
Efficiency Analysis of Five Conventional Commercial Banks in Indonesia by Examining the Principles of Sustainable Finance

Fauziah Eka Permadani¹, Siti Aisyah Tri Rahayu², Tetuko Rawidyo Putro³

¹Sebelas Maret University, Faculty of Economics and Business, Master of Economics and Development Studies, Ir. Sutami Road No.36, Surakarta, Central Java, Indonesia

²Sebelas Maret University, Faculty of Economics and Business, Master of Economics and Development Studies, Ir. Sutami Road No.36, Surakarta, Central Java, Indonesia

³Sebelas Maret University, Faculty of Economics and Business, Master of Economics and Development Studies, Ir. Sutami Road No.36, Surakarta, Central Java, Indonesia

doi: 10.51505/IJEBMR.2022.61012

URL: <https://doi.org/10.51505/IJEBMR.2022.61012>

Abstract

This research analyzes the efficiency of conventional commercial banks in Indonesia by examining the principles of sustainable finance. This research only examines 5 banks in Indonesia during 2019-2021 due to the availability of data obtained from the sustainability report. The efficiency scores in 2019-2021 will be calculated using the DEA method with an output-oriented Bankers-Charnes-Cooper (BCC) assumption or Variable Return to Scale (VRS) assumption and an intermediation approach. Third-party funds, other operating expenses, and energy efficiency are input variables used in this research. Credit and securities are the output variables. In general, the results of this research conclude that several banks in Indonesia have a DEA efficiency score equal to 1 or have worked efficiently and the bank that always works efficiently during 2019-2021 is BCA. The practical implications to improve bank efficiency for banks that are not yet efficient are to maximize the distribution of funds through credit and securities, then these banks also need to take advantage of technological advances.

Keywords: Bank, Efficiency, DEA, and SDG 7

1. Introduction

The purpose of running a business is to make a profit. Therefore, the companies will try to operate as efficiently as possible to get the maximum output from the resources they have. However, if the companies only consider profit, then the available resources will tend to run out quickly so in operating a business it is also necessary to take notice of people and the planet to create sustainable development. Sustainable development not only needs to be considered by companies that produce products but also by companies engaged in services.

Financial Services Authority or Otoritas Jasa Keuangan (OJK) assists the government in implementing sustainable development goals or SDGs by promoting the eight principles of sustainable finance. The first principle of sustainable finance is responsible investment, the second is social and environmental risk management, the third is informative communication,

and the fourth is the development of priority leading sectors (Otoritas Jasa Keuangan, 2021a). The fifth principle of sustainable finance is sustainable business strategies and practices, the sixth is governance, the seventh is inclusive, and the eighth is coordination and collaboration (Otoritas Jasa Keuangan, 2021a). In addition, OJK also ratified the OJK Regulation No. 51/POJK.03/2017 on the Implementation of Sustainable Finance for Financial Service Institutions, Issuers, and Public Companies. Thus, the implementation of sustainable finance for financial service institutions will be effective on January 1, 2019, for Commercial Conventional Banks based on Business Activities (BUKU) 3 and 4 while for BUKU 1 and 2 it will be effective on January 1, 2020 (Otoritas Jasa Keuangan, 2017).

BUKU 1 and BUKU 2 banks have fewer activities than BUKU 3 and 4 because BUKU 3 and 4 can operate overseas, so the authors are interested in analyzing BUKU 3 and 4 banks. However, based on OJK Regulation No. 12 /POJK.03/2021 on Commercial Banks, in 2021, the term BUKU will no longer be used and has been replaced with KBMI or Commercial Banks Group of Core Capital (Otoritas Jasa Keuangan, 2021b).

The research problem can be observed through the following figure:

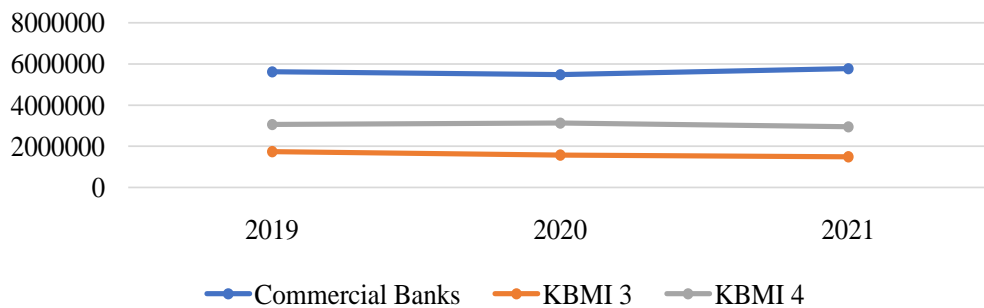


Figure 1. The credit of Conventional Commercial Banks, KBMI 3, and KBMI 4 in 2019-2021
Source: (Otoritas Jasa Keuangan, 2021c), processed

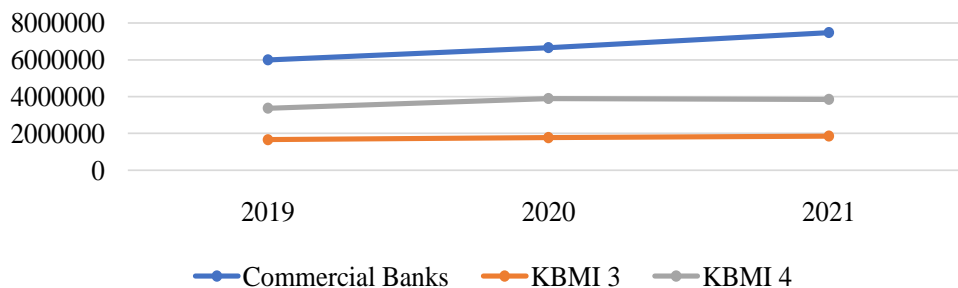


Figure 2. Third-Party Funds of Conventional Commercial Banks, KBMI 3, and KBMI 4 in 2019-2021
Source: (Otoritas Jasa Keuangan, 2021c), processed

Figure 2 shows that Third-Party Funds or TPF of conventional commercial banks and KBMI 3 always increase in 2019-2021. Meanwhile, the TPF of KBMI 4 increased in 2019-2020 but decreased in 2021, this was accompanied by a decrease which also occurred in credits granted by KBMI 4 as seen in figure 1. TPF of KBMI 3 although increased in 2019-2021 but the credit also decreased in 2019-2021. In general, there was an increase in TPF at conventional commercial banks in Indonesia in 2019-2021 but the credit decreased in 2020 due to the spread of the Covid-19 virus outbreak which caused some changes in economic activity. Because the activities of distributing funds and collecting funds as seen from credit and deposits tend to be unstable in 2019-2021, bank efficiency needs to be analyzed to find out whether conventional commercial banks in Indonesia are working efficiently or not.

The branch of economics that forms the basis of the concept of efficiency is microeconomics. This is because producers will try to produce as much output as possible from the inputs they have as reflected in the production function (Pindyck & Rubinfeld, 2018). Work efficiency can be achieved if the company can produce maximum output by using the available input variables (Farrell, 1957).

Analysis of bank efficiency has often been carried out. This study has similarities with studies analyzed by Wahab et al. (2014); Le et al. (2019); Isik & Uygur (2021); and Hadad et al. (2012) because they analyzed bank efficiency. However, this study differs from previous studies because it will analyze bank efficiency by adding one input variable related to Sustainable Development Goals (SDGs).

Research conducted by Wahab et al. (2014) is one of the studies that has analyzed bank efficiency in Indonesia. By using the Data Envelopment Analysis (DEA) intermediation approach, it can be noticed that some conventional commercial banks in Indonesia have worked efficiently (Wahab et al., 2014). Another study that examined bank efficiency in Vietnam also used DEA with an intermediation approach (Le et al., 2019).

Research conducted in emerging markets analyzes bank efficiency, including when a crisis occurs (Isik & Uygur, 2021). Before a crisis occurs, bank efficiency tends to decrease, then reaches its lowest point during a crisis and gradually increases after the crisis (Isik & Uygur, 2021).

Hadad et al. (2012) analyzed bank efficiency using DEA with an intermediation approach. The result informs that the group of state-owned banks is the most efficient bank in Indonesia (Hadad et al., 2012).

Belasri et al. (2020) analyzed Corporate Social Responsibility (CSR) and bank efficiency, where the first stage will be carried out using the DEA method to measure bank efficiency. The second stage was carried out using fixed effect panel regression and the result showed that the relationship between CSR and bank efficiency in developed countries and countries with high investor protection was significantly positive (Belasri et al., 2020).

There is also previous research that evaluates CSR by adopting the DEA model. The research was conducted by Wu & Lin (2019) and obtained the results that CEO inside debt and CSR performance turned out to have a positive and significant relationship. Most of the reasons that drive the positive relationship are deferred compensation (Wu & Lin, 2019).

This research will use the DEA method in order to analyze bank efficiency. Banks are seen as intermediary institutions that collect funds from the public and then distribute them to other parties who need funds so DEA with an intermediation approach will be used in this research. The variables that are usually used are TPF and other operating expenses as input variables, then credit and securities as output variables. Previous studies in considering SDGs in bank efficiency analysis usually use two-stage DEA where the first stage is carried out to obtain the efficiency score, followed by analyzing the factors that affect the efficiency by making CSR an independent variable in the second stage. The analysis of bank efficiency and CSR has been carried out by Belasri et al. (2020) and Wu & Lin (2019). However, there is a research gap where data related to the principles of sustainable finance is rarely used as an input variable in DEA. Thus, the research framework can be described as follows:

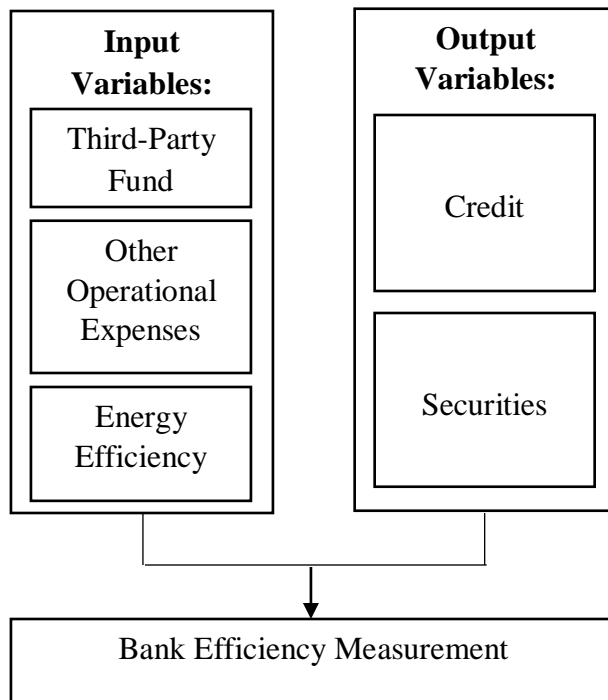


Figure 3. Research Framework

Previous studies usually include variables related to SDGs in the second stage of DEA. This research only uses one-stage DEA so that variable related to the principles of sustainable finance will be used as an input variable. Thus, this research will include energy efficiency as an input variable, along with TPF and other operating expenses as shown in figure 3. The energy

efficiency variable is related to SDG 7. SDG 7 is related to affordable and clean energy so energy efficiency is included as an input variable because efficient use of energy will help banks to save expenses and support sustainable finance. Thus, the aim of this research is to analyze the efficiency of five conventional commercial banks in Indonesia by examining the principles of sustainable finance.

2. Method

2.1 The Scope of Research

This study includes an analysis of the efficiency of five conventional commercial banks in Indonesia by examining the principles of sustainable finance using a quantitative approach. Then, in this study, secondary data will be used. The time period used is from 2019 to 2021. Conventional commercial bank categories analyzed in this research are KBMI 3 and 4 banks which have data related to the variables that will be used in the DEA method. Thus, there are five banks whose efficiency scores will be analyzed in this study. Two of the five banks analyzed in this research are included in KBMI 4 because these banks have core capital exceeding 70 trillion rupiahs, and the two banks are BCA and BNI. The other three banks, although not classified as the banks with the largest core capital, have core capital ranging from 14 trillion rupiahs to 70 trillion rupiahs, so they are included in KBMI 3. These three banks are BTPN, Maybank, and OCBC NISP.

2.2 Types and Sources of Data

Secondary data from the annual reports and sustainability reports in 2019-2021 on the website of each bank is needed in this research. Secondary data was chosen because secondary data collection saves more time. The three input variables used are third-party funds, other operational expenses, and energy efficiency. Then, credit and securities are used as output variables.

2.3 Data Collection Technique

Data collection techniques were obtained from books, annual reports, sustainability reports, announcements, and relevant previous research journals to obtain information.

2.4 Data Analysis Technique

After the data were collected, the data were analyzed using the DEA method. DEA is one method that is often used to obtain bank efficiency scores. DEA is a non-parametric method. Bank efficiency can also be measured using other methods such as the parametric method with SFA or the Stochastic Frontier Approach. However, DEA was chosen for several reasons such as DEA allows researchers to use several input and output variables, then, the specification of functional form or distributions is also not required in the DEA method (Batir et al., 2017).

The DEA model requires input and output variables. Table 1 below presents more detailed information about the variables used in this research:

Table 1. Operational Definitions of Variables

Variable	Definition	Unit
Input Variables		
Third-Party Fund (TPF)	The result of the sum of current accounts, savings, and time deposits from customer funds that the bank have been collected.	Million Rupiah
Other Operational Expenses	Expenses that are not included in interest costs, such as labor costs, administration costs, etc.	Million Rupiah
Energy Efficiency	Activities to realize energy conservation and energy saving in the process of producing the same amount of output or number of services so that the impact of environmental damage is reduced (Madonna, 2014).	Million Rupiah
Output Variables		
Credit	The agreement involving the lender of funds (bank) and the party who borrows funds (customer), where the loan needs to be repaid according to a predetermined period of time by the parties involved (Apriani & Hartanto, 2019).	Million Rupiah
Securities	Proof of collection issued by the issuer to obtain funds and can be traded so that the parties who own it have evidence to collect the payment of the price of a sum of money, and the right to collect it can be transferred to another person (Apriani & Hartanto, 2019).	Million Rupiah

The variables presented in table 1 were selected by considering the variables commonly used in the DEA model with an intermediation approach that views banks as intermediary institutions that collect and distribute funds. The addition of the energy efficiency variable as an input variable is intended to analyze bank efficiency by considering the principles of sustainable finance because efficient use of energy can help banks save expenses. In addition, this study will also use the DEA model with an output-oriented Bankers-Charnes-Cooper (BCC) assumption or Variable Return to Scale (VRS) assumption. The reason for using the BCC or VRS assumption is that when a bank adds more inputs, it is not always accompanied by an increase in output. Output orientation is also chosen because banks will try to maximize output by using available inputs (Firdaus & Hosen, 2014). Thus, mathematically, the DEA model equation can be written as follows (Rusydia et al., 2019):

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

Where h_s represents the efficiency of bank s , m represents the output of bank s while n represents the input, u_i is output weight i of the bank s produced, and y_{is} is the number of output i of the bank s produced (Rusydia et al., 2019). Then, x_{js} is the number of input j of the bank s

used, v_j is the input weight j of the bank s given and i is calculated from 1 to m and j is calculated from 1 to n (Rusydia et al., 2019).

This research used MaxDEA as software to process data. DEA scores in a bank vary but the score is between 0 to 1. A bank that has a DEA score equal to 1 means that the bank has worked efficiently. Meanwhile, a bank can be categorized as a bank that does not work efficiently if the DEA score is away from 1.

3. Results and Discussion

This study uses several input and output variables from five conventional commercial banks, and by observing table 2, it can be noticed that these variables fluctuate.

Table 2. TPF, Other Operational Expenses, Energy Efficiency, Credit, and Securities of Five Conventional Commercial Banks in Indonesia in 2019-2021 (Million Rupiah)

Bank	Year	TPF	Other Operational Expenses	Energy Efficiency	Credit	Securities
BCA	2019	698,980,000	30,742,000	547,000	572,034,000	152,559,000
BNI	2019	582,541,000	23,687,000	263,000	539,862,000	27,162,000
BTPN	2019	86,939,479	7,129,872	689,274	141,760,183	10,654,624
Maybank	2019	110,601,006	6,397,000	5,650,000	120,018,768	15,266,009
OCBC NISP	2019	126,121,499	3,768,918	192,300	114,436,825	11,864,535
BCA	2020	834,284,000	29,969,000	441,000	547,644,000	339,372,000
BNI	2020	647,572,000	24,214,000	156,000	541,979,000	29,687,000
BTPN	2020	100,788,906	6,883,113	653,439	136,212,619	14,804,656
Maybank	2020	115,003,047	5,713,000	3,560,000	102,041,553	24,099,718
OCBC NISP	2020	159,036,404	4,125,764	178,307	109,737,912	16,040,385
BCA	2021	968,607,000	30,308,000	221,000	589,814,000	371,297,000
BNI	2021	729,169,000	24,801,000	17,746,000	532,141,000	25,803,000
BTPN	2021	109,380,130	6,982,870	582,239	135,598,774	21,275,789
Maybank	2021	114,899,000	5,475,000	4,129,874	98,503,000	29,102,000
OCBC NISP	2021	168,050,732	4,214,269	128,922	113,228,691	15,624,000

Sources: Sustainability reports and annual reports from each bank (BCA, 2022a, 2022b; BNI, 2022b, 2022c; BTPN, 2022b, 2022a; Maybank Indonesia, 2020, 2021, 2022b, 2022a; OCBC NISP, 2020, 2021, 2022)

In general, TPF for five conventional commercial banks has increased, except for Maybank in 2021. Other operating expenses for BNI and Bank OCBC NISP have increased during 2019-

2021. Other operating expenses of BCA and BTPN fluctuated during the study period. Meanwhile, Maybank's other operating expenses decreased during 2019-2021. The energy efficiency of BTPN and Bank OCBC NISP has decreased from 2019 to 2021. Energy efficiency in the other three banks fluctuated but there was a spike in energy efficiency at BNI bank from Rp156,000.00 million in 2020 to Rp17,746,000.00 million in 2021. In 2021, BNI has a green portfolio of 29.6 percent of its total loan portfolio, pushing BNI's MSCI ESG rating to A in November 2021 (BNI, 2022a). Credit at BCA, BNI, and OCBC NISP fluctuated while credit at BTPN and Maybank decreased in 2019-2021. The securities of BCA, BTPN, and Maybank increased while the securities of BNI and OCBC NISP fluctuated.

After the required data has been obtained, the data will be processed using the DEA method. The results of data processing are shown in table 3 which presents the efficiency scores.

Table 3. Efficiency Score of Five Conventional Commercial Banks in Indonesia

Bank	Year	Score
BCA	2019	1
BNI	2019	1
BTPN	2019	1
Maybank	2019	0.881374
OCBC NISP	2019	1
BCA	2020	1
BNI	2020	1
BTPN	2020	0.972456
Maybank	2020	0.930375
OCBC NISP	2020	0.991011
BCA	2021	1
BNI	2021	0.970588
BTPN	2021	1
Maybank	2021	1
OCBC NISP	2021	1

Source: Processed Secondary Data (2022)

Table 3 shows that several banks have worked efficiently. However, some banks have not worked efficiently. The bank that has worked efficiently three times in a row during 2019-2021 is BCA. This is because BCA can use input variables to produce maximum output variables. BCA was also able to maintain the percentage of Return on Assets (ROA) and Return on Equity (ROE) so that these two ratios remained in good condition. Although the ROA of BCA in 2020 is 3.3 percent and ROE is 16.5 percent smaller than ROA and ROE in 2019 but the ratio has increased in 2021 so that the ROA ratio is 3.4 percent and ROE is 18.3 percent, moreover BCA was also able to record growth in Current Account Saving Accounts (CASA) which was higher than the industry average (BCA, 2022a).

BNI worked efficiently during 2019-2020 but the efficiency score decreased in 2021 and the score became equal to 0.970588 or 0.971. This is because BNI improves the quality of work during the economic recovery period, but it turns out that the credit and securities of BNI decreased in 2021 so it can trigger a slight decrease in efficiency scores (BNI, 2022b).

BTPN has worked efficiently in 2019 but its efficiency was reduced during the Covid-19 pandemic in 2020 so the efficiency score became 0.972456 or 0.972. BTPN's performance is efficient again in 2021, this is because BTPN has succeeded in using input variables to produce the maximum possible output. Moreover, BTPN has also succeeded in increasing its balance, ROA from 1.4 percent in 2020 to 2.2 percent in 2021, and ROE from 6.1 percent in 2020 to 8.6 percent in 2021 (BTPN, 2022b).

Maybank has not worked efficiently in 2019-2020 but its performance is efficient in 2021. Bank efficiency at Maybank is carried out by reducing non-performing loans so that the NPL ratio becomes better from 4.00 percent in 2020 to 3.69 percent in 2021 (Maybank Indonesia, 2022b). Moreover, credit quality after being impacted by the Covid-19 pandemic was also improved by restructuring and simplifying the credit process (Maybank Indonesia, 2022b). Thus, although credit at Maybank decreased, gross NPL also decreased in 2021.

Bank OCBC NISP has worked efficiently in 2019 but its performance has slightly decreased in 2020 due to TPF and other operating expenses have increased but credit has not. NPL and BOPO of OCBC NISP in 2020 were also higher than in 2019. The Gross NPL of Bank OCBC NISP is 1.72 percent in 2019 but in 2020 the ratio is equal to 1.93 percent, and BOPO also increased from 74.77 percent in 2019 to 81.13 percent in 2020 (OCBC NISP, 2022). The efficiency score of OCBC NISP in 2020 is 0.991011 or 0.911, then the score increased to equal to 1 in 2021 because credit at OCBC NISP increased in 2021 (OCBC NISP, 2022).

If the bank efficiency score is 1, it can be interpreted that the bank has worked efficiently and can produce maximum output. The results of this research indicate that some of the banks studied have worked efficiently, this does not contradict the results obtained by Wahab et al. (2014).

Based on the core capital owned, the five conventional commercial banks studied in this study can be divided into 2 groups of banks. The two groups of banks are KBMI 3 and KBMI 4. BCA and BNI are included in KBMI 4 while BTPN, Maybank, and OCBC NISP are included in KBMI 3. If a comparison is made, it can be seen that banks that are included in KBMI 4 more often work efficiently. This can be due to the large number of customers so that banks can do more activities to distribute funds and collect funds.

Based on ownership, the five conventional commercial banks studied in this study can be divided into 2 groups of banks, namely state-owned banks and national private banks. BNI is a state-owned bank while the other 4 banks are national private banks. When comparing the average efficiency of BNI during 2019-2021 with four other banks during the same period, BNI as a state-owned bank has a higher average efficiency than the national private banks analyzed in this study. This is supported by research in Indonesia which states that state-owned banks work more

efficiently than banks with other types of ownership (Hadad et al., 2012). The reason is that many people who have a fixed salary, such as employees of State-Owned Enterprises (BUMN) or other large company employees, are customers of state-owned banks so that the distribution and collection of funds become more stable. Research in Brazil also suggests that state-owned banks have an advantage because many of their customers are civil servants who have steady incomes (Staub et al., 2010). Thus, the input variables can produce output variables more efficiently.

4. Conclusion

This research analyzes the efficiency of five conventional commercial banks in Indonesia by examining the principles of sustainable finance. From the results of data processing using the DEA method, several conclusions can be drawn. First, by adding energy efficiency as an input variable together with two other input variables such as TPF and operating expenses, it can be seen that several banks have worked efficiently. Second, the bank that worked efficiently in a row during 2019-2021 was BCA. However, some banks have not worked efficiently. This can be caused by several factors such as the implementation of social distancing to stop the transmission of the Covid-19 virus and some people have lost their livelihoods so that economic activity decreases causing the input and output of banking variables to also fluctuate.

Because bank sustainability reports have only been established in 2019 for BUKU 3 and 4 banks or currently some of these banks are equivalent to KBMI 3 and 4, this study can only analyze bank efficiency by considering the principles of sustainable finance for three years, from 2019 to 2021. However, this study provides a new novelty by using variables related to SDGs as input variables because the data needed, especially about the SDGs, has now been included in the sustainability report.

Suggestions that can be given to banks that are not yet efficient are to increase output as much as possible with the inputs that they already have through promotions (promotions can be done by collaborating with other companies, making events, becoming sponsors, etc.) and utilizing technology to assist bank activities and customer activities. Then, in general, the energy efficiency of five conventional commercial banks in Indonesia is still not stable due to fluctuations but if these banks can save energy more consistently then these banks can save more costs so that the input variable already owned can be used to produce maximum output.

Future research can use a longer research period compared to this study. Future research is also expected to use other variables related to the SDGs because the SDGs have 17 goals, and the further researcher can choose one of the sustainable development goals or more as variables that will be used to analyze bank efficiency by considering the principles of sustainable finance.

Acknowledgments

This research is supported by the Program of Master of Economics and Development Studies at the Universitas Sebelas Maret. The first author would also like to thank Dr. Siti Aisyah Tri Rahayu, S.E., M.Si, and Dr. Tetuko Rawidyo Putro, S.E., M.Si who have guided the writing of this research.

References

- Apriani, R., & Hartanto. (2019). *Hukum Perbankan dan Surat Berharga*. Penerbit Deepublish.
- Batir, T. E., Volkman, D. A., & Gungor, B. (2017). Determinants of bank efficiency in Turkey: Participation banks versus conventional banks. *Borsa Istanbul Review*, 17(2), 86–96. <https://doi.org/10.1016/j.bir.2017.02.003>
- BCA. (2022a). *BCA Annual Report 2021*. <https://www.bca.co.id/-/media/Feature/Report/File/S8/Laporan-Tahunan/2022/20220217-buku-ar-bca-2021-EN.pdf>
- BCA. (2022b). *BCA Sustainability Report 2021*. <https://www.bca.co.id/-/media/Feature/Report/File/S8/Laporan-Keberlanjutan/2022/20220304-laporan-keberlanjutan-2021-bca-eng.pdf>
- Belasri, S., Gomes, M., & Pijourlet, G. (2020). Corporate social responsibility and bank efficiency. *Journal of Multinational Financial Management*, 54, 100612. <https://doi.org/10.1016/j.mulfin.2020.100612>
- BNI. (2022a). *BNI's Profit 2021 Increases 3 Times*. <https://www.bni.co.id>. <https://www.bni.co.id/en-us/home/news/pressrelease/articleid/9076>
- BNI. (2022b). *BNI Annual Report 2021*. <https://www.bni.co.id/Portals/1/BNI/Perusahaan/HubunganInvestor/Docs/AR-BNI-TB-2021-ENG-v2.pdf>
- BNI. (2022c). *BNI Sustainability Report 2021*. <https://www.bni.co.id/Portals/1/BNI/Perusahaan/HubunganInvestor/Docs/SR-BNI-2021-EN-3.pdf>
- BTPN. (2022a). *Laporan Keberlanjutan BTPN 2021*. https://www.btpn.com/pdf/investor/laporan-keberlanjutan/sr-bank-btpn_27-april-in.pdf
- BTPN. (2022b). *Laporan Tahunan BTPN 2021*. https://www.btpn.com/pdf/investor/annual-report/2022/ar-2021-btpn_ina_14-april.pdf
- Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society. Series A*, 120(3), 253–290.
- Firdaus, M. F., & Hosen, M. N. (2014). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. *Buletin Ekonomi Moneter Dan Perbankan*, 16(2), 167–188. <https://doi.org/10.21098/bemp.v16i2.31>
- Hadad, M. D., Hall, M. J. B., Kenjegalieva, K. A., Santoso, W., & Simper, R. (2012). A new approach to dealing with negative numbers in efficiency analysis: An application to the Indonesian banking sector. *Expert Systems with Applications*, 39(9), 8212–8219. <https://doi.org/10.1016/j.eswa.2012.01.145>
- Isik, I., & Uygur, O. (2021). Financial crises, bank efficiency and survival: Theory, literature and emerging market evidence. *International Review of Economics and Finance*, 76(July), 952–987. <https://doi.org/10.1016/j.iref.2021.07.016>
- Le, P. T., Harvie, C., Arjomandi, A., & Borthwick, J. (2019). Financial liberalisation, bank ownership type and performance in a transition economy: The case of Vietnam. *Pacific-Basin Finance Journal*, 57(April), 101182. <https://doi.org/10.1016/j.pacfin.2019.101182>
- Madonna, S. (2014). EFISIENSI ENERGI MELALUI PENGHEMATAN PENGGUNAAN AIR (Studi Kasus: Institusi Pendidikan Tinggi Universitas Bakrie). *Jurnal Teknik Sipil*, 12(4), 267–274. <https://doi.org/10.24002/jts.v12i4.635>

- Maybank Indonesia. (2020). *Laporan Keberlanjutan Maybank Indonesia 2019*.
<https://www.maybank.co.id/-/media/Downloaded-Content/Laporan-Tahunan/Laporan-Keberlanjutan-Maybank-Indonesia-2019.pdf>
- Maybank Indonesia. (2021). *Laporan Tahunan Maybank Indonesia 2020*.
<https://www.maybank.co.id/-/media/Downloaded-Content/Laporan-Tahunan/Laporan-Tahunan-Maybank-Indonesia-2020.pdf>
- Maybank Indonesia. (2022a). *Laporan Keberlanjutan Maybank Indonesia 2021*.
<https://www.maybank.co.id/-/media/Downloaded-Content/Sustainability-Reports/Sustainability-Report-Maybank-Indonesia-2021.pdf>
- Maybank Indonesia. (2022b). *Laporan Tahunan Maybank Indonesia 2021*.
<https://www.maybank.co.id/-/media/Downloaded-Content/Laporan-Tahunan/Laporan-Tahunan-Maybank-Indonesia-2021.pdf>
- OCBC NISP. (2020). *Laporan Tahunan dan Laporan Keberlanjutan OCBC NISP 2019*.
https://www.ocbcnisp.com/asset/media/Feature/AboutOCBC/Hubungan-Investor/Laporan-Tahunan/2019/2019_Financial-Annual-Report.pdf
- OCBC NISP. (2021). *Laporan Tahunan dan Laporan Keberlanjutan OCBC NISP 2020*.
https://www.ocbcnisp.com/asset/media/Feature/AboutOCBC/Hubungan-Investor/Laporan-Tahunan/2020/2020_annual-report_sustainability_report.pdf
- OCBC NISP. (2022). *Laporan Tahunan dan Laporan Keberlanjutan OCBC NISP 2021*.
https://www.ocbcnisp.com/asset/media/Feature/AboutOCBC/Hubungan-Investor/Laporan-Tahunan/2021/2021_annual-report_sustainability_report.pdf
- Otoritas Jasa Keuangan. (2017). *OJK Regulation No. 51/POJK.03/2017 on the Implementation of Sustainable Finance for Financial Service Institutions, Issuers, and Public Companies*. Jakarta.
- Otoritas Jasa Keuangan. (2021a). *MENCIPTAKAN EKOSISTEM KEUANGAN BERKELANJUTAN DI PASAR MODAL INDONESIA*. <https://Pasarmodal.Ojk.Go.Id>.
[https://pasarmodal.ojk.go.id/News/Detail/20519#:~:text=Selain itu%2C berdasarkan Peraturan OJK Nomor 51 tahun,Rencana Aksi Keuangan Berkelanjutan %28RAKB%29 dan Laporan Keberlanjutan](https://pasarmodal.ojk.go.id/News/Detail/20519#:~:text=Selain%20berdasarkan%20Peraturan%20OJK%20Nomor%2051%20tahun,Rencana%20Aksi%20Keuangan%20Berkelanjutan%20RAKB%20dan%20Laporan%20Keberlanjutan).
- Otoritas Jasa Keuangan. (2021b). *OJK Regulation No. 12 /POJK.03/2021 on Commercial Banks*. Jakarta.
- Otoritas Jasa Keuangan. (2021c). *STATISTIK PERBANKAN INDONESIA 2008-2021*.
<https://www.ojk.go.id/id/kanal/perbankan/data-dan-statistik/statistik-perbankan-indonesia/Default.aspx>
- Pindyck, R. S., & Rubinfeld, D. L. (2018). *Microeconomics* (Ninth Edit). Pearson Education Limited.
- Rusydia, A. S., Laila, N., & Sudana. (2019). Efisiensi dan produktivitas industri perbankan pada sistem moneter ganda di Indonesia. *Jurnal Siasat Bisnis*, 23(1), 50–66.
<https://doi.org/10.20885/jsb.vol23.iss1.art5>
- Staub, R. B., Souza, G. da S., & Tabak, B. M. (2010). Evolution of bank efficiency in Brazil: A DEA approach. *European Journal of Operational Research*, 202(1), 204–213.
<https://doi.org/10.1016/j.ejor.2009.04.025>
- Wahab, A., Hosen, M. N., & Muhari, S. (2014). Komparasi Efisiensi Teknis Bank Umum

Konvensional (BUK) dan Bank Umum Syariah (BUS) di Indonesia Dengan Metode Data Envelopment Analysis (DEA). *Al-Iqtishad: Jurnal Ilmu Ekonomi Syariah*, 6(2), 179–194. <https://doi.org/10.15408/aiq.v6i2.1229>

Wu, T. H., & Lin, M. C. (2019). Relationship of CEO inside debt and corporate social performance: A data envelopment analysis approach. *Finance Research Letters*, 29(August 2018), 308–314. <https://doi.org/10.1016/j.frl.2018.08.002>