Input orientation and output orientation: which one is more challenging? A study of agricultural co-operative

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Abstract. Co-operatives have unique characteristics that are not found in other entities; namely, members are the owner and the user or consumer of its product. Therefore, Co-operative members have the right to determine the direction of co-operative development and at the same time, get optimal service from the co-operative. Every year, the co-operative holds an annual member meeting, and at that moment, the remaining income is distributed based on the contribution of each member. In connection with that matter, co-operatives need to earn positive income to serve members sustainably. To achieve a business surplus, a strategy is needed whether to optimize input or output optimization. The objective of this study is to measure the level of efficiency of agricultural co-operatives compared to other types of co-operatives from the perspective of input orientation and output orientation. The analytical method used is descriptive-analytical, using data from the Central Statistics Agency from 2010 to 2019. Data analysis uses Data Envelopment Analysis with the assumption of Variable Return to Scale. The results showed that based on input and output orientation, agricultural co-operatives were relatively inefficient compared to other co-operatives year by year. Between the two orientations, it is recommended that agricultural co-operatives choose output orientation to achieve its goal.

1. Introduction

The world's first modern co-operative (Rochdale) was founded by a group of people to improve the quality of life [1]. At that time, Rochdale established a business unit to provide necessities to meet its members' basic needs. Over time, this co-operative continues to grow and the principles used became the reference for co-operatives around the world today. In Indonesia, the initiative to establish a co-operative originated from the establishment of a savings and loan institution, as an effort to help people from debt with relatively high-interest rates [2]. Besides, since most Indonesian people work in the agricultural sector, it was needed to establish agricultural co-operatives to provide farmers with savings and loans, provision of production facilities, agricultural tools and machinery and processing of crops.

The establishment of a business unit is intended to meet the needs of members and the community. Therefore, it requires active participation from members and society so that the business unit can grow continuously and help the co-operative realize its goals. If the opposite occurs, where the interest of members and the community is relatively low, then there is a tendency for the co-operative's business
volume to stagnate. The residual income obtained cannot be maximally distributed to stakeholders. Thus, the co-operative is getting away from the achieving the objectives.

Co-operatives need to determine a strategy whether they want to be oriented towards increasing business volume and remaining business results by optimizing existing members, or minimizing the number of members, assuming that the business volume and the remaining business results are fixed.

2. Methods
This study uses secondary data originating from BPS in Bantul Regency from 2010 to 2019. To answer the research objective, the Data Envelopment Analysis model used a non-constant return scale with input orientation and output orientation. The DEA VRS model assumes that every addition of one input unit, the resulting output can be greater than one unit or less than one unit. Meanwhile, measurements using input orientation and output orientation want to show the extent to which the DMU optimizes input to produce output and how the DMU obtains optimal output with existing inputs. The two orientations produce different recommendations. In the input orientation, if the DMU is classified as inefficient, then the effort that can be done is to reduce the use of inputs to produce the same output.

On the other hand, in the output orientation, if the DMU is categorized as inefficient, then the effort that can be done is to increase the output without changing the input. The results of the DEA analysis are scores in the range of zero to one. It is called efficient if it is one, while less than one is categorized as inefficient.

The input used in this study is the number of members, while the output consists of the volume of the business and the residual income. Co-operatives in Bantul Regency consist of agricultural co-operatives covering general agriculture (fishermen co-operatives, fishery co-operatives, livestock co-operatives, farmer co-operatives, and village unit co-operatives) and non-agricultural co-operatives (civil servants, youth, tourism, transportation, employees, students, industry, folk crafts, Islamic boarding schools, women, markets, BMT, Syari'ah, savings and loans, multi-business, KOPABRI, army, police, KOVERI, Secondary, Werdatama, air force, and others). Among the 27 co-operatives, 14 co-operatives were not involved because they did not fulfill the DEA's basic concept: the data must be numeric (numbers) and have positive values (greater than zero). From 2010 to 2019, if data on the number of members / business volume / residual income is not available, or if the co-operative has negative business results, then the co-operative will not be included as a DMU in the DEA.

The fourteen co-operatives involved in this study are village unit co-operatives and farmer co-operatives (agricultural co-operatives) and non-agricultural co-operatives (civil servants, tourism, transportation, employees, women, markets, savings and loans, multi-business, KOPABRI, army, and police). Furthermore, the co-operative will be referred to as the Decision Making Unit (DMU), namely the unit for which the efficiency level will be measured.

3. Result and Discussion
3.1 Number of Members
Village unit co-operatives have the largest number of members than other types of co-operatives in Bantul Regency from time to time, this is because during the New Order era, farmers and people in rural areas registered themselves or were registered as members to get a variety of services provided by the government through village unit co-operatives. However, in the past ten years, KUD members have decreased by 4.03 percent every year. Meanwhile, co-operatives with relatively few members consist of market co-operatives, KOPABRI, and army co-operatives. When viewed based on trends, the members of tourist co-operatives and employee co-operatives have grown respectively 556.19 percent and 414.31 percent annually.
3.2 Business Volume

From 2010 to 2019, the thirteen co-operatives in Bantul Regency had a trend of increasing business volume from time to time. The tourist co-operatives and KOPABRI experienced the most massive increases, with 883.05 percent and 694.90 percent. Meanwhile, the lowest increases occurred in farmer co-operatives, village unit co-operatives, and multi-business co-operatives, namely 22.86 percent, 26.55 percent, and 29.80 percent.

Based on the total business volume, the co-operatives with the most considerable revenue from time to time are savings and loan co-operatives, civil service co-operatives, and employee co-operatives. For example, in 2019, of the three co-operatives, the business volume achieved was 119.87 billion rupiahs, 103.76 billion rupiahs, and 44.45 billion rupiahs. This data shows that the number of members does not always correlate with the size of the successful transactions obtained in one year. This is because the number of members of the three co-operatives is still below the village unit co-operatives' total members. Furthermore, the co-operative with the lowest business volume achievement is KOPABRI, which is 0.279 billion rupiahs.
3.3 Return of Operating Results

Besides having the highest growth in business volume, tourist co-operatives were ranked number one in terms of increased residual operating income from year to year. In the last ten years, the remaining income from the tourism co-operative's business in Bantul Regency has grown by 1,109 percent per year. Furthermore, KOPABRI was ranked second in line with the achievement of business volume growth. The remaining results of KOPABRI's operations grew by 551.89 percent per year.

The highest remaining income was achieved by savings and loan co-operatives, employees and civil servant co-operatives, namely 4.2 billion rupiahs, 3.78 billion rupiahs, and 2.35 billion rupiahs. When compared with the number of members, in each of these co-operatives, the remaining income per-member amounts to 171 thousand rupiahs, 642 thousand rupiahs and 175 thousand rupiah.

Figure 3. Return of Operating Results of Co-operative Members in Bantul Regency by Type of Co-operative

3.4 The efficiency of Agricultural Co-operatives and Non-Agricultural Co-operatives in Bantul Regency

The efficiency of agricultural co-operatives and non-agricultural co-operatives in Bantul Regency was measured using Data Envelopment Analysis (DEA). DEA is a non-frontier method parametric that uses a linear program to calculate the ratio ratios output and input for all units being compared in a population. Aim of the DEA method is to measure the level of efficiency of the take-up unit decision (DMU) relative to similar DMUs in a set of analyzes [6].

3.4.1 Input Orientation

The considerations used in measuring the efficiency of using input orientation is that the co-operative is more flexible to control use of inputs rather than adjusting the output to be produced. Thus, an inefficient co-operative means that more inputs are used much more than the potential amount. Based on the DEA analysis, a co-operative said to be efficient if it is worth 1. Conversely, if the efficiency score is worth smaller than 1, the co-operative is inefficient [7].

From 2010 to 2019, based on the results of the DEA VRS Model analysis with input orientation, relatively efficient co-operatives tend to be the same, namely DMU 2 and DMU 12. Meanwhile, DMU 4, DMU 5, and DMU 9 show performance that is getting better with their achievements. Efficiency in the past two years. On the other hand, village unit co-operatives and farmer co-operatives are in the
second lowest ranking with the most excellent inefficiency scores. Inefficiency can be reduced, one way is imitate the efficient implementation / operational activities of the DMU [8].

Table 1. Efficiency of Co-operatives in Bantul Regency based on Input Orientation of Variable Return to Scale Model

| DMU | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-----|------|------|------|------|------|------|------|------|------|------|
| 1   | 0.0373 | 0.0265 | 0.0112 | 0.0112 | 0.0307 | 0.0175 | 0.0175 | 0.002 | 0.0506 | 0.0229 |
| 2   | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| 3   | 0.9578 | 0.5254 | 0.5318 | 0.5318 | 0.5921 | 0.4586 | 0.4586 | 1     | 0.1819 | 0.1416 |
| 4   | 0.7708 | 0.726 | 0.726 | 0.7909 | 0.7518 | 0.7518 | 0.0303 | 1     | 1     |
| 5   | 0.6757 | 0.2514 | 0.2514 | 0.4722 | 1     | 1     | 0.2765 | 1     |
| 6   | 0.1722 | 0.4408 | 0.1906 | 0.1906 | 0.2962 | 0.1587 | 0.1587 | 0.0299 | 0.1748 | 0.1164 |
| 7   | 0.2844 | 0.2011 | 0.2615 | 0.2615 | 0.212 | 0.1079 | 0.1079 | 0.0379 | 0.3668 | 0.1674 |
| 8   | 0.4666 | 0.9033 | 1     | 1     | 0.8282 | 0.4237 | 0.4237 | 1     | 0.59  | 0.4558 |
| 9   | 0.3426 | 0.411 | 0.5919 | 0.5919 | 1     | 1     | 0.1425 | 0.746 | 0.6229 |
| 10  | 0.4666 | 0.9033 | 1     | 1     | 0.8282 | 0.4237 | 0.4237 | 1     | 0.59  | 0.4558 |
| 11  | 0.3426 | 0.411 | 0.5919 | 0.5919 | 1     | 1     | 0.1425 | 0.746 | 0.6229 |
| 12  | 0.3426 | 0.411 | 0.5919 | 0.5919 | 1     | 1     | 0.1425 | 0.746 | 0.6229 |
| 13  | 0.8966 | 0.6462 | 0.719 | 0.719 | 0.5817 | 0.5955 | 0.5955 | 0.1693 | 0.8558 | 0.6688 |

Source: BPS, 2020 (analyzed)

3.4.2 Output Orientation
DEA analysis using an output orientation sees efficiency as a level DMU's ability to produce output using some inputs which exist. A DMU is said to be efficient if the resulting output is appropriate with its potential output. Conversely, DMU is in an inefficient condition if producing output lower than the actual target that can still be achieved [7].

The output orientation is generally applied to the DMU that has the goal of increasing output as much as possible, such as educational institutions [9] and hospitals [10]. Even so, co-operatives also need to be oriented towards increasing the volume of business and the residual income, as an effort to improve the welfare of members in particular and society in general.

Table 2. Efficiency of Co-operatives in Bantul Regency based on Output Orientation of Variable Return to Scale Model

| DMU | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|-----|------|------|------|------|------|------|------|------|------|------|
| 1   | 0.0204 | 0.018 | 0.0074 | 0.0074 | 0.03 | 0.0085 | 0.0085 | 0.0018 | 0.0187 | 0.0068 |
| 2   | 0.7762 | 0.6347 | 0.8796 | 0.8796 | 0.9742 | 0.2958 | 0.2958 | 0.0923 | 0.3642 | 0.2362 |
| 3   | 0.826 | 0.4237 | 0.4539 | 0.4539 | 0.5891 | 0.1317 | 0.1317 | 0.0043 | 0.1691 | 0.1297 |
| 4   | 0.7568 | 0.6892 | 0.6892 | 0.7884 | 0.1916 | 0.1916 | 0.0118 | 1     | 1     |
| 5   | 0.6757 | 0.437 | 0.2241 | 0.2241 | 0.392 | 0.3015 | 0.3015 | 0.1484 | 0.4955 | 0.4051 |
| 6   | 0.1594 | 0.3389 | 0.1876 | 0.1876 | 0.2926 | 0.0944 | 0.0944 | 0.0122 | 0.1536 | 0.0469 |
| 7   | 0.2189 | 0.1794 | 0.2442 | 0.2442 | 0.2095 | 0.089 | 0.089 | 0.0122 | 0.2247 | 0.1168 |
| 8   | 0.1185 | 0.1573 | 0.6366 | 0.6366 | 0.1409 | 0.0358 | 0.0358 | 0.0159 | 0.1532 | 0.1015 |
| 9   | 0.195 | 0.2394 | 0.3931 | 0.3931 | 0.4415 | 0.2703 | 0.2703 | 0.8681 | 0.334 | 0.1489 |
| 10  | 0.3256 | 0.5854 | 0.8451 | 0.8451 | 0.7171 | 0.1495 | 0.1495 | 1     | 0.2823 | 0.1188 |
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Based on the DEA analysis results of the output-oriented VRS model, there are only two relatively efficient co-operatives, namely transport co-operatives and army co-operatives. Meanwhile, farmer co-operatives and village unit co-operatives remain in the bottom two ranks of efficiency. When compared to the results of the input orientation and output orientation, it is known that the DMU in the input orientation is relatively more efficient than the result in the output orientation. This shows that the DMU, which is the object of analysis, is more inclined to be unable to produce maximum output instead of using minimum input[7].

4. Conclusion

Village unit co-operatives and farmer co-operatives in this study have a relatively large number of members than non-agricultural co-operatives. However, if a ratio between input and output is built, the village unit co-operatives and farmer co-operatives are relatively low. This is also supported by the results of measuring the efficiency of both input orientation and output orientation, where the two co-operatives have the highest inefficiency scores. Between input orientation and output orientation, the more challenging thing to apply in agricultural co-operatives is how to increase the activeness/participation of several existing members to increase the volume of business and the residual income of the business.

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