
Analysis of Technical Efficiency of Rural Bank in Tasikmalaya Indonesia Using *Data Envelopment Analysis* (DEA) Approach

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Abstract: This study aimed to implement a model of assessment of the level of efficiency in Rural Bank with non-parametric statistical approach. This research was conducted at Rural Bank in the Tasikmalaya City with a span that is in 2013 and 2014. The analysis tool used is Data Envelopment Analysis (DEA). The results showed that of 5 Rural Bank, as many as 4 Rural Bank experiencing technical efficiency in 2013 and 2014. Among those who have efficient that Artha Galunggung, Artha Sukapura, Artha Jaya Mandiri and Pola Dana. While 1 Rural Bank that has not experienced the efficiency during the study period, namely Siliwangi. The cause of the inefficiency of Siliwangi are too much assets, too much third party fund unemployed, too much deposits are unemployed, so the lack of credit, as well as too the lack of operating income. So in order to achieve optimal efficiency it must reduce its assets by 15%, decrease in deposits from savings by 21% and reduced deposits by 42%, should increase lending as much as 6% and operating income should be increased as much as 6%. Whereas in 2014, Siliwangi be in a position decreasing (declining condition) or the condition through a period of efficient, so it can not be given a solution.

Keywords: Rural Bank, Efficiency, Data Envelopment Analysis

1. Introduction

Appropriate financial institutions and strategically located to serve the banking services to the community is rural banks. Rural Banks is required to be able to withstand the global economic crisis that occurred at this time because of the Rural Bank plays an important role in providing financing to the SMEs sector in the whole area. Rural Bank has a simple service procedures, rapid processing and credit schemes that is more easily adjusted and the locations is scattered throughout urban and rural areas as compared to commercial banks. Commercial banks also play a role in providing financing but with the form of credit default (not adjustable) and its location just in urban areas. Considering the magnitude of the role of rural banks, the decision makers (managers) need to conduct an adequate evaluation of the performance of the bank.

Reciprocation of the current economy makes the

entrepreneurs, especially in Tasikmalaya need a backrest funds that can nourish their business, so the role of rural banks is very important to help the community's economy. However, today's society is more keen to see a rural bank which condition in a healthy state. Usually one of the health assessment is to look at the bank financial performance. Therefore, to measure the performance of banks required a computation technique that can determine overall productivity of a bank. The technique is also known as efficiency analysis method. In this case the question is the efficiency relative efficiency. Efficiency relative of a Rural Bank is the efficiency of Rural Bank compared to other Rural Bank in the samples that use the same type of input and output. Whereas the value relative efficiency is the ratio of total output weighted by total weighted input. Efficiency analysis method that will be used in this research is non-parametric statistical approach Data Envelopment Analysis (DEA).

The relative efficiency is attained when a DMU is fully

(100%) efficient on the basis of available evidence if and only if the performances of other DMUs does not show that some of its inputs or outputs can be improved without worsening some of its other inputs or outputs [1].

DEA models can either be input oriented or output oriented. The terms input and output-oriented relate to the way in which inefficient DMUs are projected onto the efficient frontier. Input-oriented models aim at reducing the input amounts by as much as possible without reducing present output levels. Output oriented models maximize output levels without increasing input consumption. The Additive Model and the Slack Based Model (SBM) deal with input excesses and output shortfalls simultaneously in a way that jointly maximizes both [2].

DEA is an approach to estimate the production function of organizations and organizational units and enables the assessment of their efficiency [3]. Therefore, the DEA will calculate the level of efficiency at every Rural Bank in Tasikmalaya. For the Rural Bank which is have not efficient for given inputs to optimize certain components in order to achieve the target. So that the analysis results can be used as reference material regarding the components into a material evaluation to be efficient financial management.

This is necessary because the Indonesian economy is currently in a state of uncertainty, which would certainly have an impact on the financial condition of the bank. When this situation occurs, it takes the maximum efficiency in order to avoid the adverse circumstances the bank. Mokhtar conducted research on the efficiency of Islamic banking in Malaysia with the technique of Stochastic Frontier Approach (SFA) [4]. The study period from 1997 to 2003. From the research found that overall the Islamic banks in Malaysia continued to increase during the study period, while conventional banks is stable over time. If we compare the efficiency of Islamic banks is still below conventional banks. Sheldon conducted a study on banking in Europe during the period 1993 to 1997 [5]. With indicators of comparison between the costs and profits of banks to seek the level of efficiency among banks with assets scale of 0.5 to 1.5 US dollars to the one below. The results showed that the banks that have large assets, product specificity and orientation to the retail market showed a better level of efficiency. Al-Delaimi and Al-Ani used DEA as an analytical tool to measure the relative efficiency at 24 institutions of Islamic banks in Iraq [6]. By using multiple inputs and outputs on the bank, DEA measure the efficiency of the bank to be used as a decision-making unit by comparing various units. The results of DEA analysis, it can be concluded that Islamic banking institutions in Iraq at the samples used in this study are relatively efficient. Fadzlan conducted a study on the efficiency performance of Islamic banks in Malaysia during the period 2001 to 2005 by using a non-parametric Data Envelopment Analysis [7]. Analyzing how the difference between input and output variables. Sufian found that during the study period inefficiency scale dominates Islamic banks in Malaysia and found that foreign banks showed the efficiency of the technique than the domestic banks. Sulistyoningih analyze the cost efficiency of Islamic Banks

in Indonesia using X-efficiency [8]. Object research that Bank Muamalat Indonesia and Bank Syariah Mandiri for the period 2001 to 2005. His research resulted in that the price of labor, investment, labor prices combined with the price of capital, and the combination of price with investment capital has been streamlined, while prices of capital and combination of labor prices working with inefficient investment. Simultaneously, the price of labor, the price of capital, investment, and their combinations affect the total cost. Partially price of labor, the price of capital, the combination of the price of capital at a price of labor, and the combination of the price of capital by investing significantly affect the total cost, while the combination of investment and the price of labor by investing not significantly affect the total cost. Ratnawati and Pusparini showed that in 2005 of the 23 banks tested are 14 bank-efficient relative or an efficiency of 100% [9]. Then in 2006 increased to 16 banks. The input factors that most influence on the level of technical efficiency of Islamic banking in 2005 is input interest expense and personnel burden. Then the factors that contribute most output is in demand and time deposits in 2005 and in 2006 that deposits and savings. Yousif conducted a study aimed to measure and break down the technical efficiency of the banks in Palestine through the period from 2002 to 2005. In this research, he presented the mathematical background and characteristics of DEA model, and measured the efficiency of 16 banks out of the 21 banks working in Palestine. To measure technical efficiency, two basic models of the DEA were used under the assumptions of constant returns to scale and the variable returns to scale; the study found that, there were differences among banks in relation to their technical efficiency scores, and the average pure technical efficiency score was 96.3%. The main source of overall technical inefficiency was caused by the scale problem. The study compared the efficiency scores between local and foreign banks and found that local banks had a higher averaged score of technical efficiency than foreign banks, but the difference was statistically insignificant [10]. Pochathan, et al. also applied the same method in measuring the efficiency of eight Thai major commercial banks. However, in their research, they measured the efficiency in two periods, before the economic crisis (1993-1996) and after the economic crisis (1997-2006). In addition, they also used Malmquist index of the Thai banking industry for the whole period of 1993-2006. Their research showed that the mean value of technical and scale efficiency scores before the economic crisis period are higher than those after the economic crisis period. In addition, the results also indicated that Thai commercial banks had a rising productivity level at a decreasing rate. Moreover, they also pointed out that the return on assets and non-performing loans have affected the productivity growth of the banking industry in Thailand [11]. In accordance with Yudistira's results and by employing the same method, Sufian and Nour [12] found that MENA Islamic banks suffered from pure technical inefficiency more than scale inefficiency during the period 2001–2006. This result was consistent with the study of Ben Hassine and Limani [13]

who focused on a sample of 22 MENA Islamic banks over the period 2005–2009. They showed that MENA Islamic banks' technical inefficiency is caused mainly by pure technical inefficiency rather than scale inefficiency.

From some research results in above-average research conducted on commercial banks certainly have a great asset, in addition to the bank studied are based on sharia bank except research Kwan and Robert, which conducts research in conventional banks [14]. Therefore, research is currently focused on the research of conventional banks such as Kwan and Robert. The difference lies in the type of banks in this study conducted at Rural Bank and certainly smaller assets than commercial banks. Kwan and Robert research results have proved that the relatively small size of the bank is more efficient than a large bank. So this research will be proving whether banks, especially small-sized assets in Tasikmalaya on average have experienced efficiently as in the United States or on the contrary, is not efficient. No one is knowing yet because no researcher to conduct research on the level of efficiency, especially Rural Bank in Tasikmalaya.

Departing from the above explanation, it would require a study of the efficiency of Rural Bank especially in Tasikmalaya because Rural Bank is a financial institution with not so large assets that the bank has to be able to optimize the management of existing potential in order to achieve maximum profit. And with the conditions that exist today with the lack of clarity in economic conditions will result in a negative impact on the performance of Rural Bank so it is urgent to do research as soon as possible in order to find the best solution in order to achieve maximum efficiency level.

2. Research Methodology

2.1. Population and Sample

The population is the sum of all objects on individuals who have certain, clear and complete characteristics to be studied. The population in this study were Rural Bank in Tasikmalaya issuing financial statements in 2014 and 2013. While the sample is a portion of the population whose characteristics will be expected and is considered to represent the population. Sampling in this research is purposive sampling means that the method of selecting the sample is selected based on the consideration (judgment sampling) which means the selection of the sample is not random, the information obtained by certain considerations. The sample in this study is the Rural Bank in Tasikmalaya, amounting to 5 Rural Bank. In contrast to the samples on the regression which requires minimal data 30, the Data Envelopment Analysis validity of the data is the availability of data that can be processed for analysis efficiency.

2.2. Types and Source of Data

This study uses primary data, retrieving data directly to the subject of research at Rural Bank in Tasikmalaya by using data collection method is the method of documentation. This method involves the collection of information and data,

through the method of literature study and exploration of literature and the financial statements of the RB concerned.

2.3. Research Variable

This study has three variables, namely the input and output variables that are used to analyze the technical efficiency and methods Data Envelopment Analysis (DEA). Assets include the input variables (I1), saves (I2) and Operating Expenses (I3), while the output variables consist of Credit (O1) and operating income (O2).

2.4. Operational Definition

There are three variables used in this study consist of two variables efficiency of input variables and output variables that will serve as the independent variables and one dependent variable (dependent).

Input variables consist of deposits (I1), assets (I2) and operational costs (I3). Here are explanations of each input variable:

1. Deposits (I1) is the amount of public funds, both individuals and legal entities that have been collected by the Rural Bank through fund raising product in units of millions rupiah. In this case saves divided by 2 into Savings and Deposit.
2. Assets (I2) is the amount of total assets owned Rural Bank measured in millions rupiah.
3. Operational costs (I3) is the total cost incurred for operations at the RB that is measured in millions rupiah.

While the variable output consists of financing and operating income. The explanation of these variables are as follows:

1. Loans (O1) is a product of Rural Bank fund distribution to the public, both individuals and legal entities in units of millions rupiah.
2. Operating Income (O2) is the income generated from the operations of Rural Bank.

2.5. Analysis Method

This research technique to measure and analyze the efficiency of Rural Bank in Tasikmalaya during 2014, using non-parametric approach, especially DEA. Several approaches were used to measure the efficiency of the bank, but broadly there are two types of approaches, which is parametric and non-parametric. Approach Stochastic Frontier Approach (SFA), Thick Frontier approach (TFA) and Distribution Free approach (DFA) is an approach parametrik, while the non-parametric approach included are Data Envelopment approach (DEA) and the Free Disposable Hull (FDH).

2.6. Model of Technical Efficiency Measurement

Banking techniques efficiency measured by calculating the ratio between output and input. DEA will calculate banks that use n inputs to produce different m outputs [15].

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

Where:

hs = s bank efficiency

m = s bank output observed

n = s bank input observed

yis = the amount of output produced by the s bank

xjs = the amount of input produced by the s bank

ui = weight output generated by the s bank

vj = weight input generated by the bank counted from i to m while j counted from i to n

The equation above points to the use one inputs and one output variable. The efficiency ratio (hs), then maximized with the following obstacles [15]:

$$\text{Maximalize } h_s = \frac{\sum_{i=1}^m u_i y_{is}}{\sum_{j=1}^n v_j x_{js}} \leq 1; r = 1, \dots, N.$$

Where u_i and $v_j \geq 0$

From these equations, where N represents the number of banks in the sample, and r is a type of bank sampled in the study. Inequality first explain that the ratio for other DMU not more than 1, while the second inequality weighted non-negative (positive). The ratio will vary between 0 and 1. The bank is said to be efficient if they have ratios close to 1 or 100 percent, otherwise if it is close to 0 indicates that the lower the efficiency of the bank. At the DEA, each bank can determine their respective weights and to ensure that the chosen will produce the best performance measure [15].

3. Result and Discussion

3.1. Technical Efficiency Level of Rural Bank in Tasikmalaya

DEA method is a nonparametric method used to assess the relative efficiency of DMU, which is Rural Bank in Tasikmalaya city in the period of 2013 and 2014. To obtain the efficiency score of DMU to be compared, the authors perform data processing using Banxia Frontier Software Analyst 3. A DMU will stated have achieved relative efficiency if it achieves a score of 1 or 100% and more inefficient if getting away from the value of 1 or 100%. Here is presented the efficiency of Rural Bank in Tasikmalaya in Indonesia based on the results of the processing of DEA.

Table 1. Technical Efficiency Level of Rural Bank in Tasikmalaya.

| Unit | Eff | RTS |
|-------------------------|------|------------|
| ArthaGalunggung 2013 | 100 | Constant |
| ArthaSukapura 2013 | 100 | Constant |
| Artha Jaya Mandiri 2013 | 100 | Constant |
| Pola Dana 2013 | 100 | Constant |
| Siliwangi 2013 | 93,6 | Increasing |
| ArthaGalunggung 2014 | 100 | Constant |
| ArthaSukapura 2014 | 100 | Constant |
| Artha Jaya Mandiri 2014 | 100 | Constant |
| Pola Dana 2014 | 100 | Constant |
| Siliwangi 2014 | 88,4 | Decreasing |

Source: Banxia Frontier Analyst 3

Based on table 1, then there are 4 Rural Bank (8 observational studies) are already technically efficient. While

the rest, 1 Rural Bank (2 observational studies) showed a score of less than 100.

Processing results indicate that there are 4 Rural Bank (8 points of observation research) are already technically efficient (constant), Artha Sukapura period of 2013, Artha Galunggung period of 2013, Artha Jaya Mandiri period of 2013, Pola Dana period of 2013, Artha Sukapura period of 2014, Artha Galunggung period of 2014, Artha Jaya Mandiri period of 2014 and 2014 periods Dana Pola.

Meanwhile, 1 Rural Bank indicates that the situation has not been efficient. That is:

1. Siliwangi period of 2013. In that year, Siliwangi Tasikmalaya were inefficient and in a state that increasing means Siliwangi still able to achieve 100% efficiency, so it relates to the potential that there may actually be maximized in order to produce more better output.
2. Siliwangi period of 2014. In that year, Siliwangi were inefficient and in a state that decreasing means Siliwangi will not be able to again achieve 100% efficiency associated with potentially has a maximum. Decreasing indicates declining conditions that are unlikely to achieve efficiencies in the study period in 2013 and 2014.

3.2. Discussion

(a) Inefficiencies Cause Analysis and Solutions on each Rural Bank

Based on the processing of the financial statements of five Rural Bank in Tasikmalaya by years of research from 2013 and 2014, it is known which Rural Bank are the most efficient and inefficient. Technical measurement shows that there are four efficient Rural Bank than in 2013 and 2014, which is 100% during 2013 and 2014, there are Artha Sukapura, Artha Galunggung, Artha Jaya Mandiri and Pola Dana. Therefore, the four Rural Bank are not analyzed as to its efficiency as everything is so efficient that there is no longer a component that must be optimized in terms of both input and output.

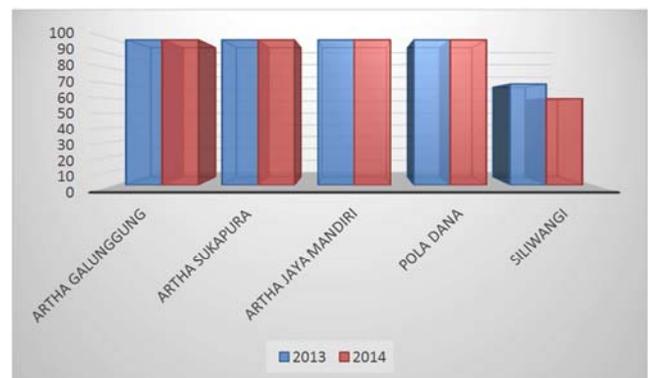


Figure 1. Comparison of Technical Efficiency.

Beside the four Rural Bank described above that is all experienced an efficient, only one bank that has not been efficient is Siliwangi. Technically, Siliwangi has not

experienced optimally efficient both in 2013 and 2014. Even there a drop in efficiency from 2013 to 2014. This indicates that there are several factors that lead to inefficiency. Changes in the level of efficiency can be seen in the picture below:

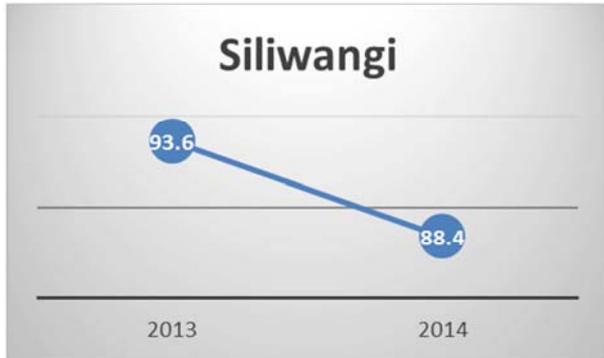


Figure 2. Technical Efficiency Trends of Siliwangi.

Based on the results of DEA analysis, it can be seen that there is a decrease in the efficiency of Siliwangi should consider such inefficiency. Source of inefficiency Siliwangi in 2013 was due to assets held too big so it is not utilized properly. Assets which can not be used show their inefficiency. In order to achieve optimum efficiency, Siliwangi must reduce its assets by 15%. Additionally too much savings (third party fund) also contribute in making Siliwangi inefficient in 2013. Supposedly third party fund of Siliwangi reduce savings element that is equal to 21%. Likewise their deposits that are too large can not be maximized for the benefit, so as to achieve efficiency, Siliwangi should reduce deposits of as much as 42%.

Not enough, in 2013 also Siliwangi should increase lending by 6% and operating income by 6%. This because there is money that is not maximized unemployed to gain so that it becomes the burden of Rural Bank. Thus, if the five components can be repaired, Siliwangi will reach the maximum level of technical efficiency.

As for the potential for efficiency improvements in 2013 can be explained in Figure 3:



Figure 3. Potential Efficiency Improvement of Siliwangi 2013.

Meanwhile in 2014, Siliwangi still experiencing technical

inefficiency so that many components that need to be repaired. The graphics potential of increased efficiency can be seen in the following figure:



Figure 4. Potential Efficiency Improvement of Artha Siliwangi 2014.

Due to the nature of inefficiency Siliwangi in 2014 is decreasing, then this year Siliwangi can not achieve maximum efficiency. Nevertheless we can see the components of which are likely to be changed in order to achieve perfect efficiency point. Among them are Siliwangi must reduce its assets by 4% and reduced deposits by 39%. While the components that must be upgraded are loan portfolio by 47% and operating income by 13%.

(b) Total Potential Improvements

Based on the research and analysis of the overall DEA regarding the assessment of the level of efficiency Rural Bank in the city of Tasikmalaya, then in order to achieve the maximum efficiency in Rural Bank must reduce its assets by 10.05%, 11.5% lower saving and reduced deposits amounting to 40.95%. In addition some of the components that should be improved are lending amounting to 27.48% and operating income of 10.02%.

Thus, if components are changed then the whole Rural Bank in Tasikmalaya will experience optimum efficiency in relative terms.



Figure 5. Total Potential Improvement Diagrams of Rural Bank in Tasikmalaya.

4. Conclusion

Based on the results of research and analysis on the technical efficiency of Rural Bank in Tasikmalaya, it can be concluded as follows:

1. Rural Bank which has experienced technical efficiency during the period 2013 and 2014 is Artha Galunggung, Artha Sukapura, Artha Jaya Mandiri and pattern Fund. So no components that must be repaired.
2. Rural Bank which has not been efficiency is Siliwangi. In 2013, Siliwangi on increasing position, which means that although it is not technically efficient, but in 2013 still has the potential to be increased again to optimum efficiency. As for the causes of inefficiency are too many assets, too much unemployed third party fund, too much deposits are idle, too lack of credit, as well as too lack of operating income. Whereas in 2014, Siliwangi is in a position decreasing (declining condition) or under conditions that passed the efficiently. So Siliwangi is not possible to improve efficiency toward the optimal point.

Solutions to overcome inefficiencies Siliwangi in 2013 is by reducing its assets by 15%, decrease in deposits from savings by 21% and reduced deposits by 42%, should increase lending by 6% and operating income should be increased as much as 6%. Whereas in 2014, Siliwangi is in a position decreasing (declining condition) or the condition passed the efficient, so it can not be given a solution.

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