & Cooper, 1984; Berger & Mester, 1997). Berger and Humphrey (1997) established DEA's appropriateness for global comparisons, while Cooper, Seiford, and Zhu (2011) emphasised its adaptability for dynamic evaluations and benchmarking. These methodological advancements have established DEA as a crucial component for empirical efficiency analysis in both conventional and Islamic financial systems.

## **2.3 Empirical Evidence from Indonesia**

Even as Indonesia's Islamic banks expand quickly, their operational results remain patchy. Using DEA window analysis on fourteen banks from 2011–2020, Rusydiana and As-Salafiyah (2021) found an 80% average efficiency score, with BRI Syariah and Syariah Mandiri consistently sitting on the frontier. Asrar et al. (2022) later verified these strong results for 2018–2020, yet Irianti et al. (2021) spotted a different problem: most Islamic banks were too small, suffering from clear scale inefficiencies. Other scholars shifted focus outward, looking at what drives efficiency from outside the bank. Himmawan and Firdausi (2021) traced sharp efficiency swings during COVID-19 back to squeezed liquidity and stuttering digital upgrades. Building on that, Hidayat and Aziz (2024) demonstrated that banks which weave worship and ethics into their governance fabric perform better proof that Maqasid al-Shariah is more than theory; it is a practical performance toolkit.

Yet these pieces leave three blind spots in the Indonesian picture. First, they zoom in on technical or cost efficiency alone, leaving revenue and profit angles out of the frame. Second, they use short time windows that miss seismic shifts like the 2021 Bank Syariah Indonesia merger. Third, none ask whether frontier banks stay there does efficiency persist, or is it fleeting? We tackle all three gaps head-on by running a single, consistent DEA model across cost, revenue and profit fronts, using a balanced panel that stretches from 2016 to 2022. That longer view captures the merger, the pandemic and the fintech wave, giving policymakers a dynamic map of how efficiency really moves in Indonesia's dual-banking landscape.

## **2.4 Theoretical and Analytical Framework: Integrating *Maqasid al-Shariah* with DEA Efficiency**

Efficiency evaluation within banking scholarship has historically operated through the lens of financial intermediation, wherein institutions convert deposits, capital, and labor into productive financing outputs. While conventional analysis distinguishes three dimensions cost efficiency (minimising resource expenditure), revenue efficiency (maximising return on resources), and profit efficiency (integrating both via input-output price structures) this taxonomy acquires particular salience in Islamic finance, where profitability remains inseparable from ethical injunctions against interest-based returns (Berger & Mester, 1997).

From an Islamic economic outlook, efficiency establishes not only an operational benchmark but an ethical obligation justified in *Maqasid al-Shariah*, the higher objectives of Islamic law. These objectives encompassing *‘adl* (justice and fairness), *ihsan* (excellence in conduct), and *hifz al-mal* (wealth protection) recast efficiency as a dual financial-moral construct. The Data Envelopment Analysis (DEA) framework maps onto this paradigm naturally: progression toward the frontier embodies *ihsan*, signalling excellence within ethical constraints, whereas divergence from it betrays *hifz al-mal* by permitting wastefulness and inequitable wealth distribution. Equitable stakeholder treatment and operational gains that augment social welfare materialize *‘adl* as distributive justice. This study constructs a *Maqasid-DEA* conceptual model that maps Islamic moral imperatives onto DEA's quantitative architecture. The model works through three linked channels. First, *‘adl* shapes which inputs count only transparent, balanced allocations make the cut. Second, *ihsan* sets the output direction, pushing management toward persistent, lasting value rather than prompt wins. Third, *hifz al-mal* grounds profit efficiency in preserving wealth, not speculating with it. Taken together, this moves DEA beyond its usual role as a neutral benchmarking tool. It becomes, instead, a vehicle for value-based intermediation (Dusuki & Bouheraoua, 2019; Mohammed, Razak & Taib, 2020; Hidayat & Aziz, 2024).

In this reading, efficiency scores carry a double meaning. They are still numbers that gauge economic performance, but they also serve as signs of moral stewardship. The result is a rounded assessment that fits the spirit of Islamic banking.

## **3.0 RESEARCH METHODOLOGY**

This study addresses this gap by applying Data Envelopment Analysis (DEA) under variable returns to scale (VRS) to evaluate nine Islamic commercial banks registered with OJK from 2016 to 2022. The sample comprises banks with complete data on the inputs/outputs required for DEA over the analysis window. However, bank-years with missing or internally inconsistent values are excluded rather than imputed. Banks are anonymised as Bank 1 – Bank 9 in tables and figures. The Bank-level variables are drawn from audited annual/quarterly financial statements and OJK's Statistik Perbankan Syariah (SPS). As for the unit of analysis and frequency, the unit is the bank-year observation. The frequency and aggregation (including any annualization of quarterly items) follow a consistent data-handling protocol. As for the variables and measurement, the outcomes are DEA cost, revenue, and profit efficiency scores. Inputs, outputs, and (for revenue/profit efficiency) price vectors follow standard bank intermediation practice; variable definitions are provided in Appendix A. No winsorization or re-scaling is applied beyond necessary unit harmonisation. This study retain only bank-years with complete variables required by the DEA models. Where balance-sheet or income-statement items are reclassified by issuers, harmonisation rules are applied before DEA construction. Internal consistency checks (e.g., totals matching subtotals, sign constraints) are performed, and selected items are cross-checked against OJK SPS aggregates.

This study employs Data Envelopment Analysis (DEA) to measure the multidimensional efficiency of Islamic banks across cost, revenue, and profit dimensions under Variable Returns to Scale (VRS) assumptions. DEA provides a non-parametric frontier-based approach that evaluates each decision-making unit (DMU) relative to best-practice peers without imposing a specific functional form (Charnes, Cooper & Rhodes, 1978; Banker, Charnes & Cooper, 1984). The method is particularly suited to Islamic banking, where inputs and outputs often reflect heterogeneous financing instruments and profit-sharing mechanisms not easily captured by parametric models.

### 3.1 Sample and Data Selection

The sample comprises nine Islamic commercial banks operating in Indonesia from 2016–2022, selected based on complete and consistent financial data availability from audited annual reports and the Financial Services Authority (OJK) Statistik Perbankan Syariah (SPS). Banks are anonymized as Bank 1–Bank 9 to ensure confidentiality. Bank-years with missing or internally inconsistent values are excluded to preserve data integrity, yielding a balanced panel of 63 observations. No imputation or winsorization is applied beyond necessary unit harmonization.

The sampling frame included all Islamic commercial banks registered with OJK. After excluding institutions with incomplete data, the final sample comprises nine full-fledged Islamic banks (63 bank-year observations):

- I. Bank Muamalat Indonesia (BMI)
- II. Bank Victoria Syariah (BVS)
- III. Bank BRI Syariah (BRIS)
- IV. Bank Jabar Banten Syariah (BJBS)
- V. Bank BNI Syariah (BNIS)
- VI. Bank Syariah Mandiri (BSM)
- VII. Bank Syariah Mega Indonesia (BMS)
- VIII. Bank Panin Syariah (BPS)
- IX. Bank Syariah Bukopin (BSB)

### 3.2 Variable Specification: Intermediation Approach

Following Berger & Humphrey (1997) and Ascarya & Yumanita (2009), the intermediation approach treats deposits as inputs transformed into loans and investments.

Table 1: Input Variables

| Variable     | Code  | Definition  |
|--------------|-------|---|
| Labor        | $X_1$ | Total personnel expenses (salaries, benefits, training)         |
| Fixed Assets | $X_2$ | Book value of physical capital, premises, and IT infrastructure |
| Total Funds  | $X_3$ | Aggregate deposits plus equity-based funding (mudharabah,       |

Table 2: Output Variables

| Variable    | Code  | Definition   |
|-------------|-------|--|
| Total Loans | $Y_1$ | Sum of short-term and long-term financing facilities |

| Variable                | Code           | Definition   |
|-------------------------|----------------|--|
| Total Earning Assets    | Y <sub>2</sub> | Investment securities, inter-bank funds, and priority sector financing |
| Off-Balance Sheet Items | Y <sub>3</sub> | Nominal value of fee-based services (LCs, guarantees, acceptances)     |

Table 3: Price Vectors for Efficiency Computation

| Price Type    | Variable                                   | Formula   | Citation   |
|---------------|--|---|--|
| Input Prices  | Price of Labor (PI <sub>1</sub> )          | Personnel expenses ÷ Total funds                    | Carvallo & Kasman (2005); Ab-Rahim et al. (2012) |
|               | Price of Fixed Assets (PI <sub>2</sub> )   | Depreciation expenses ÷ Fixed assets                | Hao, Hunter & Yang (2001)                        |
|               | Price of Funds (PI <sub>3</sub> )          | (Operating expenses + profit-sharing) ÷ Total funds | Havrylchyk (2006)                                |
| Output Prices | Price of Loans (PO <sub>1</sub> )          | Financing income ÷ Total loans                      | Bader et al. (2008)                              |
|               | Price of Earning Assets (PO <sub>2</sub> ) | Other operating income ÷ Total earning assets       | Bader et al. (2008)                              |
|               | Price of OBS Items (PO <sub>3</sub> )      | (Fee income + commission) ÷ Off-balance sheet items | Bader et al. (2008)                              |

### 3.4 DEA Model Construction and Estimation

All DEA models are, by implementing a unified linear programming formulation that accommodates cost, revenue, and profit efficiency under Variable Returns to Scale (VRS).

$$\begin{aligned}
 & \max_{\eta, \lambda} \eta \\
 & \sum_{i=1}^n \lambda_i x_{ij} \leq x_{oj} - s_j \eta, j = 1, \dots, m \text{ (inputs)} \\
 & \sum_{i=1}^n \lambda_i y_{ir} \geq y_{or} + t_r \eta, r = 1, \dots, s \text{ (outputs)} \\
 & \sum_{i=1}^n \lambda_i = 1 \text{ (VRS constraint)}
 \end{aligned}$$

$$\lambda_i \geq 0, i = 1, \dots, n$$

Where:

$\eta$  represents the efficiency improvement potential

$x_{ij}$  and  $y_{ir}$  are inputs and outputs of DMU  $i$

$x_{oj}$  and  $y_{or}$  are inputs and outputs of the evaluated DMU

$\lambda_i$  are intensity variables

The model specializes to each efficiency type through directional vectors ( $s_j, t_r$ ):

- I. Cost Efficiency (Input-Oriented):  $s_j = x_{oj}, t_r = 0$  (contracts inputs)
- II. Revenue Efficiency (Output-Oriented):  $s_j = 0, t_r = y_{or}$  (expands outputs)
- III. Profit Efficiency:  $s_j = w_j x_{oj}, t_r = p_r y_{or}$  (price-weighted optimization)

## 5.0 RESULTS: LEVELS OF EFFICIENCY

### 5.1 Cost Efficiency (2016-2022)

Table 4. reports the DEA cost efficiency scores for nine Islamic banks. The industry mean is 0.55, implying that, on average, banks could have reduced their input usage by about 45% while holding outputs constant had they operated on the frontier. Heterogeneity is marked: Bank 6 is fully efficient (1.00) throughout; Bank 3 is near-frontier (mean 0.96); while Bank 9 (mean 0.17) and Bank 8 (mean 0.23) display persistent inefficiency. Temporally, mean cost efficiency declines from 0.62 (2016) to 0.45 (2021), with a modest recovery to 0.48 (2022).

Table 4. Cost Efficiency of Islamic Banks (2016–2022)

| Bank   | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Mean |
|--------|------|------|------|------|------|------|------|------|
| Bank 1 | 1.00 | 0.50 | 0.48 | 0.41 | 0.41 | 0.35 | 0.31 | 0.49 |
| Bank 2 | 0.59 | 0.89 | 0.67 | 0.65 | 0.65 | 0.25 | 0.19 | 0.55 |
| Bank 3 | 0.80 | 1.00 | 0.91 | 1.00 | 1.00 | 1.00 | 1.00 | 0.96 |
| Bank 4 | 0.55 | 0.42 | 0.41 | 0.52 | 0.52 | 0.37 | 0.39 | 0.45 |
| Bank 5 | 0.29 | 0.36 | 0.38 | 0.49 | 0.49 | 0.47 | 0.49 | 0.42 |
| Bank 6 | 1.00 | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 7 | 1.00 | 0.93 | 0.91 | 0.54 | 0.54 | 0.28 | 0.52 | 0.67 |
| Bank 8 | 0.24 | 0.14 | 0.19 | 0.30 | 0.30 | 0.18 | 0.24 | 0.23 |
| Bank 9 | 0.13 | 0.17 | 0.17 | 0.18 | 0.18 | 0.18 | 0.17 | 0.17 |
| Mean   | 0.62 | 0.60 | 0.57 | 0.56 | 0.56 | 0.45 | 0.48 | 0.55 |

Source: Authors' calculations from OJK SPS and audited bank reports.

The dispersion suggests that best practices exist (Bank 6; Bank 3) but are not uniformly adopted. Benchmarking and slack mapping to frontier peers could yield material input savings for lagging banks.

### 5.2 Revenue Efficiency (2016-2022)

Revenue efficiency assesses a bank's ability to maximize revenue given inputs. The industry mean is 0.72, higher than cost efficiency, indicating comparatively better performance on the revenue side. Banks 3 and 6 are at the frontier (1.00) in all years. Bank 4 records the lowest mean (0.52), with Bank 9 close behind (0.58). The series displays an upward trajectory from 0.64 (2016) to 0.88 (2022), interrupted by a 2019 trough (0.60).

Table 5. Revenue Efficiency of Islamic Banks (2016–2022)

| Bank   | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Mean |
|--------|------|------|------|------|------|------|------|------|
| Bank 1 | 0.80 | 0.64 | 0.53 | 0.46 | 0.62 | 0.74 | 0.95 | 0.68 |

|        |      |      |      |      |      |      |      |      |
|--------|------|------|------|------|------|------|------|------|
| Bank 2 | 0.54 | 1.00 | 0.66 | 0.44 | 0.44 | 0.58 | 0.58 | 0.61 |
| Bank 3 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 4 | 0.43 | 0.54 | 0.40 | 0.36 | 0.40 | 0.72 | 0.81 | 0.52 |
| Bank 5 | 0.36 | 0.69 | 0.57 | 0.43 | 0.73 | 0.77 | 0.85 | 0.63 |
| Bank 6 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 7 | 0.74 | 0.91 | 0.87 | 0.73 | 0.57 | 0.70 | 0.82 | 0.76 |
| Bank 8 | 0.57 | 0.86 | 0.80 | 0.59 | 0.51 | 0.86 | 0.94 | 0.73 |
| Bank 9 | 0.30 | 0.42 | 0.41 | 0.38 | 0.55 | 1.00 | 1.00 | 0.58 |
| Mean   | 0.64 | 0.78 | 0.69 | 0.60 | 0.65 | 0.82 | 0.88 | 0.72 |

Source: Authors' calculations from OJK SPS and audited bank reports.

Sector-wide revenue generation improved meaningfully post-2019. Case studies Bank 1 (0.46 → 0.95) and Bank 9 (0.30 → 1.00) illustrate that frontier performance is attainable with targeted strategies.

### 5.3 Profit Efficiency (2016-2022)

Profit efficiency integrates both the revenue and cost sides. The industry mean is 0.84, exceeding both cost and revenue means. Multiple banks 3, 6, 7, 8, 9 are on the frontier (1.00) across much of the period. Bank 2 exhibits the lowest mean (0.45) and the greatest volatility (from 1.00 in 2017 to 0.06 in 2022). The industry means peaks at 0.96 (2020), then moderates to 0.88 (2021) and 0.86 (2022). Under the adopted normalisation, profit efficiency > 1 appears for Bank 4 (2.25 in 2020); we report it verbatim and normalisation consistently with the normalisation.

Table 6. Profit Efficiency of Islamic Banks (2016–2022)

| Bank   | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Mean |
|--------|------|------|------|------|------|------|------|------|
| Bank 1 | 1.00 | 0.97 | 0.57 | 0.10 | 0.18 | 0.72 | 1.00 | 0.65 |
| Bank 2 | 0.22 | 1.00 | 0.94 | 0.19 | 0.17 | 0.57 | 0.06 | 0.45 |
| Bank 3 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 4 | 0.61 | 0.52 | 0.90 | 0.38 | 2.25 | 0.77 | 0.80 | 0.89 |
| Bank 5 | 0.49 | 0.55 | 0.41 | 0.40 | 1.00 | 0.87 | 0.91 | 0.66 |
| Bank 6 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 7 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Bank 8 | 1.00 | 1.00 | 0.77 | 0.76 | 1.00 | 1.00 | 1.00 | 0.93 |
| Bank 9 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mean   | 0.81 | 0.89 | 0.84 | 0.65 | 0.96 | 0.88 | 0.86 | 0.84 |

Source: Authors' calculations from OJK SPS and audited bank reports.

Profit efficiency's superiority over cost and revenue efficiency indicates that Indonesian Islamic banks can offset weaknesses in one margin with strengths in another, producing resilient profit outcomes even through the COVID-19 shock.

## 6.0 DISCUSSION

Running cost, revenue, and profit efficiency through one unified DEA framework for Indonesian Islamic banks reveals a story that single-metric studies miss. Three things stand out. First, profit efficiency keeps beating the other two. This isn't random noise it signals that banks here are better at making money stick than at either tightening inputs or pushing revenue up. That's pattern one. Pattern two: heterogeneity is baked in. Banks differ sharply from each other, and those differences drift over time. No bank holds its efficiency rank forever; the order shuffles. Third, these trajectories are not sealed off. The COVID shock registered some banks bent upward, others downward, but the whole structure moved. External shocks don't just dent levels; they reshape paths.

### 6.1 Cost 1 Profit Efficiency Dominance: Structural Resilience and shariah Alignment

The efficiency ordering profit (0.84) > revenue (0.72) > cost (0.55) suggests that Indonesian Islamic banks maintain profitability despite persistent input inefficiencies. Similar patterns have been observed in Malaysia and the GCC, where profit efficiency outperforms other dimensions due to diversification and risk-sharing contracts (Kamarudin, Sufian & Nassir, 2016; Johnes, Izzeldin & Pappas, 2014).

Islamic banks' asset-backed financing models (*murābahah*, *mushārahah*, *ijārah*) stabilize returns and mitigate cost volatility. Their fee-based income channels and avoidance of interest-rate exposure also cushion profits from macro shocks (Rosman, Abdullah & Yazid, 2014). Furthermore, robust Shariah governance structures encourage prudent balance-sheet management and discourage speculative risk-taking (Hidayat & Aziz, 2024).

This hierarchy of efficiency reflects the *Maqasid al-Shariah* principle of *ihsan* (excellence) in stewardship and *hifz al-māl* (protection of wealth). Profit efficiency thus embodies not only operational strength but also ethical and social alignment, consistent with the arguments of Chapra (2016) that Islamic finance links economic productivity with moral responsibility.

## 6.2 Cross-Sectional Heterogeneity: Institutional Capacity and Frontier Persistence

Bank 3 and Bank 6 locked in DEA scores of 1.00 year after year, while Banks 8 and 9 rarely scraped past 0.60. The difference is not regulatory luck; it is scale, internal controls, and the speed with which new technology is absorbed exactly the levers Bayuny & Haron (2017) and Irianti, Febrian & Faisal (2021) highlighted for Indonesia. Berger & Mester (1997) make the same point for banks everywhere: once basic rules are equal, efficiency gaps are usually a story of skills and servers, not statutes. A dynamic DEA or Malmquist exercise (Daraio & Simar, 2007) could now trace how far the laggards are falling behind each year and whether any are actually catching up.

## 6.3 Temporal Dynamics: Crisis Adaptation and Post-2019 Recovery

Profit efficiency jumped in 2020 when COVID-19 hit, confirming Himmawan and Firdausi's (2021) finding that liquidity buffers and strong capital gave Islamic banks room to manoeuvre. The spike was temporary; scores eased back as forbearance ended and competition returned. Revenue efficiency, by contrast, rose steadily from 0.64 in 2016 to 0.88 in 2022, pulled upward by mobile banking platforms, finer customer segmentation, and a deliberate push into SME financing trends Kamarudin et al. (2016) documented across the region. Indonesia is now edging toward the revenue maturity Malaysia reached earlier, but the cost side still lags.

## 6.4 Policy and Strategic Implications

OJK and KNKS can turn these numbers into an early-warning system. A quarterly DEA dashboard cost, revenue, profit would flag weak performers before capital ratios do, a practice Berger and Humphrey (1997) recommended two decades ago. Banks stuck below the frontier can use the same tool to set internal targets, automate what can be automated, retrain who can be retrained, and invite frontier peers to share playbooks. When efficiency gains flow through to lower margins for customers and wider outreach for SMEs, the *Maqasid* goals of protecting wealth (*hifz al-māl*) and delivering fairness (*'adl*) are served profit becomes proof of value creation, not of leverage (Chapra, 2016; Hidayat & Aziz, 2024).

## 6.5 Theoretical and Regional Context

The data side with the convergence camp: Islamic banks that are large, well-run, and technologically current can match or beat conventional peers (Johnes et al., 2014; Kamarudin

et al., 2016). Regional comparisons add one more layer: regulatory clarity and digital infrastructure amplify the effect (Rosman et al., 2014). By pairing DEA with Maqasid theory, the study also reframes efficiency itself not just a ratio, but a measure of *ihsan*, the ethical excellence that Islamic finance claims as its own benchmark (Chapra, 2016).

## **7.0 COST IMPLICATIONS**

The numbers carry a clear message for anyone running, regulating, or studying an Indonesian Islamic bank. Profit efficiency may look comforting at 0.84, but the cost score stuck at 0.55 is a blunt reminder that cheap-to-run is not the same as profitable. Managers who rely on the bottom line alone risk repeating the pattern Kamarudin, Sufian & Nassir (2016) and Bayuny & Haron (2017) warned about: squeezing margins today only to lose competitiveness tomorrow. Visiting the handful of banks that hit the DEA frontier year after year our “1.00 club” would give any team a ready checklist for tighter workflows, leaner staffing models, and sharper use of digital rails. Yet the ledger is only half the story; every efficiency gain has to pass the Maqasid filter does it protect wealth (*hifz al-māl*) and deliver fairness (*‘adl*)? Stewardship, not surplus, is the yardstick (Hidayat & Aziz, 2024).

For OJK and KNKS, the findings invite a shift from compliance-heavy supervision to performance-informed oversight. Berger & Humphrey’s (1997) old plea add efficiency dashboards to the regulatory toolkit now has an Indonesian address. A quarterly DEA scorecard that flags slippage in cost, revenue, or profit space would give supervisors an early-warning heat-map long before capital ratios blink red. Where inefficiency hardens into habit, prompt corrective action can include forced pairing or merger, echoing Irianti et al. (2021) conclusion that many Islamic banks are simply too small to be scale efficient. Tie those metrics to Maqasid-based incentives capital relief or liquidity preference for banks that pair strong DEA scores with visible social outcomes and MEKSI’s 2019-2024 call for “productive, inclusive” institutions become measurable, not rhetorical.

Academics can treat the panel we have released as a public baseline. Tobit or truncated regressions (Simar & Wilson, 2007) can now test whether board size, sukūk share, or fintech penetration drives the gap between frontier and laggard. Malmquist indices will show if digital adoption since 2020 has shifted the frontier outward or merely shuffled rankings. Cross-border work Indonesia set against Malaysia or the GCC would clarify whether governance quality or regulatory style explains persistent heterogeneity (Johnes et al., 2014). And if ESG or green-finance variables are folded into future DEA models, the field can answer Chapra’s (2016) deeper question: does moving toward the efficiency frontier also move society toward justice and balanced welfare?

In short, cost discipline, data-driven supervision, and research that fuses frontier analytics with Maqasid objectives are no longer optional add-ons; they are the collective route to an Islamic banking sector that is lean, competitive, and unmistakably ethical.

## **8.0 LIMITATIONS**

This study describes levels of DEA cost, revenue, and profit efficiency strictly as reported in Tables 4.1–4.3 and does not estimate determinants, mechanisms, or causal effects. Methodologically, DEA is a relative, deterministic frontier. Scores depend on the peer set, the assumed technology (CRS/VRS), the orientation (input vs. output), and the price vectors/normalisations used in the programs (cost: input prices; revenue: output prices; profit: input and output prices). As a result, the findings are sensitive to outliers, measurement error, and sample composition, and should not be over-interpreted as structural parameters (Simar & Wilson, 2007; Daraio & Simar, 2007; Cooper, Seiford & Zhu, 2011). We retain the adopted profit-efficiency normalisation, which can yield scores > 1.00 in isolated cases and should be interpreted accordingly.

Data limitations also apply. The analysis uses publicly available bank reports and OJK SPS series, without alternative harmonisation. While internal consistency checks and harmonisation rules are applied, accounting reclassifications across banks or over time can affect comparability of inputs/outputs and price vectors, especially around product innovations and regulatory changes (OJK, various years). Annual aggregation may also mask within-year volatility that matters for efficiency measurement in crisis periods.

A final limitation concerns external validity. Year-means inevitably reflect COVID-19-era distortions (2019–2021) and post-crisis normalization, so the time profile should be interpreted as descriptive rather than counterfactual. Moreover, no direct comparisons to conventional banks or cross-country generalizations are attempted; such analyses would require harmonized samples and methods beyond the present scope (Berger & Humphrey, 1997; Cooper, Seiford & Zhu, 2011).

## **9.0 CONCLUSION**

This paper offers a full-spectrum view of how efficiently Indonesia's Islamic banks have operated between 2016 and 2022. Using Data Envelopment Analysis and a balanced panel of nine commercial banks, we estimate cost, revenue and profit efficiency under variable returns to scale. Profit efficiency averages 0.84, comfortably above revenue (0.72) and cost (0.55) efficiency; the ranking profit > revenue > cost mirrors earlier multi-country studies (Kamarudin et al., 2016; Berger & Mester, 1997) and shows that Indonesian Islamic banks can defend the bottom line even when input use or income generation is weak.

Revenue scores improved after 2019, and profit efficiency rose in 2020, a pattern consistent with rapid balance-sheet adjustments during the COVID-19 shock (Himmawan & Firdausi, 2021). Yet cross-sectional gaps remain wide: Bank 3 and Bank 6 sit on the frontier in most years, while several smaller or newly merged institutions oscillate well below it, confirming that governance quality, scale and managerial capacity still shape performance (Bayuny & Haron, 2017; Johnes et al., 2014). The persistently low cost scores also echo Irianti, Febrian & Faisal (2021), pointing to unused room for tighter cost control.

From a policy perspective, the results suggest that OJK and the National Committee on Islamic Finance could add DEA-based dashboards to their supervisory toolkit. Regular frontier benchmarks would highlight lagging banks, guide targeted restructuring and support peer-to-peer learning, all of which advance the Maqasid objective of *hifz al-mal* protecting and circulating wealth in a fair manner (Hidayat & Aziz, 2024).

The study also extends the literature by showing that a straightforward multi-dimensional DEA model can accommodate Shariah-compliant institutions without modification. The 2016–2022 estimates now serve as a baseline for two-stage or dynamic DEA work that tests external determinants, and for cross-country comparisons with Malaysian or Gulf Islamic banks (Cooper et al., 2011; Daraio & Simar, 2007). Future extensions could embed digital-transformation indicators or Shariah-supervision scores to see whether fintech adoption or stronger boards push banks closer to the frontier (Faruk et al., 2017; Ascarya & Rahmawati, 2022).

In short, Indonesian Islamic banks have demonstrated resilient profitability, but input efficiency still lags. Continued DEA monitoring, coupled with policy incentives that reward both cost discipline and social-value creation, can help the sector grow in a manner that is financially sound and ethically grounded.

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## REFERENCES

- Ab-Rahim, R., Mohd. S. N. S., & Mohd. J. N. G. (2012). Efficiency of Islamic and conventional banks in Malaysia. *International Journal of Economics, Management and Accounting*, 20(2), 109-138.
- Ascarya, A., & Rahmawati, S. (2022). Digital transformation and efficiency in Islamic banking: Evidence from Southeast Asia. *Journal of Islamic Monetary Economics and Finance*, 8(3), 501–520.
- Asrar, M., Mulyany, R., & Darwanis. (2022). *Can the Islamic banks be efficient? A DEA study in Indonesia*. <https://consensus.app/papers/can-the-islamic-banks-be-efficient-a-data-envelopment-asrar-mulyany/b30b76ade89f573ba7895c26339cf125>
- Bader, M. K. I., Mohamad, S., Hassan, T., & Ariff, M. (2008). Cost, revenue and profit efficiency of Islamic vs conventional banks: *International evidence using data envelopment analysis*. *Islamic Economic Studies*, 15(2), 23-76.
- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30(9), 1078–1092.
- Bayuny, A. H., & Haron, R. (2017). Efficiency and performance of Islamic banks in Indonesia. *Journal of Islamic Accounting and Business Research*, 8(3), 289–304.
- Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, 98(2), 175–212.
- Carvalho, O., & Kasman, A. (2005). Cost efficiency in the Latin American and Caribbean banking systems. *Journal of International Financial Markets, Institutions and Money*, 15(1), 55-72.
- Chapra, M. U. (2016). *The future of economics: An Islamic perspective*. Islamic Foundation Press.
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2(6), 429–444.
- Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). Data envelopment analysis: History, models, and interpretations. In *Handbook on Data Envelopment Analysis* (pp. 1–39). Springer.
- Daraio, C., & Simar, L. (2007). *Advanced robust and non-parametric methods in efficiency analysis*. Springer.
- Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society: Series A (General)*, 120(3), 253–290.
- Faruk, U., Disman, D., & Nugraha, N. (2017). *Efficiency and productivity growth analysis of the Islamic banking in Indonesia: DEA & MPI*. <https://consensus.app/papers/efficiency-and-productivity-growth-analysis-of-the-faruk-disman/cbc59116881152c68d4862652324fbc9>
- Firdaus, M., & Hosen, M. N. (2014). *Efficiency of Islamic banks using two-stage approach of data envelopment analysis*. <https://consensus.app/papers/efficiency-of-islamic-banks-using-two-stage-approach-of-firdaus-hosen/f7759cdcba335b20bc6d39dec7c68ec7>
- Hao, J., Hunter, W. C., & Yang, W. (2001). Deregulation and efficiency: The case of Korean banks. *Journal of Economics and Business*, 53(2-3), 237-254.
- Havrylchyk, O. (2006). Efficiency of the Polish banking industry: Foreign versus domestic banks. *Journal of Banking & Finance*, 30(7), 1975-1996.
- Hidayat, M. F., & Aziz, R. M. (2024). The role of worship values in enhancing the efficiency of Islamic commercial banks: A DEA approach. *Journal of Islamic Economics and Finance Studies*. <https://consensus.app/papers/the-role-of-worship-values-in-enhancing-the-efficiency-of-hidayat-aziz/c31f1faff93252999b145fa5ff0d8663>

- Himmawan, D. E., & Firdausi, M. (2021). Resilience and operational efficiency of Islamic banks during COVID-19 in Indonesia. *Journal of Islamic Monetary Economics and Finance*, 7(2), 335–352.
- Irianti, F., Febrian, E., & Faisal, Y. A. (2021). *Study of efficiency of Islamic commercial banks in Indonesia: Two-stage DEA*. <https://consensus.app/papers/study-of-efficiency-of-islamic-commercial-banks-in-irianti-febrian/b546d2101f4359289b0844954d634a6e>
- Johnes, J., Izzeldin, M., & Pappas, V. (2014). A comparison of performance of Islamic and conventional banks 2004–2009. *Journal of Economic Behavior & Organization*, 103, S93–S107.
- Kamarudin, F., Sufian, F., & Nassir, A. M. (2016). Does efficiency promote stability of Islamic banks? Empirical evidence from MENA countries. *Humanomics*, 32(3), 251–274.
- Kumbhakar, S. C., & Lovell, C. A. K. (2000). *Stochastic frontier analysis*. Cambridge University Press.
- Rosman, R., Abdullah, M. F., & Yazid, Z. (2014). Efficiency of Islamic banks during financial crises: Empirical evidence from the Gulf region. *Journal of Applied Business Research*, 30(1), 65–76.
- Rusydiana, A. S., & As-Salafiyah, A. N. (2021). *A decade of Indonesian Islamic bank efficiency: A DEA window analysis approach*. <https://consensus.app/papers/a-decade-of-indonesian-islamic-bank-efficiency-a-dea-rusydiana-as-salafiyah/0d2d2218d4f25018b476f22b93ab99dc>
- Simar, L., & Wilson, P. W. (2007). Estimation and inference in two-stage, semi-parametric models of production processes. *Journal of Econometrics*, 136(1), 31–64.
- Yudistira, D. (2004). Efficiency in Islamic banking: An empirical analysis of eighteen banks. *Islamic Economic Studies*, 12(1), 1–19.