

# Optimizing Shariah Bank Financing Portfolios: Efficient Contract Combinations in Indonesia

Hikmatul Aliyah<sup>1\*</sup>, Nora Azmia<sup>2</sup>, Gheny Syahdiany<sup>3</sup>

<sup>1,2,3</sup> Ibn Khaldun University Bogor, Indonesia

\*Corresponding author: [hikmatul@uika-bogor.ac.id](mailto:hikmatul@uika-bogor.ac.id)

Contributing authors: [hikmatul@uika-bogor.ac.id](mailto:hikmatul@uika-bogor.ac.id), [nora.azmia@uika-bogor.ac.id](mailto:nora.azmia@uika-bogor.ac.id),  
[geny@uika-bogor.ac.id](mailto:geny@uika-bogor.ac.id)

## Abstract

*This research aims to optimize the financing efficiency of Shariah Commercial Banks (SCBs) in Indonesia through a portfolio analysis involving various types of financing contracts. The analytical method employed is Data Envelopment Analysis (DEA). The study focuses on 9 Shariah Commercial Banks in Indonesia, utilizing quarterly data from 2015 to 2020, resulting in a total of 216 samples. The research findings reveal that SCBs achieved the highest efficiency score of 0.99 when the proportions of murabahah, musyarakah, mudharabah, ijarah, and sukuk financing were 52.79%, 29.10%, 3.25%, 2.18%, and 12.69%, respectively. These results underscore the significant impact of the financing proportions under various contract types on SCBs' efficiency levels. The highest efficiency is attained when the financing portfolio is dominated by murabahah, particularly at a proportion of 52.79%, highlighting the crucial role of murabahah in achieving optimal efficiency.*

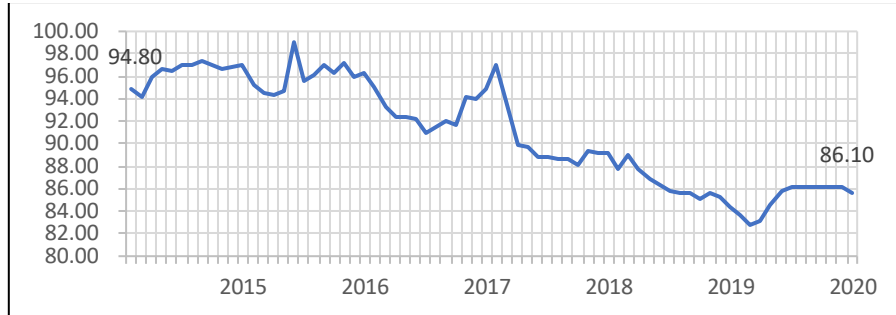
**Keywords:** Portfolio, Efficiency, Shariah Commercial Banks

## Introduction

Financing constitutes a pivotal role in the operational activities of Sharia Commercial Banks, serving as a primary revenue source crucial for ensuring profitability. The efficient allocation of funds is imperative for these banks to achieve their operational goals and enhance profitability, a point emphasized by scholars such as Laila et al. (2019), Kamarudin et al. (2019), and Mezzi (2018). Sharia Commercial Banks disburse financing through investment activities, utilizing profit-sharing principles or lease-based financing agreements like ijarah. Apart from productive financing, these banks also provide consumptive financing through contracts such as murabahah, salam, and istisna. Additionally, they offer various financial services, non-financial services, agency services, and diverse forms of financing, as highlighted by Ascarya and Yumanita (2005), Ayub (2012), and Kara (2014). Achieving a proportional distribution among these financing types is essential for fostering positive efficiency levels. Conversely, inefficient fund management may lead to financial losses for the institution, as noted by Laila et al. (2019), Mansor and Bhatti (2011), and Stuart and Markowitz (1959).

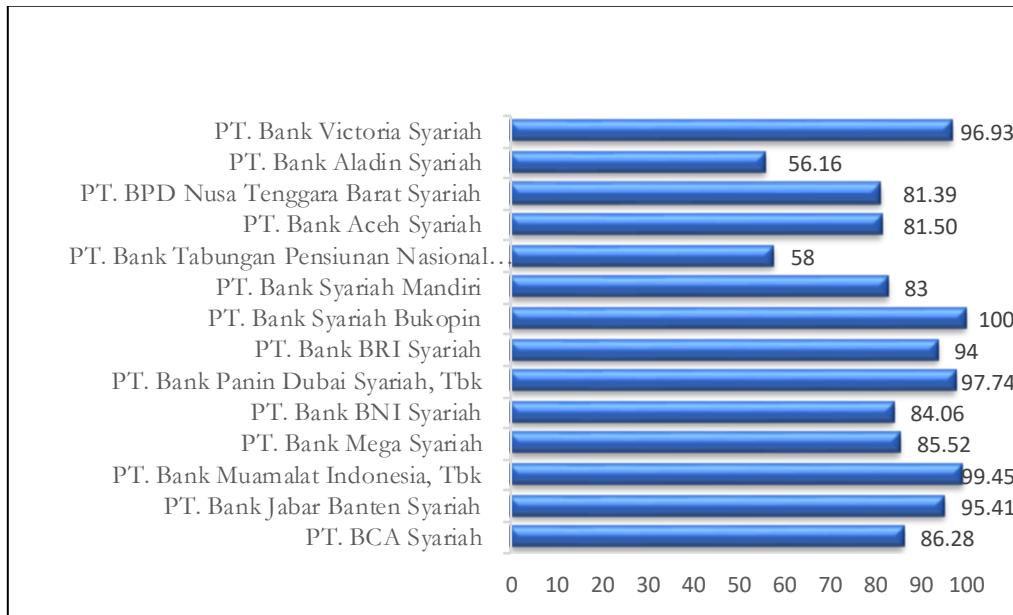
Efficiency stands as a pivotal metric in evaluating the financial performance of Islamic banks, denoting their adeptness in resource management and the discernment of pertinent factors towards corporate objectives (Spong, Sullivan, & DeYoung, 1995; Mezzi, 2018; Shah, Wu, & Korotkov, 2019). Islamic banks earnestly engage in diverse initiatives to augment efficiency, striving to yield heightened income vis-à-vis unit costs with a concurrently diminished margin vis-à-vis clientele (Lucchetti et al., 2001). Consequently, for both an individual Islamic bank and the broader Islamic banking sector, the assiduous consideration of efficiency emerges as an imperative facet in the realization of a robust and sustainable financial performance (Rosman, Wahab, & Zainol, 2014).

The efficiency level of Islamic banks can be observed through the ratio of operational costs to operational income. A decreasing ratio indicates a higher efficiency in managing operational costs and enhancing the company's profitability. An overview of the average efficiency level of Islamic banks in Indonesia can be seen in figures 1 and 2 below.



Source: Financial Services Authority of Indonesia, 2021

Figure 1. Average Operational Cost to Operating Income Ratio of Islamic Banks in Indonesia



Source: Financial reports of each Islamic Commercial Bank

Figure 2. Operational Cost to Operational Income Ratio of Each Islamic Commercial Bank in Indonesia

In figure 1, the comprehensive efficiency level of Islamic banks is presented, while figure 2 delineates the individual efficiency levels of each Islamic bank. Over the period spanning from 2017 to 2020, the Islamic banking sector in Indonesia exhibited a diminishing trend in overall efficiency. From this portrayal, it is discernible that, in a general sense, Islamic banks in Indonesia have demonstrated an enhanced capacity to yield increased income in relation to the units of cost expended. Consequently, it can be deduced that the overarching efficiency of the Islamic banking industry is on an upward trajectory.

The efficiency levels of each Islamic bank, as delineated in figure 2, disclose discernible variances among the Islamic banks in Indonesia. The Islamic bank characterized by the lowest ratio of operational costs to operational income is deemed the most

proficient. Thus, based on the graphical representation, PT Bank Aladin Syariah emerges as the most efficacious Islamic bank. Conversely, PT Bank Syariah Bukopin is identified as the least efficient relative to its peers in the Islamic banking sector.

Analyses of efficiency within Islamic banking have been extensively conducted, wherein the determination of analysis components (inputs and outputs) is guided by the behavioral models of Islamic banks. The prevailing focus in earlier studies has been on utilizing financing indicators to assess the efficiency of Islamic banks (Ahmad & Noor, 2010; Kamarudin et al., 2019; Mokhtar et al., 2007; Sufian et al., 2008). However, there exists a notable gap in exploring output variables, particularly in understanding the various types of financing products. Given the diverse range of financing products offered by Islamic banks, as emphasized by Ascarya and Yumanita (2006), Fujii et al. (2014), Hosen and Rahmawati (2017), and Sufian and Kamarudin (2015), categorizing the disbursed financing types becomes crucial for a comprehensive efficiency analysis.

Efficiency in portfolio management, as elucidated by Jones (2000), is distinguished by maintaining an equal level of profit while mitigating risk or achieving an equivalent risk with a higher rate of return. In contrast, an optimum portfolio represents the choice made by investors from the options available within an efficient portfolio set. In the context of Islamic banking principles, investors often opt for portfolios that align with their preferences, seeking to maximize expected returns while managing a specific level of risk. The quest for portfolios offering the lowest risk and a predetermined rate of return is a common goal among investors (Pirzada 2017; Aktan et al. 2018, cited in the research of Laila, Saraswati, and Kholidah 2019), resulting in what is commonly referred to as an efficient portfolio. The establishment of an efficient portfolio relies on assumptions about investor behavior, particularly the foundational assumption that investors exhibit risk aversion. Furthermore, investors are more inclined to select an optimal portfolio from the set of efficient portfolios, as highlighted by Marcowitz (1991).

This research is conducted to assess the efficiency level of Islamic Banks in Indonesia by taking into consideration the various components of financing contracts utilized. The primary objective is to gauge the extent to which Islamic banks effectively manage their resources in channeling funds into financing activities. By delving into and comprehending the efficiency levels associated with each component of financing contracts, this study aims to formulate the most efficient financing portfolio for Islamic Banks. The ultimate goal is to provide valuable insights that can enhance the operational and financial performance of Islamic banks in Indonesia.

## Literature Review

The efficiency of the banking sector is a compelling topic in the banking industry. Despite numerous studies on the efficiency of Shariah Commercial Banks (ICBs), the efficiency of ICBs dynamically evolves in line with their business environment, making ongoing research on their efficiency essential. Most existing studies aim to measure the overall efficiency of Islamic banking. In this context, research is conducted to examine the efficiency of Islamic banking over time (Ahmad & Noor, 2010; Kamarudin et al., 2019; Mokhtar et al., 2007; Sufian et al., 2008). Additionally, a substantial amount of research aims to compare the efficiency levels between Islamic and conventional banks (Alqahtani et al., 2017; Ismail et al., 2013; Kamarudin et al., 2014; Othman et al., 2017).

Previous studies have not classified the financing components provided by Shariah

Commercial Banks based on the types of contracts (Rusydia, 2020; Alqahtani et al., 2017; Kamarudin et al., 2017; Sufian and Kamarudin, 2015; Kamarudin et al., 2014). However, the portfolio of Islamic Commercial Banks' financing is based on various types of contracts with different specifications, allowing for differences in efficiency levels across different compositions and proportions of financing.

One study that used financing as an indicator in analyzing the efficiency of Islamic banks was conducted by Mezzi (2018). However, this study lacked variety in the types of contracts used. Meanwhile, the research conducted by Laila, Saraswati, and Kholidah (2019) analyzed a combination of various investment instruments to form an efficient portfolio using return, standard deviation, variance-covariance, correlation coefficient, and coefficient of variation of investment instruments between 2011 and 2015. However, this study only conducted the analysis through Microsoft Excel, lacking a more detailed analysis of how one investment instrument can be considered efficient relative to others. Traditional portfolio analysis may not provide insights as detailed as this.

The positioning of this research is to deepen the study of the efficiency of Islamic banking, addressing a research gap in the literature regarding the efficiency of the financing practices of Shariah Commercial Banks in Indonesia by classifying the financing components based on the types of contracts used. By doing so, the research aims to provide a more comprehensive understanding of the efficiency levels within the Islamic banking sector in Indonesia, with a focus on optimizing financing portfolios based on the specific contractual arrangements employed. This targeted approach is anticipated to yield insights that can inform strategic decision-making and enhance the overall performance of Shariah Commercial Banks in Indonesia.

**Research Method**

**Data**

The population under observation in this research is Islamic commercial bank (SCBs) operating in Indonesia. The data used in this research is secondary data derived from each Shariah Commercial Banks financial statements over a six-year period, from 2015 to 2020. PT BCA Syariah, PT Bank Jabar Banten Syariah, PT Bank Muamalat Indonesia Tbk, PT Bank Mega Syariah, PT Bank BNI Syariah, PT Bank Panin Dubai Syariah Tbk, PT Bank BRI Syariah, PT Bank Syariah Bukopin and PT Bank Syariah Mandiri were the nine (9) Shariah Commercial Banks used in this research.

**Model Development**

This research used an asset approach in determining the input and output variables. The asset strategy was chosen because it is most consistent with the fundamentals of Islamic banking, namely allocating/distributing funds (input) into various forms of assets (output). (Ascarya & Yumanita, 2006; Fujii et al., 2014; Fukuyama & Matousek, 2011, 2017, 2018; Kamarudin et al., 2014). Thus, the research variables in measuring the efficiency level of Shariah Commercial Banks in Indonesia are as shown in table 1 below:

Table 1. Operational Variables Based on the Type of Financing Contract

	Variables	Operational Variables	Source
Input	Labor	Labor Load (I1)	Financial Position Statement
	Third-party funds	Third-party funds (I2)	
	Miscellaneous Prices	Other Operational Expenses (I3)	

Output	Shariah Commercial Banks Financing Contracts	Murabahah (O1) Musyarakah (O2) Mudharabah (O3) Lease/Ijarah Financing (O4) Securities (O5)	Notes to Financial Statements
--------	--	--	-------------------------------

Table 1 shows that the input variables in this research consist of the labor load as a proxy for the price of labor (I1) (Ascarya & Yumanita, 2006; Fukuyama & Matousek, 2018; Hamid, Ramli, & Hussin, 2017; Hosen & Rahmawati, 2017; Kamarudin et al., 2014, 2019; Mezzi, 2018; Qayyum & Riaz, 2018; Shamsur & Weill, 2019; Sufian & Kamarudin, 2015; Wanke et al., 2016), third-party funds (I2), and other operating expenses as a proxy for other prices (I3) (Ascarya & Yumanita, 2006; Fernandes et al., 2018; Fukuyama & Matousek, 2011, 2017, 2018; Hadad et al., 2003; Kamarudin et al., 2014; Mezzi, 2018; Qayyum & Riaz, 2018).

Meanwhile, the type determines the output employed in this investigation. Table 1 shows that the efficiency measurement variables are based on the type of financing contract, with details of the output variables such as murabahah contracts (O1), musyarakah contracts (O2), mudharabah contracts (O3), and lease/ijarah financing contracts (O4), which are the most dominant financing contracts in 2014-2018, as well as Securities (O5) (Ascarya & Yumanita, 2006; Hadad et al., 2003; Kamarudin et al., 2014; Mezzi, 2017).

**Method**

This study employs the Data Envelopment Analysis (DEA) method for efficiency analysis. In the DEA method, Charnes et al. (1978) introduced a tool that has become a standard in efficiency analysis techniques (Nailah & Rusydiana, 2020; Shawtari et al., 2018). DEA is a nonparametric approach utilized to evaluate the performance of activities within an entity or organization. A mathematical programming model applied to observational data is employed to generate relative efficiency scores and potential efficient production (A. Rusydiana & Hasib, 2020; Cooper, Selford, & Zhu, 2011).

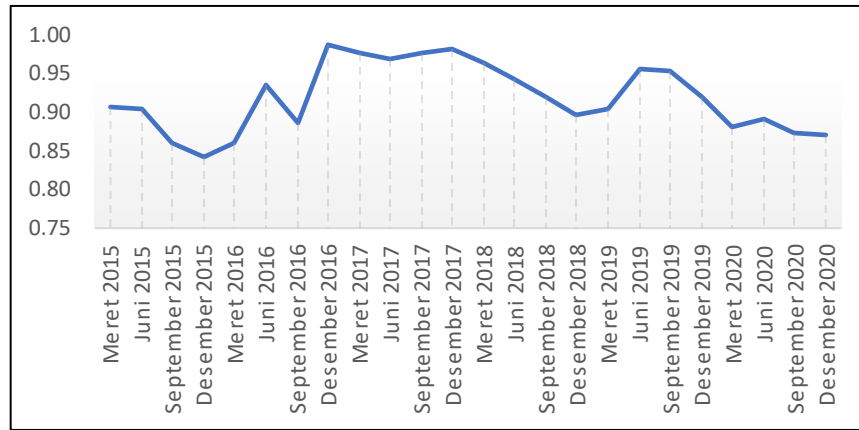
DEA testing involves the Decision Making Unit (DMU), i.e., the policymaking unit, which is assessed based on the efficiency of input and output utilization. Relative efficiency scores indicate the efficiency ratio of one DMU compared to another with similar types of input and output. Efficiency levels can be computed for more than one input and output used (A. Rusydiana & Hasib, 2020; Cooper, Selford, & Zhu, 2011).

Two fundamental DEA models developed are Constant Return to Scale (CRS) and Variable Return to Scale (VRS). The DEA CCR model (Charnes, Cooper, and Rhodes) assumes that a proportional increase in all inputs will result in a proportional increase in outputs. Meanwhile, the DEA BCC model (Banker, Charnes, and Cooper) introduces the concept of Variable Return to Scale (VRS), where the ratio of input increase is not always equal to the ratio of output increase. VRS allows for an analysis of return to scale that can be increasing or decreasing, depending on the relationship between input and output (Banker et al., 1984; Tim Coelli, 1996; Cooper et al., 2011).

Therefore, DEA serves as an effective tool in measuring the relative efficiency of policymaking units, aiding organizations in identifying best practices, and offering new insights through the concepts of CRS and VRS. The analytical tool utilized to assess the stability of BUS efficiency levels in this study is MaxDEA 8 Basic.

**Result and Discussion**

The findings from the Data Envelopment Analysis (DEA) testing reveal the overall efficiency conditions of Shariah Commercial Banks from 2015 to 2020. This is illustrated by the average efficiency scores of nine BUS in Indonesia during the research period, as depicted in figure 3:



Source: MaxDEA 8 Basic Software Output

Figure 3. Average Efficiency Scores of All Shariah Commercial Banks

The analysis results indicate that the combined average efficiency scores obtained by nine Shariah commercial banks in Indonesia exhibit a fluctuating trend. The highest efficiency level occurred in December 2016, reaching 0.99. In contrast, the lowest efficiency level for Shariah commercial banks was recorded in December 2015, with a score of 0.84. By the end of the 2020 period, the average efficiency score stood at 0.87. The lowest average efficiency score for Shariah commercial banks was 0.84, observed in December 2015. Based on the overall average efficiency scores of these banks, it can be concluded that the efficiency condition of Shariah commercial banks in Indonesia, in general, has not reached perfect efficiency.

Previous research also reached similar conclusions. Firdaus and Hosen (2013), analyzing the efficiency level of Shariah commercial banks in Indonesia from 2010 to 2012, concluded that the efficiency level of Shariah commercial banks in Indonesia was not yet efficient, with an average efficiency score of 85.3. Another study conducted by Permana and Adityawarman (2015) examining the efficiency level from 2010 to 2013 found an average efficiency level of 75.80 percent, lower than previous findings. This research indicates that the efficiency level has improved after the 2017 period.

The analysis of data from 2015 to 2020 in this study shows that the average efficiency level achieved by each Shariah commercial bank is 92.8 percent. These results align with existing theories and previous research, supporting the conclusion that testing efficiency by classifying financing components based on types of contracts as output variables in the research is appropriate.

Furthermore, data processing with DEA reveals the efficiency levels achieved by each Shariah commercial bank, as presented in Table 2 below.

Table 2. Efficiency of Shariah Commercial Banks from 2015 to 2020

No.	DMU	Trend	Ra Average	Tu The Number Of Perfect Efficiencies	Rank
1	BCAS		0,959	12	4
2	BJBS		0,872	7	7
3	BMI		0,986	12	2
4	BMS		0,786	2	9
5	BNIS		0,984	11	3
6	BPDS		0,939	8	5
7	BRIS		0,936	7	6
8	BSB		0,827	7	8
9	BSM		0,987	20	1

Source: Output from MaxDEA 8 Basic Software

Table 2 presents the results of efficiency testing for 9 Shariah Commercial Banks (SCBs) in Indonesia. The SCB that consistently achieved a perfect efficiency score of 1 in every period was Bank Syariah Mandiri (BSM). The number of perfect efficiency scores obtained by BSM was 20 out of 24 periods, as indicated by the red dots in the trend overview in Table 4.5. In contrast, the bank with the lowest efficiency level (highest inefficiency) with an average score of 0.786 was Bank Mega Syariah (BMS), achieving efficiency in only 2 periods.

The second-ranked SCB was Bank Muamalat Indonesia (BMI) with an average efficiency score of 0.986 and achieving perfect efficiency 12 times. The third-ranked SCB was Bank Negara Indonesia Syariah (BNIS) with an average efficiency score of 0.984 and achieving perfect efficiency 11 times. The fourth-ranked SCB was Bank Central Asia Syariah (BCAS) with an average efficiency score of 0.959 and achieving perfect efficiency 12 times. The fifth-ranked SCB was Bank Panin Dubai Syariah (BPDS) with an average efficiency score of 0.939 and achieving perfect efficiency 8 times. The sixth-ranked SCB was Bank Republik Indonesia Syariah (BRIS) with an average efficiency score of 0.936 and achieving perfect efficiency 7 times. The seventh-ranked SCB was Bank Jawa Barat and Banten Syariah (BJBS) with an average efficiency score of 0.872 and achieving perfect efficiency 7 times. Next, the eighth-ranked SCB was Bank Syariah Bukopin (BSB) with an average efficiency score of 0.827 and achieving perfect efficiency 2 times.

Furthermore, following the efficiency testing, it was identified that some Decision Making Units (DMUs) successfully achieved a perfect efficiency level with a value of 1. Subsequently, this research aims to explore the proportions of each financing type that can lead to perfect efficiency. These findings can serve as valuable insights for Shariah Commercial Banks (SCBs) to enhance efficiency by precisely determining the proportions of each financing type.

To determine the proportions of each financing type that can achieve perfect efficiency, the research categorizes financing data, which serves as the output



variable, and the efficiency levels resulting from DEA testing into several classes based on predetermined interval values. This categorization is carried out through statistical frequency distribution calculations. Subsequently, the average proportions of each financing type are computed within each class, providing insights into the proportions of each financing type that can lead to perfect efficiency.

It is then revealed that SCBs achieved the highest efficiency score of 0.99 when the average proportions of murabahah, musyarakah, mudharabah, ijarah, and sukuk financing were 52.79%, 29.10%, 3.25%, 2.18%, and 12.69%, respectively. This indicates that the proportions of financing in each contract type significantly influence the efficiency levels attained by SCBs. Therefore, these findings can serve as guidance for SCBs in determining financing proportions to achieve optimal efficiency levels.

To provide a more comprehensive overview, the average proportions of each financing type and the efficiency levels achieved by Shariah Commercial Banks (SCBs) overall are presented in figure 4. The following pie chart illustrates this information.

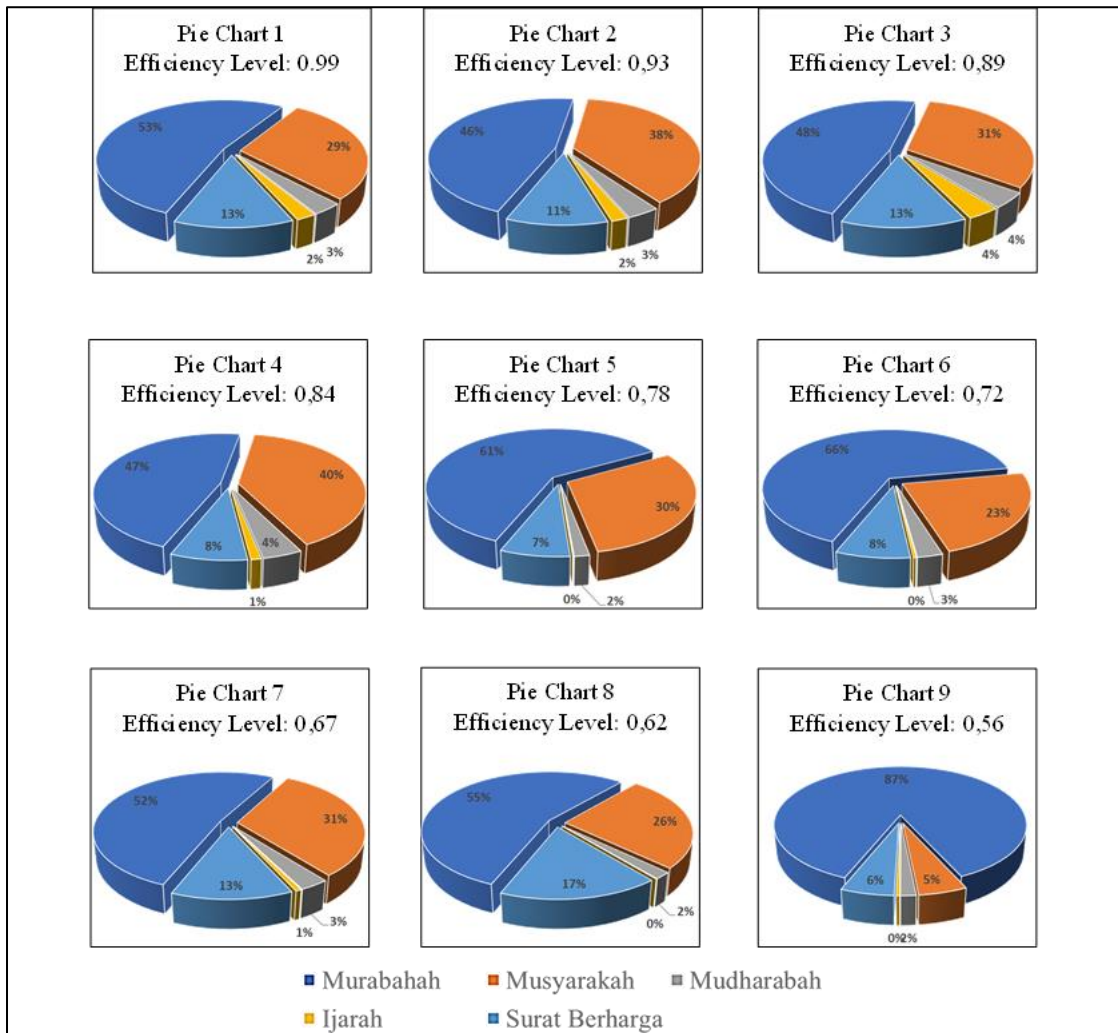


Figure 4. Average Proportions of Each Financing Type and Efficiency Level Achieved by Shariah Commercial Banks Overall

Pie chart 1 in figure 4 illustrates the highest efficiency level, achieved when the financing proportion is predominantly dominated by murabahah, accounting for 52.79%. It



can be asserted that the proportion of murabahah financing plays a crucial role in attaining optimal efficiency in SCBs. Thus, it can be considered that murabahah plays a significant role in achieving optimal efficiency.

This research finding aligns with the study conducted by Soekarni (2014), indicating that the dominance of murabahah contracts in the financing structure of SCBs is influenced by the bank's financing activities, which are primarily oriented towards consumption rather than working capital and investment. Although consumption activities are the main target of murabahah financing, it does not diminish the importance of financing for working capital and investment purposes.

Statistical data from Islamic banking (2021) also reveals that the amount of financing for consumption activities is larger than that for working capital and investment. In productive activities, the financing structure provided by SCBs is more dominated by the purchase of working capital goods. Financing for working capital is also conducted under the principle of sale and purchase, i.e., murabahah financing. This is in contrast to the financing structure for investment, which only employs profit-sharing principles, namely musyarakah and mudarabah financing. In 2020, the amount of financing for consumption activities was recorded at IDR 181.851 trillion, working capital at IDR 114.908 trillion, and investment at IDR 87.186 trillion.

Previous research by Rachmawati and Darmaya (2018) suggested that the dominance of murabahah-patterned financing is due to a simpler margin determination system for SCBs and greater transparency for customers. This margin determination system is related to cost prices and profits, making financing with profit-sharing principles considered more complex due to the calculation of established ratios. Moreover, murabahah-patterned financing is perceived as less risky as it provides certainty regarding installments and fixed margins. A recent study by Agustina et al. (2021) found that the financing pattern of murabahah significantly influences the net profit of SCBs, while the musyarakah financing pattern does not have a significant impact on the net profit of SCBs.

## Conclusion

This study is conducted to assess the efficiency levels of Islamic banks in Indonesia, taking into account various components of financing contracts employed. The main objective is to evaluate how effectively Islamic banks allocate their resources to financing activities. Through a detailed analysis and comprehension of the efficiency levels associated with each financing contract component, the research aims to devise the most efficient financing portfolio for Islamic banks. The ultimate goal is to provide valuable insights that can enhance the operational and financial performance of Islamic banks in Indonesia.

The efficiency analysis of nine Islamic Commercial Banks (ICBs) in Indonesia reveals fluctuating efficiency scores. The peak efficiency is recorded in December 2016 (0.99), whereas the lowest point is observed in December 2015 (0.84). The mean efficiency score at the close of 2020 is 0.87. Based on this analysis, it can be inferred that the overall efficiency status of ICBs in Indonesia has not yet reached perfect efficiency. Three Shariah Commercial Banks (SCBs) exhibit optimal efficiency levels, namely BSM, BMI, and BRIS. These banks achieve maximum efficiency in resource utilization. Furthermore, BNIS, BPDS, and BCAS also demonstrate optimal efficiency levels with moderate stability. BJBS experiences low efficiency, whereas BSB and BMS display both low efficiency and very low stability. To improve efficiency, BSB and BMS need to implement changes in their management and

resource utilization. Additionally, it is discovered that SCBs can achieve perfect efficiency when the average proportions of murabahah, musyarakah, mudarabah, ijarah, and sukuk financing are 52.79%, 29.10%, 3.25%, 2.18%, and 12.69%, respectively.

## References

- Adiwaran A, K. (2017). *Bank Islam: Analisis Fiqih dan Keuangan* (Edisi ke-lima ed.). Depok: Rajawali Press.
- Ahmad, N. H., & Noor, M. A. N. M. (2010). The Determinants Efficiency and Profitability of World Islamic Banks. *International Conference on E-Business, Management and Economics*, 4-7.
- Ahmed, H. (2014). Islamic Banking and Shari'ah Compliance: A Product Development Perspective. *Journal of Islamic Finance*, 15-29.
- Ahn, H., & Le, M. H. (2014). An insight into the specification of the input-output set for DEA-based bank efficiency measurement. *Journal Fur Betriebswirtschaft*, 3-37.
- Al Arif, N., & Rahmawati, Y. (2015). *Manajemen Risiko Perbankan Syariah*. Ciputat: UIN Press.
- Al-Muharrami, S. (2014). Islamic Banking: Basic Guidelines for Researchers. *European Journal of Social Sciences*.
- Alqahtani, F., Mayes, D. G., & Brown, K. (2017). Islamic Bank Efficiency Compared to Conventional Banks during the Global Crisis in the GCC Region. *Journal of International Financial Markets, Institutions and Money*, 58-74.
- Ascarya, & Yumanita, D. (2005). Bank Syariah: Gambaran Umum. *Pusat Pendidikan dan Studi Kebanksentralan (PPSK)*. 14-38.
- Ascarya, & Yumanita, D. (2006). Analisis Efisiensi Perbankan Syariah di Indonesia dengan Data Envelopment Analysis. *TAZKIA Islamic Finance and Business Review*, 1-31.
- Ascarya. (2006). *Akad dan Produk Bank Syariah: Konsep dan Praktek Dibeberapa Negara*. Jakarta: Bank Indonesia.
- Avkiran, N. K. (2015). An Illustration of Dynamic Network DEA in Commercial Banking Including Robustness Tests. *Omega (United Kingdom)*, 2-24.
- Ayub, M. (2012). Understanding Islamic Finance. In *Understanding Islamic Finance*.
- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, 1078-1092.
- Bartuševičienė, I., & Šakalytė, E. (2013). Organizational Assessment: Effectiveness Vs. Efficiency. *Social Transformations in Contemporary Society*, 45-53.
- Berger, A. N., & Humphrey, D. B. (1997). Efficiency of Financial Institutions: International Survey and Directions for Future Research. *European Journal of Operational*.
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research*, 429-444.
- Coelli, Tim, Rahman, S., & Thirtle, C. (2002). Technical, Allocative, Cost and Scale Efficiencies in Bangladesh Rice Cultivation: A Non-Parametric Approach. *Journal of Agricultural Economics*, 607-626.

- Coelli, Tim. (1996). A Guide to DEAP Version 2.1: Data Computer Analysis (Computer) Program. *CEPA Working Papers*, 1-49.
- Coelli, Tim. (1998). A Multi-Stage Methodology for the Solution of Orientated DEA Models. *Operations Research Letters*, 143-149.
- Coelli, Tim. (2005). A Guide to DEAP Version 2.1: A Data Envelopment Analysis (Computer) Program. *An Introduction to Efficiency and Productivity Analysis*.
- Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). Handbook on Data Envelopment Analysis. *Chapter 1: Data Envelopment Analysis*, 315-362.
- Dissanayake, C. K., Cross, J. A., & T-orabzadehkhorsani, S. (2017). Application of DEA vs. PLSPM in Organizational Performance Measurement. *67th Annual Conference and Expo of the Institute of Industrial Engineers 2017*.
- Doumpos, M., Hasan, I., & Pasiouras, F. (2017). Bank Overall Financial Strength: Islamic Versus Conventional Banks. *Economic Modelling*, 1-12.
- Drucker, P. F. (1963). Managing for Business Effectiveness. *Harvard Business Review*, p. 31-33.
- Fernandes, F. D. S., Stasinakis, C., & Bardarova, V. (2018). Two-Stage DEA-Truncated Regression: Application in Banking Efficiency and Financial Development, 284-131.
- Forsund, F. R. (2016). Productivity interpretations of the Farrell Efficiency Measures and the Malmquist Index and Its Decomposition. *International Series in Operations Research and Management Science*, 121-147.
- Forsund, F. R., & Hjalmarsson, L. (1979). Generalised Farrell Measures of Efficiency: An Application to Milk Processing in Swedish Dairy Plants. *The Economic Journal*, 219-315.
- Forsund, F. R., & Sarafoglou, N. (2002). On the Origins of Data Envelopment Analysis. *Journal of Productivity Analysis*, 1-32.
- Fujii, H., Managi, S., & Matousek, R. (2014). Indian Bank Efficiency and Productivity Changes with Undesirable Outputs: A Disaggregated Approach. *Journal of Banking and Finance*, 41-50.
- Fukuyama, H., & Matousek, R. (2011). Efficiency of Turkish Banking: Two-Stage Network System. Variabel Returns to Scale Model. *Journal of International Financial Markets, Institutions and Money*, 71-91.
- Fukuyama, H., & Matousek, R. (2017). Modelling Bank Performance: A Network DEA approach. *European Journal of Operational Research*, 721-732.
- Fukuyama, H., & Matousek, R. (2018). Nerlovian revenue inefficiency in a bank Production Context: Evidence from Shinkin Banks. *European Journal of Operational Research*. 2-35.
- Hadad, M. D., Santoso, W., Mardanugraha, E., & Ilyas, D. (2003). Pendekatan Parametrik untuk Efisiensi Perbankan Indonesia. *Bank Indonesia*. <https://doi.org/10.1016/j.ejca.2010.07.018>
- Hassan, M. (2017). Islamic Banking and Finance. *Handbook of Empirical Research on Islam and Economic Life*.
- Hosen, M. N., & Rahmawati, R. (2017). Analysis of the Efficiency, Profitability and Soundness of Islamic Banks in Indonesia for the Period of 2010-2013. *International Journal of Applied Business and Economic Research*.

- Huang, J., Chen, J., & Yin, Z. (2014). A Network DEA Model with Super Efficiency and Undesirable Outputs: An Application to Bank Efficiency in China. *Mathematical Problems in Engineering*. <https://doi.org/10.1155/2014/793192>
- Ilieva, J., Ristovska, N., & Kozuharov, S. (2017). Banking without Interest. *UTMS Journal of Economics*.
- Ismail, F., Shabri Abd. Majid, M., & Rahim, R. A. (2013). Efficiency of Islamic and Conventional Banks in Malaysia. *Journal of Financial Reporting and Accounting*. <https://doi.org/10.1108/jfra-03-2013-0011>
- Jiménez-Hernández, I., Palazzo, G., & Sáez-Fernández, F. J. (2019). Determinants of Bank Efficiency: Evidence from the Latin American Banking Industry. *Applied Economic Analysis*. <https://doi.org/10.1108/aea-09-2019-0027>
- Kablan, S. (2010). Banking Efficiency and Financial Development in Sub-Saharan Africa. *IMF Working Papers*. <https://doi.org/10.5089/9781455201198.001>
- Kamarudin, F., Nordin, B. A. A., Muhammad, J., & Hamid, M. A. A. (2014). Cost, Revenue and Profit Efficiency of Islamic and Conventional Banking Sector: Empirical Evidence from Gulf Cooperative Council Countries. *Global Business Review*. <https://doi.org/10.1177/0972150913515579>
- Kamarudin, F., Sufian, F., Nassir, A. M., Anwar, N. A. M., & Hussain, H. I. (2019). Bank Efficiency in Malaysia a DEA Approach. *Journal of Central Banking Theory and Practice*. <https://doi.org/10.2478/jcbtp-2019-0007>
- Kara, M. (2014). Kontribusi Pembiayaan Perbankan Syariah terhadap Pengembangan Usaha Mikro, Kecil, dan Menengah. *AHKAM: Jurnal Ilmu Syariah*. <https://doi.org/10.15408/ajis.v13i2.944>
- Laila, N., Saraswati, K. A., & Kholidah, H. (2019). Efficient Portofolio Composition of Indonesian Islamic Bank Financing. *Entrepreneurship and Sustainability Issues*. [https://doi.org/10.9770/jesi.2019.7.1\(3\)](https://doi.org/10.9770/jesi.2019.7.1(3))
- Liang, L. W., Cheng, C. P., & Lin, Y. (2018). Determinants of Banking Efficiency and Survival in Taiwan with Consideration of the Real Management Cost. *Emerging Markets Finance and Trade*. <https://doi.org/10.1080/1540496X.2018.1470504>
- Lotto, J. (2019). Evaluation of Factors Influencing Bank Operating Efficiency in Tanzanian Banking Sector. *Cogent Economics & Finance*. <https://doi.org/10.1080/23322039.2019.1664192>
- Mansoor Khan, M., & Ishaq Bhatti, M. (2008). Development in Islamic Banking: a Financial Risk-Allocation Approach. *Journal of Risk Finance*. <https://doi.org/10.1108/15265940810842401>
- Mansor, F., & Bhatti, M. I. (2011). Risk and Return Analysis on Performance of the Islamic Mutual Funds: Evidence from Malaysia. *Global Economy and Finance Journal*.
- Mezzi, N. (2018). Efficiency of Islamic Banks and Role of Governance: Empirical Evidence. *Managerial Finance*. <https://doi.org/10.1108/MF-05-2017-0171>
- Miller, S. M., & Noulas, A. G. (1996). The Technical Efficiency of Large Bank Production. *Journal of Banking and Finance*. [https://doi.org/10.1016/0378-4266\(95\)00017-8](https://doi.org/10.1016/0378-4266(95)00017-8)
- Mohammad, S. (2013). Liquidity Risk Management in Islamic Banks: A Survey. *Afro Eurasian Studies*.

- Mokhtar, H. S. A., Abdullah, N., & Alhabshi, S. M. (2007). Technical and Cost Efficiency of Islamic Banking in Malaysia. *Review of Islamic Economics*.
- Mubarak, F. (2020). *Dinamika Efisiensi dan Risiko Pembiayaan Perbankan Syariah Pada Sektor Riil*. (Jakarta: Disertasi tidak dipublikasikan, UIN Syarif Hidayatullah).
- Nafis, H. C. (2011). *Teori Hukum Ekonomi Islam*. Jakarta: Penerbit Universitas Indonesia.
- Nasution, M. L. (2018). *Manajemen Pembiayaan Bank Syariah*. Medan: FEBI UIN-SU Press.
- Novickyte, L., & Drozdz, J. (2018). Measuring the Efficiency in the Lithuanian Banking Sector: The DEA Application. *International Journal of Financial Studies*. <https://doi.org/10.3390/ijfs6020037>
- Othman, N., Abdul-Majid, M., & Abdul-Rahman, A. (2017). Partnership Financing and Bank Efficiency. *Pacific Basin Finance Journal*. <https://doi.org/10.1016/j.pacfin.2017.08.002>
- Ozcan, Y. A. (2008). Health Care Benchmarking and Performance Evaluation. *International Series in Operations Reserach & Management Science*. <https://doi.org/10.1007/978-0-387-75448-2>
- Partovi, E., & Matousek, R. (2019). Bank efficiency and Non-Performing Loans: Evidence from Turkey. *Research in International Business and Finance*. <https://doi.org/10.1016/j.ribaf.2018.12.011>
- Qayyum, A., & Riaz, K. (2018). Incorporating Credit Quality in Bank Efficiency Measurements: A Directional Distance Function Approach. *Journal of Risk and Financial Management*. <https://doi.org/10.3390/jrfm11040078>
- Quaranta, A. G., Raffoni, A., & Visani, F. (2018). A Multidimensional Approach to Measuring Bank Branch Efficiency. *European Journal of Operational Research*. <https://doi.org/10.1016/j.ejor.2017.10.009>
- Řepková, I. (2015). Banking Efficiency Determinants in the Czech Banking Sector. *Procedia Economics and Finance*. [https://doi.org/10.1016/s2212-5671\(15\)00367-6](https://doi.org/10.1016/s2212-5671(15)00367-6)
- Rosman, R., Wahab, N. A., & Zainol, Z. (2014). Efficiency of Islamic Banks during the Financial Crisis: An analysis of Middle Eastern and Asian countries. *Pacific Basin Finance Journal*. <https://doi.org/10.1016/j.pacfin.2013.11.001>
- Rusydiana, A., & Hasib, F. F. (2020). Super Efisiensi dan Analisis Sensitivitas Dea: Aplikasi pada Bank Umum Syariah di Indonesia. *Amwaluna: Jurnal Ekonomi dan Keuangan Syariah*, 4(1). <https://doi.org/10.29313/amwaluna.v4i1.5251>
- Rusydiana, Aam S., & Firmansyah, I. (2017). Efficiency versus Maqashid Islamic Index: an Application on Indonesian Islamic Bank. *Shirkah: Journal of Economics and Business*. <https://doi.org/10.22515/shirkah.v2i2.154>
- Rusydiana, Aam Slamet. (2018). Indeks Malmquist untuk Analisis Efisiensi dan Produktivitas Bank Syariah di Indonesia. *Jurnal Ekonomi Pembangunan*. <https://doi.org/10.14203/jep.26.1.2018.47-58>
- Salim, R., Arjomandi, A., & Dakpo, K. H. (2017). Banks' Efficiency and Redit Risk Analysis using By-Production Approach: The Case of Iranian Banks. *Applied Economics*, <https://doi.org/10.1080/00036846.2016.1251567>
- Salman, A., & Nawaz, H. (2018). Islamic Financial System and Conventional Banking: A Comparison. *Arab Economic and Business Journal*. <https://doi.org/10.1016/j.aebj.2018.09.003>

- Shamshur, A., & Weill, L. (2019). Does Bank Efficiency Influence the Cost of Credit? *Journal of Banking and Finance*. <https://doi.org/10.1016/j.jbankfin.2019.05.002>
- Siddiqui, A. (2008). Financial Contracts, Risk and Performance of Islamic Banking. *Managerial Finance*. <https://doi.org/10.1108/03074350810891001>
- Stuart, A., & Markowitz, H. M. (1959). Portfolio Selection: Efficient Diversification of Investments. *OR*. <https://doi.org/10.2307/3006625>
- Sufian, F., & Kamarudin, F. (2015). Determinants of revenue efficiency of Islamic banks: Empirical Evidence from the Southeast Asian countries. *International Journal of Islamic and Middle Eastern Finance and Management*. <https://doi.org/10.1108/IMEFM-12-2012-0114>
- Tan, Y., & Floros, C. (2018). Risk, Competition and Efficiency in Banking: Evidence from China. *Global Finance Journal*. <https://doi.org/10.1016/j.gfj.2017.12.001>
- Wahid, H., Ahmad, S., Nor, M. A. M., & Rashid, M. A. (2017). Prestasi Kecekapan Pengurusan Kewangan dan Agihan Zakat: Perbandingan Antara Majlis Agama Islam Negeri di Malaysia. *Jurnal Ekonomi Malaysia*.
- Wanke, P., Azad, M. A. K., & Barros, C. P. (2016). Efficiency Factors in OECD banks: A Ten-Year Analysis. *Expert Systems with Applications*. <https://doi.org/10.1016/j.eswa.2016.07.020>