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# Efficiency of the intermediation function of Regional Development Banks (BPD) in Indonesia: Data Envelopment Analysis (DEA) approach

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## Abstract

Regional Development Banks (BPD) have a strategic role in encouraging regional economic growth through the financial intermediation function. However, the effectiveness of these functions still faces various challenges, such as low productive credit disbursement and high dependence on local government funds. This study aims to measure the level of efficiency of the intermediation function of Regional Development Banks (BPD) in Indonesia during the period 2020–2024 using the Data Envelopment Analysis (DEA) method. The data used included 27 BPDs with input variables (Total Assets, Third-Party Funds, Labor Expenses) and outputs (Loans Provided, Net Interest Income). The results of the study show that the average efficiency of BPD intermediation is 94.54%, with a downward trend in 2024 to 92.2%. Only three BPDs have been consistently efficient for five years, namely the Central Kalimantan BPD, the West Java and Banten BPD (BJB), and the South and West Sulawesi BPD (Sulselbar). These findings indicate the need to optimize the use of inputs and increase credit distribution to achieve maximum efficiency. The implications of the study include policy recommendations in the form of BPD consolidation and strengthening of intermediation strategies.

**Keywords:** Efficiency; Data Envelopment Analysis; Intermediation Function; Regional Development Bank; Variable Return to Scale

## 1. Introduction

Efficiency is a key concept in the banking industry to achieve goals with optimal resource allocation. In the context of Regional Development Banks (BPDs), the efficiency of the intermediation function is vital to create healthy and sustainable financial performance. Efficient banks can raise funds effectively, distribute credit optimally, and manage risk well. The OJK Roadmap 2024-2027 also emphasizes the importance of efficient product and service innovation for BPDs. Thus, efficiency is the foundation to support regional banking integration and collaboration.

The Regional Development Bank (BPD) plays a strategic role in encouraging regional economic growth through its intermediation function. The efficiency of intermediation is a key indicator in assessing the performance of BPDs, especially in collecting and distributing public funds. However, based on data from the Financial Services Authority (OJK), the Loan to Deposit Ratio (LDR) ratio in many BPDs is still relatively low, indicating that the distribution of funds is not optimal. In addition, BPD's high dependence on local government deposits and limited productive credit expansion are challenges in itself.

There are 27 Regional Development Banks (BPD) operating in Indonesia, which are owned by their respective local governments. Of these, only three BPDs carry out their operations in sharia. BPD plays a strategic role not only as an intermediary institution but also in increasing Regional Original Revenue (PAD) through dividend distribution. The

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good performance of BPD is expected to have a positive and significant impact on regional economic growth. Therefore, a healthy and highly competitive regional banking industry is needed.

Previous research has extensively examined the efficiency of banking in Indonesia, including BPD, using the DEA approach. However, there have not been many studies that focus on the current period (2020–2024) with coverage of all BPDs in Indonesia. This study aims to fill this gap by comprehensively analyzing the efficiency of BPD intermediation. The goal is to measure the level of efficiency, determine the amount of inputs that need to be improved, and identify the determinants of efficiency.

Based on this background, this study aims to measure the efficiency of the BPD intermediation function in Indonesia in the period 2020 to 2024. Specifically, this study is designed to answer three fundamental questions. First, what is the overall and individual efficiency level of BPD. Second, how to improve efficiency performance by determining the amount of input and output. Third, what factors are the determinants of the efficiency level of BPD in Indonesia.

The results of this study are expected to make a practical contribution to local governments, regulators, and BPD management in formulating strategies to improve intermediation efficiency. In addition, this research also provides an analytical basis for performance-based BPD consolidation policies. Thus, efforts to improve BPD efficiency not only strengthen the bank's financial performance, but also support regional economic development.

To prove its authenticity, this study highlights the context of the update with a focus on the current period (2020-2024) that has not been widely researched. A number of previous studies have examined the efficiency of BPD using the Data Envelopment Analysis (DEA) method, such as research by Zaenal Abidin & Endri (2009) and Lutfi & Suyatno (2019). This research will continue the study with more up-to-date data and comprehensive coverage of all BPDs. Thus, the novelty and contribution of this research can be clearly identified.

Overall, the Introductory Chapter has presented the urgency, problems, objectives, and contributions of research on the efficiency of BPD intermediation This description is the basis for further discussion of the theoretical framework and research methodology that will be used to analyze and answer the problems that have been formulated, in order to achieve the research objectives that have been set.

## 2. Literature Review

### 2.1. Efficiency Measurement

Efficiency Measurement aims to evaluate performance by comparing the output produced to the inputs used, which in the context of banking is measured through parametric approaches such as Stochastic Frontier Analysis (SFA) which requires the assumption of a certain form of production function, or non-parametric such as Data Envelopment Analysis (DEA) which does not require the assumption of a certain form of function.

According to Coelli (1996), efficiency measurement is usually represented through the frontier function which is a reference for efficient technology, while Berger & Humphrey (1997) explained that the intermediary approach is more appropriate to evaluate the performance of financial institutions because of its characteristics as financial intermediaries. Kurnia (2017) added that banking efficiency can be decomposed into scale, scope, and technical efficiency, where technical efficiency basically states the relationship between output and input in the production process. This research uses the concept of technical efficiency with an intermediary approach through DEA, which is in line with the main function of banks as financial intermediaries that collect and distribute public funds.

### 2.2. Data Envelopment Analysis (DEA)

Data Envelopment Analysis (DEA) is a non-parametric analysis technique to measure the relative efficiency of decision-making units (DMUs) developed based on linear program techniques by Charnes, Cooper, and Rhodes (1978) with the CCR model. According to Cook et al. (2005), in an output-oriented model, a unit is said to be efficient if no other unit produces a larger output vector by using the same input vector. Sengupta (2010) explained the development of DEA theory through three phases starting from the concept of efficiency as a ratio of weighted output to weighted input.

The advantage of DEA as a non-parametric method is that it does not require the assumption of a specific form of production function, although it is sensitive to measurement errors. In this study, DEA was used to measure the efficiency of BPD intermediation with an output-oriented approach and the assumption of Variable Returns to Scale (VRS) to evaluate the ability of BPD to maximize the output of intermediation.

### 2.3. Bank Intermediation Function (Input – Output)

The Bank's Intermediation function in the DEA approach positions the bank as a financial intermediary that transforms inputs into outputs, with the main input specifications including Third-Party Funds (DPK) as a source of funds, total assets representing operational capacity, and labor expenses as cost components. Berger & Humphrey (1997) in Casu & Molyneux (2003) stated that the intermediary approach is more appropriate to evaluate the performance of financial institutions because of its characteristics as financial intermediaries.

Meanwhile, its main output consists of loans provided as the realization of the intermediation function, net interest income (NIM) which reflects profitability, and current assets to measure liquidity. In contrast to the production approach that positions deposits as outputs, the intermediary approach places deposits as inputs because they are raw materials that will be transformed into credit. This study uses the ratio variable to total assets to avoid bank size bias, so that the measured efficiency purely reflects the performance of the intermediary rather than just the scale of the business.

Based on the complexity of the challenges faced by the regional banking industry, this study constructs three main questions: (1) The extent of the level of intermediation efficiency of Regional Development Banks (BPD) in Indonesia during the 2020-2024 period both in aggregate and individually; (2) How is the form of optimization of input and output variables effective in improving the efficiency performance of BPD; and (3) What determinant variables significantly affect the achievement of BPD intermediation efficiency.

The construction of this problem formulation is not only aimed at mapping the empirical conditions and efficiency disparities between BPDs, but also provides a basis for strategic recommendations for management in optimizing resource allocation, as well as analyzing the fundamental factors that cause inefficiency to formulate appropriate policies to improve the intermediation performance of regional banks.

## 3. Research Method

This study uses a quantitative approach by applying the Data Envelopment Analysis (DEA) method developed by Charnes, Cooper, and Rhodes (1978). The theoretical contribution of Berger & Humphrey (1997) in determining the intermediary approach became the basis for the selection of input and output variables. This study analyzed 27 Regional Development Banks (BPD) in Indonesia during the 2020-2024 period with a total of 135 observations. Secondary data is obtained from the annual financial statements of each BPD and publications of the Financial Services Authority (OJK).

The variable specification adopts a starvarek intermediation model with three input variables: Total Assets, Third-Party Funds (DPK), and Labor Expenses. Meanwhile, the output variable consists of Loans Granted and Net Interest Income (NIM). As per the recommendation of Coelli (1996) on the importance of data normalization, all variables are converted in the form of a ratio to total assets to avoid business scale bias. The analysis was conducted using DEAPxp 2.1 software with an output-oriented approach and Variable Returns to Scale (VRS) assumptions. The selection of output orientation is based on the characteristics of BPDs that seek to maximize the output of the intermediation. The VRS model was chosen to accommodate the differences in business scale between BPDs, following the development of DEA theory from Banker, Charnes, and Cooper (1984).

The analysis procedure begins with the measurement of the technical efficiency of each BPD, followed by the identification of slacks and peer groups to provide recommendations for improvement. The DEA's excellence in identifying best practice units according to Cook et al. (2005) is used to determine performance benchmarks. The validity of the results was tested through sensitivity analysis and consistency of results during the study period.

This research provides a methodological contribution through the implementation of DEA in the context of regional banking in Indonesia with the current period. The findings of the study are expected to enrich the banking efficiency literature and become a reference for the development of a model for measuring the performance of regional financial institutions in developing countries, as well as answering the recommendations of Sengupta (2010) on the need for the application of DEA in various institutional contexts.

## 4. Results

### 4.1. Variable Input

Analysis of input variables showed significant disparities between BPDs. BPD's total assets ranged from Rp 7.15 trillion to Rp 162.69 trillion with an average of Rp 33.76 trillion, confirming the findings of Zaenal Abidin & Endri (2009) that banks with larger assets tend to be more efficient. Third-Party Funds (DPK) showed a wide range from IDR 3.99 trillion to IDR 117.39 trillion, while the labor burden varied between IDR 128.35 billion to IDR 2.53 trillion. These results reinforce the opinion of Berger & Mester (1997) that optimal input management is the key to banking efficiency.

**Table 1** Descriptive Statistics of Input Variables (in billions of Rupiah**)**

| Variabel | Minimum | Maximum | Average |
|---|---|---|---|
| Total Assets | 7152 | 162694 | 33761 |
| DPK | 3996 | 117391 | 24766 |
| Labor Load | 128 | 2536 | 666 |

### 4.2. Variable Output

In the output variable, the loans provided ranged from IDR 3.62 trillion to IDR 105.63 trillion with an average of IDR 20.12 trillion. Meanwhile, net interest income (NIM) showed variations from IDR 128.81 billion to IDR 6.67 trillion. This finding is in line with research by Lutfi & Suyatno (2019) which states that non-interest income is an important source of bank efficiency. Large-scale BPDs such as BJB, East Java BPD, and Central Java BPD dominate the highest output achievements, confirming the theory of economies of scale in banking.

**Table** 2 Descriptive Statistics of Output Variables (in billions of Rupiah)

| Variabel | Minimum | Maximum | Average |
|---|---|---|---|
| Credit | 3624 | 105631 | 20124 |
| Net Interest Margin | 128 | 6677 | 1774 |

### 4.3. Efficiency Analysis

Based on DEA analysis assuming VRS, the average BPD intermediation efficiency was 94.54% during the 2020-2024 period. These results are consistent with the findings of Nidar et al. (2020) that most BPDs have not achieved optimal efficiency. Only three BPDs have been consistently efficient for five years, namely the Central Kalimantan BPD, BJB, and South Sulawesi. The efficiency trend shows a decline in 2024 to 92.2%, indicating operational pressures faced by BPD.

**Table 3** BPD Efficiency Summary 2020-2024

| Year | Average Efficiency | Number of Efficient BPDs |
|---|---|---|
| 2020 | 0,947 | 11 |
| 2021 | 0,95 | 14 |
| 2022 | 0,94 | 11 |
| 2023 | 0,968 | 15 |
| 2024 | 0,922 | 7 |

These findings reinforce the research of Wheelock & Wilson (1999) on the importance of technology adoption and innovation in improving banking efficiency. As many as 70% of BPD is in a Decreasing Returns to Scale (DRS) condition, indicating excess capacity that has not been offset by an increase in output. Only 18% of BPDs are operating at optimal

scale (CRS), while 12% are still in the Increasing Returns to Scale (IRS) phase that requires business expansion. This condition confirms the importance of regional banking consolidation as recommended in the OJK Roadmap 2024-2027.

## 5. Discussion

Empirical analysis of the performance of 27 BPDs during the 2020-2024 period showed an average intermediation efficiency of 94.54%, which confirms the previous findings from Zaenal Abidin & Endri (2009) regarding the lack of optimal technical efficiency of BPDs. The temporal trend reveals a significant decline to 92.2% by 2024, a phenomenon that has not been identified in previous studies. The dominance of Decreasing Returns to Scale at 70% of BPD in this study strengthens the theory of economies of scale by Wheelock & Wilson (1999) which states that small-medium banks are more susceptible to declining efficiency.

The identification of efficiency determinants reveals a more determinant role of net interest income (NIM) than non-interest income, although previous research by Lutfi & Suyatno (2019) emphasized the importance of non-interest income. The consistency of the three BPDs - Central Kalimantan, BJB, and South Sulawesi - in maintaining optimal efficiency for five consecutive years supports the findings of Nidar et al. (2020), while revealing new findings that ownership characteristics and geographical location are not always linearly related to efficiency levels. The level of dependence on local government funds identified strengthens the research of Effendi et al. (2018), with a new dimension regarding the influence of digital transformation on efficiency during the pandemic.

The theoretical contribution of this research lies in the enrichment of financial intermediation theory through proving that the efficiency of BPD is not only determined by quantitative factors such as assets and deposits, but is greatly influenced by the quality of operational management and the effectiveness of credit disbursement. The application of DEA in the context of Indonesian macroprudential has succeeded in answering the methodological gap identified by Jiang & He (2018), as well as providing an empirical basis for accelerating the implementation of the OJK BPD Strengthening Roadmap 2024-2027. The resulting policy implications emphasize the importance of a strategic approach tailored to the specific characteristics of each BPD.

## 6. Conclusion

Based on the results of the analysis and discussion that has been carried out, this study concludes that the efficiency level of the intermediation function of Regional Development Banks (BPD) in Indonesia during the 2020-2024 period has averaged 94.54%, but it has not been optimal and has decreased significantly to 92.2% in 2024. These findings are consistent with the research of Zaenal Abidin & Endri (2009) which states that the technical efficiency performance of BPD banks has not reached the optimal level of 100%. Only three BPDs have been able to maintain perfect efficiency for five consecutive years, namely the Central Kalimantan BPD, the West Java and Banten BPD (BJB), and the South and West Sulawesi (South Sulawesi) BPD.

This study identifies that the optimization of input and output variables is the key to improving the efficiency of BPD intermediation. As stated by Berger & Humphrey (1997) in the intermediation approach, the bank's ability to convert Third Party Funds (DPK) into productive credit and net interest income (NIM) determines the level of efficiency. Inefficient BPD needs to increase credit distribution, especially to the MSME sector, as well as to make labor and operational cost efficiency as recommended by Wijayanto & Sutarno (2010).

Significant determinants affecting the efficiency of BPD include the ability to manage productive assets, the effectiveness of the transformation of deposits into credit, the control of labor expenses, and the achievement of net interest income. These findings reinforce the research of Lutfi & Suyatno (2019) which states that bank efficiency is positively influenced by capital and loan-to-deposit ratios, as well as negatively influenced by non-performing loans. The Decreasing Returns to Scale (DRS) condition experienced by 70% of BPD indicates the need to consolidate the regional banking industry.

The policy implications of this study support the acceleration of the implementation of the OJK BPD Strengthening Roadmap 2024-2027 through the consolidation strategy of BPD with small-medium assets, optimization of productive credit distribution, and the use of digital technology. For further research, it is recommended to develop an analysis with a parametric approach such as Stochastic Frontier Analysis (SFA) and include external variables such as regional economic conditions, as recommended in Effendi et al.'s (2018) study on the differences in regional and non-regional bank efficiency.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclsoed.

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