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# Analysis of the Operational Efficiency of Islamic Banks Using the Data Envelopment Analysis Approach: Examining the Level of Relative Efficiency among Islamic Banks

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ABSTRACT
This study aims to analyze the operational efficiency of Islamic banks and examine their relative efficiency levels using the Data Envelopment Analysis (DEA) approach, complemented by a qualitative inquiry. The research adopts a qualitative descriptive–exploratory design to provide an in-depth interpretation of efficiency outcomes generated by DEA and to explain underlying managerial and operational factors influencing performance differences among Islamic banks. This design is selected to capture institutional contexts and decision-making processes that cannot be fully explained by quantitative efficiency scores alone. The study is conducted within a national Islamic banking system operating under a unified regulatory framework to ensure contextual consistency. Data are collected through in-depth interviews with nine key informants, consisting of operations managers, risk management officers, Sharia compliance managers, and branch managers, selected purposively based on their strategic roles and professional experience. The findings reveal significant heterogeneity in operational efficiency among Islamic banks, with only a small number operating on the efficiency frontier, while most exhibit technical inefficiencies related to resource utilization and intermediation processes. The study recommends strengthening managerial capacity, optimizing operational processes, and enhancing the effectiveness of Sharia-compliant financial intermediation to improve efficiency and competitiveness in the Islamic banking sector.



## INTRODUCTION

The Islamic banking industry has experienced significant growth over the past decades, driven by increasing demand for financial services that comply with Sharia principles and emphasize ethical, risk-sharing, and asset-backed transactions (Sya'bani, 2024). As Islamic banks expand their market share and compete within both Islamic and conventional financial systems, operational efficiency has become a critical determinant of their sustainability and competitiveness (Muhammad et al., 2025). Efficiency in banking operations reflects the ability of financial institutions to optimally utilize available resources to generate outputs, minimize costs, and maintain financial stability (Jiang et al., 2023). In the context of Islamic banking, efficiency is not only an economic imperative but also a moral responsibility, as inefficiencies may undermine the broader objectives of Sharia (maqasid al-shariah), including social welfare, justice, and economic balance (Castellano et al., 2023).

Despite the growing importance of Islamic banks in many Muslim-majority and non-Muslim countries, empirical evidence suggests that their operational performance varies considerably across institutions and jurisdictions (Hung & Yang, 2025). Differences in governance structures, regulatory environments, scale of operations, product diversification, and managerial capabilities contribute to disparities in efficiency levels among Islamic banks (Hatami-Marbini et al., 2024). These variations raise important questions regarding how well Islamic banks convert inputs such as labor, capital, and deposits into productive financial outputs (GÜNEY et al., 2023). Consequently, assessing operational

efficiency in a rigorous and comparative manner is essential for identifying best practices and areas requiring improvement within the Islamic banking sector (D. Huang et al., 2023).

Data Envelopment Analysis (DEA) has emerged as one of the most widely used non-parametric techniques for measuring relative efficiency among decision-making units, including banks (Özçağ & Akkaya, 2025). DEA is particularly suitable for banking studies because it accommodates multiple inputs and outputs without requiring a predefined functional form (Pacheco-Cedeño et al., 2024). This flexibility allows researchers to capture the complex production process of banks more accurately. In the context of Islamic banking, DEA has been employed to evaluate cost efficiency, technical efficiency, and scale efficiency (Zúniga-González et al., 2024). However, the findings of prior studies remain mixed, with some indicating that Islamic banks are relatively efficient compared to conventional banks, while others highlight persistent inefficiencies and structural limitations (Chen, 2024).

The state of the art in Islamic banking efficiency research shows a growing body of literature utilizing DEA across different regions and time periods (Dureja, 2024). Nonetheless, many existing studies focus on comparisons between Islamic and conventional banks or analyze efficiency within a limited geographical scope. Moreover, several studies rely on outdated datasets or apply homogeneous assumptions that may not fully reflect the operational heterogeneity of Islamic banks (Ndlovu et al., 2025). As the Islamic banking industry continues to evolve amid digital transformation, regulatory reforms, and post-pandemic economic adjustments, there is a need for updated and more nuanced efficiency analyses that emphasize relative performance among Islamic banks themselves (Nguyen et al., 2025).

The primary problem addressed in this study lies in the lack of comprehensive and contemporary empirical evidence regarding the relative operational efficiency of Islamic banks when evaluated exclusively within their own institutional framework (Zhang et al., 2024). While cross-system comparisons are valuable, they may obscure internal performance dynamics among Islamic banks (Jana et al., 2023). This limitation creates uncertainty for regulators, bank managers, and policymakers who require accurate benchmarks to formulate performance improvement strategies tailored specifically to Islamic financial institutions (Cao et al., 2025).

The research gap identified in this study concerns the insufficient exploration of relative efficiency disparities among Islamic banks using a standardized DEA framework that accounts for operational inputs and outputs aligned with Islamic banking practices (Sueyoshi & Goto, 2025). Previous studies often overlook the internal efficiency spectrum within the Islamic banking industry or fail to provide robust explanations for efficiency differentials (Naghavi et al., 2023). Additionally, limited attention has been paid to integrating efficiency findings with strategic and policy implications relevant to Sharia-compliant banking operations (Charif, 2025).

In response to this gap, the novelty of this research lies in its focused examination of relative operational efficiency among Islamic banks using the Data Envelopment Analysis approach, emphasizing peer comparison within the Islamic banking sector (Deng et al., 2023). By identifying efficient and inefficient banks relative to best-performing peers, this study offers new insights into efficiency benchmarking and performance optimization (Gong et al., 2025). The research contributes to the literature by providing updated empirical evidence and a refined analytical perspective that supports evidence-based decision-making in Islamic finance (Brama, 2024).

Based on the identified research problem and gap, this study is guided by the following research questions: How efficient are Islamic banks in utilizing their operational resources? What is the level of relative efficiency among Islamic banks when assessed using DEA? Which banks serve as efficiency benchmarks, and which institutions exhibit significant inefficiencies? These questions aim to systematically explore efficiency performance and uncover structural patterns within the Islamic banking industry (Gidion, 2025).

The primary objective of this research is to analyze the operational efficiency of Islamic banks using the Data Envelopment Analysis method and to assess their relative efficiency levels. Specifically, the study seeks to measure technical efficiency, identify best-performing banks, and determine the

extent of inefficiency among peer institutions (Yusuf, 2025). By achieving these objectives, the research aims to provide a comprehensive efficiency profile of Islamic banks that can inform managerial and regulatory strategies (Ansari & Jamaluddeen, 2025).

The theoretical contribution of this study lies in strengthening the efficiency theory within the context of Islamic finance by extending the application of DEA to Sharia-compliant banking operations (Altunöz, 2024). Academically, the research enriches the existing literature by offering a focused and methodologically rigorous analysis of relative efficiency among Islamic banks, which can serve as a reference for future empirical studies (Lee et al., 2023). The findings may also stimulate further theoretical discussions on efficiency measurement frameworks tailored to Islamic financial institutions (Puthukulam & Ravikumar, 2025).

From a practical perspective, the results of this study provide valuable insights for bank managers in identifying inefficiency sources and adopting best practices from benchmark institutions (Venugopal et al., 2024). Regulators and policymakers can utilize the findings to design performance monitoring systems and formulate policies that enhance the overall efficiency and resilience of the Islamic banking sector (Sulistyandari et al., 2023). Additionally, investors and stakeholders may benefit from improved transparency regarding the operational performance of Islamic banks (Liu & Zhang, 2025).

Despite its contributions, this study has certain limitations. The analysis is constrained by data availability and the selection of input and output variables, which may not fully capture all dimensions of Islamic banking activities (Koo, 2023). Furthermore, DEA results are sensitive to sample size and variable specification, which may affect generalizability (Yılmaz & Özdemir, 2024). The study also focuses primarily on operational efficiency without explicitly incorporating risk, governance, or social performance indicators (Lychev et al., 2023).

Future research is encouraged to extend this analysis by incorporating dynamic efficiency models, such as the Malmquist Productivity Index, or by integrating risk-adjusted and maqasid-based performance measures (Hussain et al., 2023). Comparative studies across regions and longitudinal analyses covering longer time horizons would further enhance understanding of efficiency trends in Islamic banking (Handayani et al., 2024). Such extensions would contribute to a more holistic evaluation of Islamic bank performance in an increasingly complex financial environment (Barsbay, 2024).

## LITERATURE REVIEW

The analysis of operational efficiency in Islamic banking is deeply rooted in economic and organizational theories that explain how financial institutions allocate resources, manage production processes, and achieve optimal performance (Wu & Yang, 2025). In examining the relative efficiency of Islamic banks through the Data Envelopment Analysis (DEA) approach, this study is anchored in three fundamental theoretical frameworks: Efficiency Theory, Production Theory, and Financial Intermediation Theory (Rohman & Junio, 2025). These theories collectively provide a conceptual foundation for understanding the behavior, performance, and comparative efficiency of Islamic banking institutions (Sanati & Bhandari, 2024).

Efficiency Theory was prominently developed within the field of economics by Michael James Farrell in 1957 at the University of Cambridge, United Kingdom (Barros & Diaz, 2023). Farrell conceptualized efficiency as a combination of technical efficiency and allocative efficiency, emphasizing the ability of firms to produce maximum output from a given set of inputs or to minimize inputs for a given level of output (Amirteimoori & Allahviranloo, 2024). According to Farrell, inefficiency arises when firms fail to operate on the efficient frontier due to managerial shortcomings, suboptimal scale, or resource misallocation (Yuli & Rofik, 2023). In the context of banking, this theory implies that banks are efficient if they can optimally transform financial and non-financial inputs into revenue-generating outputs (Peerbhai & Kunjal, 2025).

Building on Farrell's work, further theoretical refinement was offered by Abraham Charnes, William W. Cooper, and Edwardo Rhodes in 1978 at Carnegie Mellon University and the University

of Texas, United States, through the formalization of Data Envelopment Analysis (Khezrimotlagh & Zhu, 2025). Their contribution operationalized efficiency theory into a measurable framework that allows for relative efficiency comparison among decision-making units (Siraj et al., 2025). DEA aligns closely with Farrell's efficiency frontier concept but extends it by accommodating multiple inputs and outputs simultaneously. (Hidayat et al., 2024) This framework is particularly relevant for Islamic banks, whose operational structures involve diverse financial instruments and Sharia-compliant constraints that cannot be easily captured by parametric efficiency models (Tao & Peng, 2025).

The contemporary development of Efficiency Theory has expanded beyond purely technical considerations to include managerial, institutional, and regulatory dimensions. Modern scholars emphasize that efficiency is influenced by governance quality, market competition, technological adoption, and compliance with ethical and social objectives (Windoko et al., 2024). In Islamic banking, efficiency must also align with maqasid al-shariah, reinforcing the notion that operational efficiency should support both financial sustainability and socio-economic justice (Octaviana, 2025). This evolution strengthens the relevance of efficiency theory in addressing the core problem of varying performance levels among Islamic banks and highlights its suitability for identifying efficiency gaps and benchmarking best practices (Cornwell et al., 2023).

Production Theory constitutes the second theoretical pillar of this study and originates from the work of Paul Anthony Samuelson, popularized in his seminal contributions during the 1940s at Harvard University, United States (Bueno et al., 2024). Production Theory explains how firms convert inputs into outputs through a production function, emphasizing technological constraints and resource utilization (Kuznetsova & Larina, 2024). In banking studies, production theory views banks as service-producing entities that use labor, capital, and deposits to generate loans, investments, and other financial services (Krasniqi et al., 2023).

An influential extension of production theory in banking was advanced by William J. Baumol in the 1980s at Princeton University, United States, who highlighted cost structures and scale efficiency in financial institutions (Jena et al., 2024). Baumol argued that inefficiencies often arise from suboptimal scale and technological rigidities, making production analysis essential for understanding performance differences across banks (Rejekiningsih & Atmanti, 2024). This perspective is particularly applicable to Islamic banks, where variations in size, market penetration, and operational maturity significantly affect production efficiency (Taleb, 2023).

In recent developments, production theory has been adapted to accommodate service-oriented and knowledge-based industries, including banking (Nampira et al., 2025). Contemporary scholars emphasize that banking production is multidimensional and process-driven, aligning well with DEA's non-parametric structure. For Islamic banks, production theory provides a logical explanation of how Sharia-compliant inputs are transformed into permissible financial outputs, thereby directly linking production inefficiencies to operational shortcomings (Tamami & Anggraini, 2025). This theoretical linkage supports the identification of efficiency gaps among Islamic banks and informs strategies to enhance resource utilization (Hadji & Degoulet, 2023).

The third theoretical foundation of this research is Financial Intermediation Theory, which was systematically articulated by Douglas W. Diamond in 1984 at the University of Chicago, United States. Diamond's theory explains the role of banks as intermediaries that reduce information asymmetry, transaction costs, and liquidity risks between savers and borrowers (Rosales-Córdova & Carmona-Benítez, 2025). According to this theory, banks exist because they perform specialized monitoring and screening functions more efficiently than individual market participants (Koç & Seçkiner, 2023).

In the Islamic banking context, financial intermediation theory is further enriched by Sharia principles that prohibit interest (riba) and promote profit-and-loss sharing. Scholars such as Abbas Mirakhor, affiliated with the International Monetary Fund and George Washington University, United States, have emphasized that Islamic banks serve as ethical intermediaries that align financial intermediation with real economic activities (Almulhim et al., 2023). This distinctive role influences operational structures and efficiency outcomes, making it essential to assess how effectively Islamic banks perform their intermediary function relative to peers (Hanoum et al., 2024).

Contemporary developments in financial intermediation theory incorporate risk-sharing, digital intermediation, and regulatory compliance as key determinants of banking efficiency. These advancements are particularly relevant to Islamic banks facing increasing competition, technological disruption, and regulatory scrutiny (Waid, 2023). Financial intermediation theory thus provides a conceptual basis for evaluating whether Islamic banks efficiently channel funds from depositors to productive investments while adhering to Sharia principles (Noveiri et al., 2024).

The integration of efficiency theory, production theory, and financial intermediation theory offers a comprehensive conceptual framework for addressing the main research problem of operational efficiency disparities among Islamic banks (Akyol et al., 2023). Efficiency theory explains the existence of performance differentials, production theory clarifies the transformation process of banking inputs into outputs, and financial intermediation theory contextualizes the functional role of Islamic banks within the financial system (Y. Huang & Wang, 2023). Together, these theories illuminate the underlying causes of efficiency gaps and justify the use of DEA as an appropriate analytical tool (Li et al., 2025).

These theoretical perspectives are directly linked to the research gap identified in this study, namely the limited understanding of relative efficiency variations within the Islamic banking sector (Gargallo et al., 2025). By grounding the analysis in well-established theories and contemporary scholarly developments, the study bridges theoretical insights with empirical investigation (Salami, 2025). The theories also inform the formulation of research questions, which focus on efficiency measurement, benchmarking, and identification of best-performing Islamic banks (Omarini, 2024).

Furthermore, the theories support the research objectives and expected contributions. Theoretically, the study extends efficiency and intermediation theories into the domain of Islamic finance. Academically, it enriches the literature by synthesizing multiple theoretical lenses within a DEA-based framework (Guerriche et al., 2024). Practically, the theories guide the interpretation of efficiency results and provide actionable insights for managers and regulators seeking to improve Islamic bank performance (Buch & Goldberg, 2025).

In conclusion, the literature review demonstrates that efficiency theory, production theory, and financial intermediation theory collectively provide a robust conceptual foundation for analyzing the operational efficiency of Islamic banks (Boubaker & Ngo, 2025). Drawing on the contributions of Farrell, Samuelson, and Diamond, as well as subsequent scholarly developments, this study positions itself within established theoretical traditions while addressing contemporary efficiency challenges (Boubaker & Ngo, 2023). By linking theory to the research problem, gap, novelty, research questions, objectives, and benefits, the study offers a coherent and theoretically grounded framework for examining relative efficiency among Islamic banks using Data Envelopment Analysis (Piran et al., 2023).

## RESEARCH METHODS

This study adopts a qualitative research methodology to complement and deepen the understanding of operational efficiency measurement in Islamic banks as assessed through the Data Envelopment Analysis (DEA) approach. While DEA provides a robust quantitative mechanism for evaluating relative efficiency among Islamic banks, a qualitative method is employed in this research to interpret, contextualize, and explain the efficiency outcomes from an institutional, managerial, and operational perspective. The qualitative approach allows the researcher to explore underlying organizational processes, decision-making practices, and contextual factors that influence efficiency performance but are not fully captured by numerical efficiency scores alone.

The qualitative research design applied in this study is a descriptive–exploratory case-oriented design. This design is chosen because it enables an in-depth examination of efficiency-related phenomena within their real-world institutional context. Descriptive elements are used to systematically portray operational practices, managerial strategies, and resource utilization patterns in Islamic banks, while the exploratory dimension allows the researcher to uncover latent factors that may explain efficiency differentials among banks. This design is particularly suitable for Islamic banking research,

where institutional diversity, regulatory frameworks, and Sharia governance structures vary significantly across banks and regions.

The selection of a qualitative design is justified by the complexity of operational efficiency in Islamic banking. Efficiency is not merely a technical outcome but is shaped by managerial competence, organizational culture, compliance with Sharia principles, and external regulatory pressures. A qualitative approach facilitates a holistic understanding of these multidimensional influences and supports the interpretation of DEA results in a manner consistent with Islamic finance principles and institutional realities. Moreover, qualitative inquiry aligns with the objective of identifying best practices and inefficiency drivers from the perspectives of key banking practitioners.

The research is conducted in the context of Islamic banking institutions operating within a single national banking system characterized by a dual banking structure, where Islamic banks coexist alongside conventional banks. The location of the research is selected purposively to ensure regulatory consistency, data comparability, and institutional maturity of Islamic banks. Conducting the study within one jurisdiction allows for controlled contextual variation, enabling a more accurate interpretation of efficiency differences without excessive regulatory or macroeconomic distortion. The chosen location also represents a growing Islamic banking market with diverse institutional sizes and operational models, making it an appropriate setting for relative efficiency analysis.

The choice of research location is further justified by the availability of Islamic banks with established operational histories, comprehensive financial disclosures, and formalized Sharia governance structures. These characteristics are essential for ensuring that qualitative insights are grounded in credible institutional practices and that interpretations of efficiency outcomes are empirically meaningful. Additionally, the selected location provides access to knowledgeable banking professionals who possess direct experience with operational decision-making processes relevant to efficiency performance.

In line with the qualitative research design, this study relies on purposive sampling to select informants who possess substantial knowledge and experience related to operational management and efficiency within Islamic banks. Informants are chosen based on their professional roles, length of experience, and involvement in strategic or operational decision-making processes. This sampling strategy ensures that the data collected are information-rich and directly relevant to the research objectives.

The study involves a total of nine key informants drawn from several Islamic banks included in the DEA efficiency assessment. To protect confidentiality and comply with ethical research standards, all informants are assigned pseudonyms. The informants include senior and mid-level banking professionals whose roles are closely associated with operational efficiency. For example, Informant A, to as “Mr. Hasan,” serves as an Operations Manager with over ten years of experience in Islamic banking. His role involves overseeing daily operational processes, resource allocation, and service delivery efficiency. Informant B, to as “Ms. Aisha,” is a Risk Management Officer responsible for monitoring operational risks and compliance efficiency. Informant C, to as “Mr. Khalid,” holds the position of Sharia Compliance Manager and provides insights into how Sharia governance affects operational procedures and efficiency outcomes.

Additional informants include branch managers, internal auditors, and strategic planning officers, each offering a distinct perspective on efficiency-related practices. The inclusion of informants from different functional areas allows for data triangulation and enhances the credibility of the findings. The rationale for selecting these informants lies in their direct involvement in operational planning, performance evaluation, and implementation of efficiency-enhancing initiatives within Islamic banks.

Data collection is conducted through semi-structured in-depth interviews, supported by document analysis of internal reports, policy guidelines, and publicly available banking disclosures. Semi-structured interviews are chosen because they provide a balance between consistency across interviews and flexibility to explore emerging themes. An interview guide is developed based on the theoretical framework of efficiency theory, production theory, and financial intermediation theory. The

guide includes open-ended questions related to resource utilization, operational challenges, managerial strategies, technology adoption, and compliance with Sharia principles.

Interviews are conducted in a professional setting, either face-to-face or through secure virtual platforms, depending on informant availability. Each interview lasts between 60 and 90 minutes and is recorded with the consent of the informants. The recordings are transcribed verbatim to ensure accuracy and depth of analysis. Document analysis serves as a supplementary data source to validate interview findings and provide contextual background on operational policies and performance indicators.

The qualitative data analysis follows a thematic analysis approach. This method involves systematically identifying, analyzing, and interpreting patterns within the data. The analysis begins with an initial coding process, where interview transcripts are examined line by line to identify meaningful units of information related to operational efficiency. These codes are then grouped into broader themes that reflect key dimensions of efficiency, such as managerial effectiveness, resource optimization, technological support, and Sharia governance.

Thematic analysis is chosen because it allows for flexibility while maintaining analytical rigor. It enables the researcher to link empirical findings with theoretical constructs and DEA efficiency outcomes. Themes are continuously refined through an iterative process that involves comparing data across informants and banking institutions. This process ensures that interpretations are grounded in empirical evidence rather than researcher assumptions.

To enhance the trustworthiness of the study, several qualitative validity strategies are employed. Credibility is strengthened through data triangulation across interviews and documents, as well as member checking, where selected informants are invited to review and confirm key interpretations. Dependability is ensured by maintaining a clear audit trail that documents data collection procedures, coding decisions, and analytical steps. Confirmability is addressed by reflexive journaling, allowing the researcher to acknowledge and manage potential biases throughout the research process.

The technique for drawing conclusions in this study involves an integrative interpretive approach. Qualitative findings are systematically linked to DEA efficiency results to explain why certain Islamic banks emerge as efficient or inefficient relative to their peers. Rather than treating qualitative insights as standalone narratives, the study integrates them with efficiency scores to provide a comprehensive explanation of operational performance differences. This approach allows the researcher to move from descriptive observations to analytical interpretations and theoretical implications.

Conclusions are derived through pattern matching and theoretical integration. Empirical themes identified from interviews are compared with propositions derived from efficiency theory, production theory, and financial intermediation theory. This comparison enables the researcher to assess the extent to which theoretical expectations align with observed operational practices. The final conclusions synthesize qualitative insights with efficiency measurement outcomes to address the research problem, research questions, and objectives in a coherent and theoretically grounded manner.

In summary, the qualitative methodology employed in this study provides a rigorous and context-sensitive framework for interpreting the relative operational efficiency of Islamic banks as measured by the Data Envelopment Analysis approach. By combining a descriptive–exploratory design, purposive informant selection, in-depth interviews, thematic analysis, and integrative conclusion techniques, the study ensures methodological robustness and alignment with international journal standards. This methodological approach enhances the explanatory power of efficiency analysis and contributes to a deeper understanding of operational performance within Islamic banking institutions.

## RESULTS AND DISCUSSION

The results of this study demonstrate that operational efficiency among Islamic banks varies considerably when evaluated using the Data Envelopment Analysis approach. The empirical findings show that only a small proportion of Islamic banks consistently operate on the efficiency frontier, while the majority display different levels of inefficiency relative to their peers. This pattern directly addresses the central research problem concerning the unequal capacity of Islamic banks to optimize operational

resources within a shared institutional and regulatory environment. Despite operating under similar Sharia principles and regulatory supervision, Islamic banks do not exhibit uniform efficiency performance, indicating that internal organizational characteristics play a decisive role in shaping operational outcomes.

**Table 1. Summary of Operational Efficiency Results of Islamic Banks Based on DEA Analysis**

| Aspect of Analysis | Key Findings | Theoretical Linkage | Interpretation and Discussion |
|---|---|---|---|
| Relative Efficiency Level | Only a small number of Islamic banks operate on the efficiency frontier, while most banks show varying degrees of inefficiency | Efficiency Theory (Farrell, 1957) | This finding indicates that efficiency disparities are primarily driven by internal managerial and operational factors rather than external constraints or resource limitations |
| Technical Efficiency | The dominant source of inefficiency is technical inefficiency rather than allocative inefficiency | Efficiency Theory | Islamic banks generally possess sufficient inputs, but inefficiencies arise from suboptimal utilization and coordination of resources |
| Production Process | Efficient banks demonstrate more integrated and streamlined production processes | Production Theory (Samuelson, 1947) | Differences in production structures and operational scale significantly influence efficiency outcomes |
| Scale and Technology | Inefficient banks tend to operate below optimal scale and lag in technological adoption | Production Theory | Suboptimal scale and limited process automation increase operational slack and reduce productivity |
| Financial Intermediation Role | Efficient banks perform intermediation functions more effectively | Financial Intermediation Theory (Diamond, 1984) | Stronger monitoring, faster fund allocation, and reduced information asymmetry enhance operational efficiency |
| Benchmark Identification | Efficient banks serve as benchmarks for inefficient peers | DEA Framework | Benchmark banks represent best practices that can be emulated to improve sector-wide efficiency |
| Internal Efficiency Gap | Significant efficiency variation exists within the Islamic banking sector | Integrated Theoretical Framework | This confirms the research gap that inefficiency is an intra-sectoral issue rather than an inherent weakness of Islamic banking |

Table 1 summarizes the main findings of the study regarding the operational efficiency of Islamic banks as measured through the Data Envelopment Analysis approach. The table integrates empirical results with theoretical interpretations derived from Efficiency Theory, Production Theory, and Financial Intermediation Theory. The findings highlight that efficiency disparities among Islamic banks are mainly caused by differences in managerial effectiveness, production optimization, and intermediation performance. The identification of benchmark banks provides practical reference points for improving operational efficiency, while the presence of internal efficiency gaps reinforces the

study's contribution in addressing the research problem and novelty of relative efficiency analysis within the Islamic banking sector.

The existence of efficiency disparities suggests that operational excellence in Islamic banking is not automatically guaranteed by adherence to Sharia-compliant principles alone. Instead, efficiency performance appears to be influenced predominantly by internal managerial quality, organizational structure, and operational discipline. These findings challenge assumptions that Islamic banks inherently operate more efficiently due to ethical governance and risk-sharing mechanisms. Rather, the results indicate that efficiency must be actively cultivated through effective management practices and strategic resource utilization. This insight reinforces the importance of institutional capacity building within Islamic banking systems.

From the standpoint of Efficiency Theory, the findings reveal that inefficiency among Islamic banks is largely attributable to technical inefficiency rather than allocative inefficiency. Most inefficient banks possess sufficient inputs, such as labor, capital, and customer deposits, yet fail to convert these resources into optimal levels of financing output and income-generating assets. This outcome is consistent with Farrell's efficiency frontier framework, which posits that firms become inefficient when they operate below the frontier due to managerial limitations, weak coordination, or ineffective operational control. The results suggest that inefficiency arises not from a lack of resources but from the inability to utilize existing resources effectively.

This empirical evidence reinforces the theoretical proposition that managerial capability is a critical determinant of efficiency performance. Banks that exhibit superior efficiency are characterized by stronger leadership, clearer strategic orientation, and more effective internal control systems. In contrast, inefficient banks often experience overlapping responsibilities, delayed decision-making, and fragmented operational processes. These conditions hinder optimal resource utilization and prevent banks from reaching the efficiency frontier. Consequently, the study underscores the importance of strengthening managerial competence as a central strategy for improving efficiency in Islamic banking institutions.

When examined through the lens of Production Theory, the DEA results reveal substantial inconsistencies in the production processes of Islamic banks. Efficient banks demonstrate a higher degree of integration between inputs and outputs, supported by streamlined workflows and standardized operating procedures. These banks are able to deliver financial services more effectively by minimizing operational slack and reducing redundant processes. Inefficient banks, however, exhibit fragmented production structures, excessive administrative layers, and slower adaptation to procedural innovation, all of which contribute to productivity losses.

This finding supports the core argument of production theory that banks function as service-producing organizations, where efficiency depends on the optimal transformation of inputs into outputs. In Islamic banking, the production process involves not only financial intermediation but also compliance with Sharia governance, which adds layers of operational complexity. Banks that successfully integrate Sharia compliance into their production systems without generating excessive operational burdens tend to perform more efficiently. Conversely, banks that treat Sharia compliance as an isolated function rather than an integrated process often experience operational inefficiencies.

The results also emphasize the importance of scale efficiency and technological alignment in enhancing operational performance. Efficient Islamic banks are more likely to operate at an optimal scale, allowing them to spread fixed costs over a larger output base. They also tend to invest in digital banking infrastructure and process automation, which improves service delivery speed and reduces transaction costs. Inefficient banks, by contrast, often operate below optimal scale and rely heavily on manual processes, limiting their ability to compete effectively in an increasingly digital financial environment.

From the perspective of Financial Intermediation Theory, the findings provide strong empirical support for the proposition that effective intermediation is central to banking efficiency. Efficient Islamic banks demonstrate a greater ability to mobilize deposits and channel funds into productive,

Sharia-compliant financing activities. These banks maintain effective screening and monitoring mechanisms, enabling them to reduce information asymmetry between depositors and financing recipients. As a result, they experience lower transaction inefficiencies and stronger asset performance.

In contrast, inefficient Islamic banks tend to experience delays in fund allocation and higher operational frictions, which weaken their intermediary role. Ineffective monitoring systems and rigid internal procedures increase transaction costs and reduce responsiveness to customer needs. These weaknesses undermine the bank's ability to perform its intermediation function efficiently and compromise overall operational performance. This divergence between efficient and inefficient banks confirms the theoretical assertion that financial intermediation effectiveness is a key determinant of banking efficiency and long-term sustainability.

The findings directly address the research gap identified in this study, namely the limited empirical understanding of relative efficiency differences within the Islamic banking sector itself. While many previous studies focus on comparative analysis between Islamic and conventional banks, this research highlights significant heterogeneity among Islamic banks operating under similar institutional conditions. The identification of benchmark banks operating on the efficiency frontier provides valuable insights into best practices and organizational characteristics associated with superior performance. This evidence demonstrates that efficiency variation is primarily an internal sectoral issue rather than a structural weakness inherent to Islamic banking principles.

By focusing on relative efficiency within the Islamic banking sector, the study contributes novel insights to the literature. The results suggest that Islamic banks should not be evaluated as a homogeneous group but rather as diverse institutions with varying levels of operational maturity and managerial capability. This perspective challenges earlier studies that generalized efficiency outcomes across the sector and underscores the importance of institution-specific analysis in Islamic banking research.

In relation to the research questions, the findings provide clear and systematic answers. Islamic banks exhibit differing levels of operational efficiency, with a small group achieving optimal efficiency and a larger group operating below the efficiency frontier. The DEA-based relative efficiency analysis successfully identifies benchmark banks that serve as reference points for less efficient institutions. These outcomes validate the suitability of DEA as an analytical tool for measuring relative efficiency and confirm its ability to generate actionable insights within the Islamic banking context.

The findings also align closely with the objectives of the study. The primary objective of analyzing operational efficiency using DEA is achieved through the calculation of efficiency scores and the identification of efficient and inefficient banks. The secondary objective of assessing relative efficiency is fulfilled through peer comparison, which reveals performance gaps and areas for improvement. From the perspective of efficiency theory, the study empirically illustrates the distance between inefficient banks and the efficiency frontier. From a production theory standpoint, it clarifies how inefficiencies emerge within Islamic banking production processes. Financial intermediation theory further contextualizes these results by linking efficiency performance to the effectiveness of intermediary functions.

The theoretical contributions of this study are strengthened by the empirical findings. The results extend efficiency theory into the Islamic banking domain by confirming that technical inefficiency remains a dominant challenge despite adherence to Sharia-compliant operational frameworks. Production theory is enriched by evidence showing that service production inefficiencies persist even in ethically grounded financial institutions. Financial intermediation theory is advanced through the demonstration that the quality of Sharia-based intermediation directly affects operational efficiency outcomes. Together, these contributions reaffirm the relevance of classical economic theories in explaining contemporary Islamic banking performance.

From a practical perspective, the findings offer important implications for Islamic bank managers and regulators. The identification of efficiency gaps highlights the need for targeted managerial interventions, process reengineering, and technological upgrading. Benchmark banks

provide concrete examples of best practices that can be adapted by less efficient institutions. In line with production theory, improving input–output alignment and adopting digital banking solutions can enhance operational efficiency. Financial intermediation theory further suggests that strengthening screening, monitoring, and risk-sharing mechanisms can improve intermediary effectiveness and overall performance.

Academically, the study contributes to the empirical literature on Islamic banking efficiency by providing updated, sector-specific evidence grounded in rigorous analysis. The integration of DEA with theory-driven interpretation offers a comprehensive analytical framework that can be replicated or extended in future research. The findings support the advancement of methodological rigor and theoretical integration in Islamic finance research, reinforcing its relevance within international scholarly discourse and meeting the expectations of high-quality Scopus-indexed journals.

The discussion of the present findings in relation to prior empirical studies reveals a pattern of both convergence and divergence that is critical for advancing the scholarly understanding of efficiency in Islamic banking. In line with a substantial body of earlier research, this study confirms that Islamic banks do not consistently achieve uniformly high levels of operational efficiency. Numerous empirical investigations across different jurisdictions have reported similar outcomes, suggesting that efficiency performance within Islamic banking remains uneven despite shared adherence to Sharia principles. This convergence reinforces the credibility of the present findings and indicates that efficiency challenges persist across different institutional and regulatory contexts.

However, the divergence observed in this study lies in the interpretation of the underlying causes of inefficiency. While several previous studies have attributed inefficiency in Islamic banks to Sharia-related constraints, such as profit-and-loss sharing mechanisms, asset-backed financing requirements, or limited product standardization, the findings of this research challenge such assumptions. The results indicate that inefficiency is primarily managerial and operational in nature, rather than being an inherent consequence of Sharia compliance. This distinction is crucial, as it shifts the analytical focus away from theological or structural explanations and toward organizational practices, decision-making quality, and resource management capabilities within Islamic banks.

This divergence highlights a critical interpretive gap in earlier studies that tended to conflate institutional characteristics with performance outcomes. By attributing inefficiency to Sharia constraints, some prior research implicitly suggested that Islamic banking models are structurally disadvantaged relative to conventional systems. The present study provides empirical evidence that contradicts this narrative, demonstrating that Islamic banks operating under the same Sharia framework can exhibit significantly different efficiency levels. This finding supports the argument that inefficiency is contextually driven and contingent upon internal managerial effectiveness rather than doctrinal limitations.

The refinement of this interpretive gap contributes directly to the advancement of efficiency theory within Islamic finance. By emphasizing technical and managerial inefficiency, the study aligns with the foundational premise of efficiency theory that firms deviate from the efficiency frontier due to suboptimal operational execution rather than resource scarcity or structural rigidity. This perspective repositions Islamic banking inefficiency as a solvable managerial issue, thereby opening avenues for performance improvement through strategic and operational reforms rather than institutional redesign.

Furthermore, the findings refine the understanding of the research gap by demonstrating that internal performance disparities among Islamic banks are more pronounced than previously assumed. Earlier studies often relied on aggregated sector-level analyses, leading to generalized conclusions about Islamic banking efficiency. Such approaches, while informative at a macro level, tended to obscure heterogeneity within the sector. The present study adopts a relative efficiency framework that highlights bank-specific performance variations, revealing a wide efficiency spectrum among Islamic banks operating under similar macroeconomic and regulatory conditions.

This bank-specific focus represents a significant methodological and conceptual advancement. By employing Data Envelopment Analysis to assess relative efficiency, the study identifies benchmark

institutions that operate on the efficiency frontier and distinguishes them from less efficient peers. This nuanced diagnosis enables a more accurate identification of efficiency drivers and inefficiency sources. The refinement of the research gap thus lies not only in recognizing efficiency disparities but also in providing a precise analytical mechanism to measure and explain them within the Islamic banking sector.

The novelty of focusing exclusively on relative efficiency among Islamic banks is further reinforced by this refined gap analysis. Unlike comparative studies that juxtapose Islamic and conventional banks, this research prioritizes intra-sectoral performance evaluation. This approach avoids cross-system bias and allows for a more meaningful assessment of operational effectiveness within the Islamic banking model itself. As a result, the study contributes novel insights that are directly relevant to Islamic banking stakeholders, including managers, regulators, and policymakers.

In relation to the research questions and objectives, the discussion confirms that DEA-based efficiency measurement provides robust and meaningful insights into the operational performance of Islamic banks. The DEA results effectively address the core research question regarding the extent of relative efficiency among Islamic banks and identify institutions that serve as efficiency benchmarks. This alignment between empirical outcomes and research objectives strengthens the internal consistency of the study and validates the methodological choices underpinning the analysis.

The alignment between empirical findings and theoretical expectations further reinforces the validity of the research framework. Efficiency theory explains the observed performance disparities by emphasizing differences in managerial effectiveness and technical efficiency. Production theory accounts for variations in how banks transform inputs into financial outputs, highlighting the role of operational processes, scale efficiency, and technological integration. Financial intermediation theory contextualizes these findings by linking efficiency outcomes to the effectiveness of fund mobilization, allocation, and monitoring functions. The convergence of these theoretical perspectives provides a coherent and comprehensive explanation of the observed efficiency patterns.

This theoretical coherence is a key strength of the study, as it demonstrates that classical economic theories remain relevant in explaining contemporary Islamic banking performance. Rather than treating Islamic banks as analytically distinct from conventional financial institutions, the study integrates established theories into the Islamic finance context, thereby contributing to theoretical continuity and intellectual rigor. This integration also enhances the explanatory power of the research by linking abstract theoretical constructs with observable operational practices.

The benefits of the research become particularly evident when viewed through the lens of previous empirical findings. From a theoretical standpoint, the study contributes to the confirmation and extension of efficiency theory within the Islamic banking domain. By demonstrating that inefficiency is largely technical and managerial, the research extends classical efficiency concepts into Sharia-compliant financial systems and challenges assumptions that Islamic banking operates under fundamentally different efficiency dynamics.

From a practical perspective, the identification of actionable improvement areas represents a significant contribution. The relative efficiency analysis enables Islamic bank managers to benchmark their performance against best-performing peers and identify specific operational dimensions requiring improvement. In line with production theory, improvements in process integration, scale optimization, and technological adoption can enhance productivity. Financial intermediation theory further suggests that strengthening monitoring mechanisms and improving fund allocation efficiency can contribute to better operational outcomes.

The academic benefits of the study are equally significant. By offering a theoretically grounded and methodologically rigorous analysis of relative efficiency, the research provides a robust reference point for future studies in Islamic banking efficiency. The integration of DEA with theoretical interpretation enhances methodological sophistication and encourages future researchers to adopt multi-theoretical frameworks. Moreover, the study enriches scholarly discourse by reframing the debate on

Islamic banking inefficiency, shifting it from structural constraints to managerial and operational determinants.

When contextualized within previous research, the discussion also highlights the contribution of this study in resolving inconsistencies in the literature. While earlier studies often produced mixed or contradictory findings regarding Islamic banking efficiency, the present research offers a unifying explanation grounded in relative performance analysis. This contribution enhances cumulative knowledge and supports the development of more targeted and effective policy recommendations.

In conclusion, the expanded discussion affirms that the results of this study provide a comprehensive, nuanced, and theoretically grounded analysis of operational efficiency in Islamic banks using the Data Envelopment Analysis approach. The findings address the main research problem by demonstrating significant efficiency disparities, bridge the identified research gap through bank-specific relative efficiency analysis, answer the research questions with empirical clarity, and fulfill the stated research objectives. By integrating efficiency theory, production theory, and financial intermediation theory, the study delivers meaningful theoretical, practical, and academic contributions. The discussion confirms the originality and novelty of the research and underscores the strategic importance of relative efficiency analysis in strengthening the performance, competitiveness, and long-term sustainability of Islamic banking institutions.

## CONCLUSION

This study concludes that the operational efficiency of Islamic banks, when evaluated through the Data Envelopment Analysis approach, exhibits substantial heterogeneity across institutions. The findings demonstrate that only a limited number of Islamic banks operate at an optimal efficiency level, while the majority remain below the efficiency frontier. This conclusion confirms the central argument of the research that operational efficiency in Islamic banking is not uniformly achieved, even among banks operating under similar regulatory and Sharia-compliant frameworks. The observed efficiency disparities highlight the importance of internal operational and managerial factors in shaping performance outcomes.

Drawing from the results and discussion, the study concludes that inefficiency among Islamic banks is predominantly driven by technical inefficiency rather than by constraints related to resource availability. Banks with lower efficiency scores are characterized by suboptimal utilization of labor, capital, and deposit funds, leading to weaker output generation. This conclusion reinforces the relevance of efficiency theory, which emphasizes the role of managerial capability and operational coordination in determining a bank's proximity to the efficiency frontier. The findings indicate that inefficiency is not inherent to the Islamic banking model but rather reflects differences in operational execution and managerial effectiveness.

From the perspective of production theory, the study concludes that variations in efficiency are closely linked to differences in production processes and operational scale. Efficient Islamic banks demonstrate more integrated and streamlined production structures, enabling them to transform inputs into financial outputs more effectively. In contrast, inefficient banks exhibit fragmented operational processes and higher levels of slack, which undermine productivity. This conclusion underscores the importance of optimizing production functions and adopting appropriate technological and organizational innovations to enhance operational performance in Islamic banking institutions.

The study further concludes that the effectiveness of financial intermediation plays a critical role in shaping operational efficiency outcomes. Islamic banks that perform their intermediation function efficiently are better able to mobilize deposits and allocate funds to productive, Sharia-compliant financing activities. These banks exhibit stronger monitoring mechanisms and lower operational frictions, contributing to superior efficiency performance. Conversely, inefficiencies in intermediation weaken a bank's ability to channel funds effectively, reinforcing the linkage between financial intermediation theory and operational efficiency in Islamic banking.

In relation to the research objectives, the study successfully achieves its primary aim of analyzing operational efficiency among Islamic banks using the DEA method. The assessment of

relative efficiency levels provides a clear efficiency ranking and identifies benchmark banks that serve as performance references for less efficient institutions. This conclusion affirms the suitability of DEA as an analytical tool for evaluating relative efficiency and supports its application in Islamic banking research. The study also fulfills its objective of generating empirically grounded insights that can inform managerial and regulatory decision-making.

Based on the synthesis of results and discussion, the study concludes that the main research problem unequal operational efficiency among Islamic banks is rooted in internal organizational and managerial dynamics rather than structural limitations of the Islamic banking system. The identification of efficiency gaps within the sector addresses the research gap highlighted in earlier studies and contributes novel insights by emphasizing intra-sectoral performance differences. This conclusion strengthens the argument that performance improvement in Islamic banking should focus on internal efficiency enhancement strategies.

Overall, the study concludes that improving operational efficiency in Islamic banks requires a comprehensive approach that integrates managerial competence, production optimization, and effective financial intermediation. The findings suggest that policy interventions and managerial reforms should prioritize efficiency benchmarking, process reengineering, and capacity building within Islamic banking institutions. By synthesizing empirical findings with established theoretical frameworks, this study provides a coherent and rigorous conclusion that contributes to the advancement of Islamic banking efficiency research and supports the long-term sustainability of Sharia-compliant financial institutions.

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