Efficiency Evaluation of Primary and Secondary Education Sector Performance in East Java Using Data Envelopment Analysis

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Abstract

Education has an important role in creating excellent human resources for the advancement of national development. However, in Indonesia, there are still gaps in equal access to education. This study aims to evaluate the performance efficiency of the education sector to provide recommendations of which considered inefficient by using the Data Envelopment Analysis (DEA) method. This study measures the technical efficiency of primary and both secondary schools (junior and senior high School) in 38 regencies/cities in East Java Province for three academic years (2016-2019). The results showed that technical inefficiency still occurs in the implementation of education in East Java. In addition, peer groups and improvement targets were obtained for the inefficient regencies/cities. The indicators that most influence the efficiency value of the education sector in East Java are the Education Fund Allocation as the input variable and the School Continuing Rate as the output variable. The scale efficiency analysis shows that most of the education sector in East Java operates in decreasing returns to scale.

Keywords: DEA; Efficiency; Regency/City; Elementary School; Junior High School; High School

Introduction

The progress of a country's development is largely determined by the quality of its human resources in managing it. Education is one of the key in building an excellent human resources. In 2018, Indonesian Human Capital Index in ranked 87 out of 157 countries, this shows that the contribution of Indonesian human resources is still low to the country's development (The World Bank, 2018). In the same year, the results of Programme for International Student Assessment (PISA) also show that Indonesian Students academic abilities are still far below the international average. Indonesia is still in the category of 10 countries with the lowest ranking of PISA (OECD, 2018). One of the efforts by the government to improve the quality of education in Indonesia is by allocating a large amount of funds, that is 20% of the State Budget to the education sector. However, this policy has yet to see an optimal impact, indicated by the value of the Net Participation Rate (NER) and the increase of the Human Development Index (HDI) which still is not evenly distributed in each province and regency/city in Indonesia (Kementerian Keuangan...
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Republik Indonesia, 2019). The Minister of Finance Sri Mulyani said it was due to inaccuracies in the distribution and management of the education budget (Novelino, 2019).

East Java is a province in Indonesia with the largest number of cities/regencies, consisting of 9 cities and 29 regencies. In 2019, the Human Development Index (HDI) of East Java was still below the national HDI average, scored 71.50 with a national average of 71.92 (Badan Pusat Statistik, 2020). In addition, East Java’s HDI is also the lowest of the provinces in Java Island. The HDI is an index that measures the ability of the population to access education, income, and healthcare from the results of development. Among the three, education holds the lowest index in East Java. This condition shows that there are still problems in the education sector in East Java.

Table 1. Human Development Index in Java Island (2019).

| Province            | Life Expectancy (Year) | School Life Expectancy (Year) | Average Schooling Years (Year) | Outcome per Capita (Rp.) | HDI   |
|---------------------|------------------------|-------------------------------|--------------------------------|--------------------------|-------|
| DKI Jakarta         | 72.79                  | 12.97                         | 11.06                          | 18.527                   | 80.76 |
| DI Yogyakarta       | 74.92                  | 15.58                         | 9.38                           | 14.394                   | 79.99 |
| Banten              | 69.84                  | 12.88                         | 8.74                           | 12.267                   | 72.44 |
| Jawa Barat          | 72.85                  | 12.48                         | 8.37                           | 11.152                   | 72.03 |
| Jawa Tengah         | 74.23                  | 12.68                         | 7.53                           | 11.102                   | 71.73 |
| Jawa Timur          | 71.18                  | 13.16                         | 7.59                           | 11.739                   | 71.50 |

Note: “Jawa Timur” stands for East Java

According to Ramliyanto, the secretary of East Java Regional Education Office, the low score of the education index in HDI is due to the high gap in the School Participation Rate and the distribution of teaching staff (Nasafi, 2019). In addition, according to the strategic plan of East Java Regional Education Office for 2014-2019, there are several main problems of education in East Java including: 1) disparity in the quality of education is still high; 2) the quality of teaching staff is still low; 3) the quantity and quality of educational facilities and infrastructure is still low; 4) the quality of non-formal and informal education is still low; 5) the level of literacy and interest in reading is still low; 6) the Gross Enrollment Rate (GER) and Net Enrollment Rate (NER) are still low, especially in secondary education; 7) the lack of infrastructure for vocational secondary education; 8) the lack of teaching staff in special education and special services (Dinas Pendidikan Jawa Timur, 2014).

Figure 1. GER (APK) dan NER (APM) in East Java for 2018/2019
One of the efforts of the East Java Provincial Government in overcoming these problems is by allocating 30 percent of the total Regional Budget (APBD) for the education sector in order to increase equal access to education and reduce dropout rates so as to improve the quality of education in East Java (Soekarno, 2020). Evaluation of performance efficiency in the education sector in Indonesia is important considering the large allocation of education funds. Performance measurement in the education sector aims to understand the process of activity management, ensure objective decision-making, assist the government and those responsible for improving performance and hold them accountable to the public (Mahsun et al., 2011).

This study aims to evaluate the performance efficiency of primary and secondary education sector in each city/regency in East Java so that the allocation of resources used is right on target so as to increase equal access to education. The results of this study are in the form of evaluation, determining indicators of the most influential variables, and recommendations for improving performance efficiency, all from technical cost efficiency, technical system efficiency, and overall efficiency in the education sector in each city/regency in East Java. The results of this study can also be used as a reference for other provinces that have similar problems in the education sector in order to increase the efficiency of their performance.

**Literature Review**

**Performance**

Performance is the achievement of individual or group work from an organization or entity based on responsibility and authority to achieve legal organizational goals (Sutrisno, 2010). Another definition of performance is the result of correction of a job with the target achievements have already been made (Rai, 2008).

**Efficiency Based Performance Measurement**

Efficiency is the ratio of output to input. performance is considered efficient when (1) output can be increased from the use of constant input, (2) output is constant even with less input, and (3) output increases with the increases of input (Suswadi, 2007). Efficiency is a performance parameter that underlies the entire performance of an organization (Hadad et al., 2003).

**Data Envelopment Analysis (DEA)**

DEA is a linear programming used in measuring performance using the ratio of output to input from a Decision Making Unit (DMU) or production entity (Suliasih et al., 2013). DMU is a term for a unit or organization that produces an output using certain inputs. A DMU is considered to have the best performance (efficient) if they have a score of 1 or 100%, while considered inefficient if they have a score between 0 and 100% (Ramanathan, 2003).

There are two DEA models, namely DEA-CCR or CRS (Constant Returns to Scale) and DEA-BCC or VRS (Variable Returns to Scale). This study uses the DEA CRS and DEA VRS models with output orientation. The DEA VRS model assumes that not all DMUs work optimally and there are differences in
scale between DMUs. The DEA CRS model in this study is used to obtain the scale efficiency (SE) value by comparing the technical efficiency value of the CRS (TECRS) model with the VRS (TEVRS) model.

Figure 2. DEA Scale Efficiency

![DEA Scale Efficiency Diagram]

The value of one (efficient DMU) in SE is obtained if TECRS value is the same as TEVRS. If the SE value is more than one, it indicates that the DMU has a scale inefficiency. TEVRS>SE indicates an increase or decrease in efficiency is influenced by pure technical efficiency. Meanwhile, TEVRS<SE shows that the change in efficiency is more influenced by scale efficiency (Worthington, 2000).

**Peer Group**

Peer group is the determination of reference DMU for inefficient DMUs in order to achieve better efficiency (Nugroho et al., 2011). DMUs with a relatively low level of efficiency can be improved by referring to the relatively more efficient DMUs. The target of improvement in both input and output is calculated by multiplying the peer group value with the DMU input or output used as the reference.

**Efficiency Evaluation in the Education Sector**

Evaluation of efficiency in education generally discusses the attainment of broad access to education with optimal educational facilities. Access to education is the level of convenience for the school age population to get an education. This convenience is in the form of educational services and infrastructure which include the construction of school units, classrooms, libraries, laboratories, and the availability of teachers and educators that are evenly distributed across regions (Tsani et al., 2017).

**Methodology**

**Research Stages**

There are four stages in this research. First, the preparation stage in the form of problem identification and defining research objectives by conducting literature studies. Second, the model specification stage. Data collection uses secondary data accessed from the East Java Regional Education Office and the Ministry of Education and Culture publications. The methods used are CRS and VRS Data Envelopment Analysis (DEA) with orientation on output to measure technical cost efficiency, technical system efficiency, and overall efficiency. The third stage is the implementation of the model in the form of determining the
efficient DMU, peer group, target improvement, and the most influential variables. The fourth and the last stage is the analysis and conclusions of the research.

**Determining the DMUs**

The DMUs in this study is determined based on the number of cities/regencies in East Java, which consists of 9 cities and 29 regencies.

**Determining the Variables**

The determination of input, intermediate, and output variables in this study is based on the vision, mission, goals, and strategic targets of the Ministry of Education and Culture for the years 2015-2019, the 2014-2019 East Java Regional Education Office Strategic Plan, and previous studies which were then adjusted based on the availability of data that can be accessed from the East Java Regional Education Office. Input variable EFA in this study uses a budget for education affairs consisting of regional funds and regional transfer funds for education divided by the number of students with the assumption allocation student is the same.

Intermediate variables are used to relate input variables and output variables. Intermediate variables consist of the Teacher per Student Ratio (TSR), the Class per Student Ratio (CSR), and the Net Enrollment Rate (NER). The commonly used ratios are student/teacher ratios and student/class ratios, but in this study the opposite is true because of the use of the DEA output-oriented model in order to avoid the risk of bias. The values of TSR and CSR are relatively small, henceforth necessary to multiply them by 1000 to accommodate the use of DEA which can only use two decimal digits maximum.

The output variable uses the School Continuing Rate (SCR) and the Non-Dropping Rate (NDR). SCR is the proportion between the number of new grade 1 students at a certain level of education and the number of graduates the lower level of education. The use in the analysis for Elementary and Junior High School levels will be different from Senior High School levels which use the Graduation Rate (GR) indicator because Senior High School is the highest level in secondary education. Dropout Rate (DR) is the percentage of students who are no longer attending school or have not completed their education, consequently NDR indicator uses the 100-DR formula.

![Figure 3. Research Model](image-url)
**Technical Cost Efficiency (TCE)**

**Objective function:**
\[ \text{Max} \quad \theta + \varepsilon \left( \sum_i IS_i + \sum_j OS_j \right) \]

**Constraining Function:**

Output 1: Teacher/Student Ratio  
\[ \sum_j y_{1n} \lambda_n - \theta_n y_{10} - os_1 = 0 \]

Output 2: Class/Student Ratio  
\[ \sum_j y_{2n} \lambda_n - \theta_n y_{20} - os_2 = 0 \]

Output 3: Net Enrollment Rate  
\[ \sum_j y_{3n} \lambda_n - \theta_n y_{30} - os_3 = 0 \]

Input 1: Education Fund Allocation  
\[ \sum_i X_{1n} \lambda_n + IS_1 = x_{10} \]

**Index:**

- \( n = \text{DMU}, n = 1, \ldots, 38 \)
- \( j = \text{output}, j = 1, \ldots, 3 \)
- \( i = \text{input}, i = 1 \)

**Data**

- \( y_{jn} = \text{Output value to-} j \text{ from DMU to } n \)
- \( X_{in} = \text{Input value to-} i \text{ from DMU to } n \)
- \( \varepsilon = \text{Small positive number (10}^{-6} \text{)} \)

**Variables**

- \( \theta_n = \text{DMU}_n \text{ relative efficiency} \)
- \( IS_i OS_j = \text{Slack from input } i, \text{ output } j \ (\geq 0) \)
- \( \lambda_n = \text{DMUn value (} \geq 0 \text{) relative to DMU observed.} \)

\( y_{j0} \text{ and } x_{i0} \text{ are the output and input value DMU} \)

**Technical System Efficiency**

The calculation of technical system efficiency is conducted by connecting the intermediate variables with the output variables.

**Objective Function:**
\[ \text{Max} \quad \theta + \varepsilon \left( \sum_i IS_i + \sum_j OS_j \right) \]

**Constraining Function:**

Output 1: School Continuing Rate  
\[ \sum_j y_{1n} \lambda_n - \theta_n y_{10} - os_1 = 0 \]

Output 2: Non-Dropping Rate  
\[ \sum_j y_{2n} \lambda_n - \theta_n y_{20} - os_2 = 0 \]

Input 1: Teacher/Student Ratio  
\[ \sum_i X_{1n} \lambda_n + IS_1 = x_{10} \]

Input 2: Class/Student Ratio  
\[ \sum_i X_{2n} \lambda_n + IS_2 = x_{20} \]

Input 3: Net Enrollment Rate  
\[ \sum_i X_{3n} \lambda_n + IS_3 = x_{30} \]

**Overall Efficiency (OE)**

The overall efficiency calculation is conducted by connecting the input, intermediate and output variables.
Objective Function:

Max \[ \theta + \varepsilon \left( \sum_{i} IS_{i} + \sum_{o} OS_{i} \right) \]

Constraining Function:

Output 1 : School Continuing Rate \[ \sum y_{2} \lambda_{n} - \theta ny_{2} o - OS_{1} = 0 \]
Output 2 : Non-Dropping Rate \[ \sum y_{2} \lambda_{n} - \theta ny_{2} o - OS_{2} = 0 \]
Input 1 : Education Fund Allocation \[ \sum y_{1} \lambda_{n} + IS_{1} = x_{10} \]
Input 2 : Teacher/Student Ratio \[ \sum y_{2} \lambda_{n} + IS_{2} = x_{20} \]
Input 3 : Class/Student Ratio \[ \sum y_{3} \lambda_{n} + IS_{3} = x_{30} \]
Input 4 : Net Enrollment Rate \[ \sum y_{4} \lambda_{n} + IS_{4} = x_{40} \]

Scale Efficiency

The difference in the technical efficiency output of TECRS and TEVRS indicates the SE value. If the TECRS and TEVRS outputs are the same, in other words SE = 1, then the DMU is said to be operating optimally.

Results and Discussion

Efficiency Calculation with DEA-VRS

Calculations using the DEA-VRS model assume that not all DMUs work optimally, and there are differences in scale between DMUs. DMU is said to be efficient if it has a perfect efficiency value (\( \theta = 1 \)).

Table 2. The values of TCE, TSE, and OE Output Oriented VRS for Elementary School/Equivalents (‘kab.’ is for ‘kabupaten’ or regency, and ‘kota’ is for city)

| KABUPATEN/KOTA | 2016/2017 TCE | TSE | OE | 2017/2018 TCE | TSE | OE | 2018/2019 TCE | TSE | OE |
|----------------|---------------|-----|----|----------------|-----|----|----------------|-----|----|
| Kota Surabaya  | 0.9184        | 1.0000 | 1.0000 | 0.9267        | 1.0000 | 1.0000 | 0.9254        | 1.0000 | 1.0000 |
| Kota Malang    | 0.9963        | 0.9999 | 1.0000 | 1.0000        | 0.9999 | 1.0000 | 1.0000        | 0.9967 | 1.0000 |
| Kota Madiun    | 0.9708        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 | 0.9581        | 1.0000 | 1.0000 |
| Kota Kediri    | 0.9598        | 1.0000 | 1.0000 | 0.9635        | 0.9999 | 1.0000 | 0.9498        | 0.9996 | 1.0000 |
| Kota Mojokerto | 0.9620        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 |
| Kota Blitar    | 0.9550        | 1.0000 | 1.0000 | 0.9651        | 1.0000 | 1.0000 | 0.9999        | 1.0000 | 1.0000 |
| Kota Pasuruan  | 0.9819        | 1.0000 | 1.0000 | 1.0000        | 0.9999 | 1.0000 | 1.0000        | 0.9997 | 1.0000 |
| Kota Probolinggo | 0.9721      | 1.0000 | 1.0000 | 0.9726        | 1.0000 | 1.0000 | 0.8610        | 1.0000 | 1.0000 |
| Kota Bata      | 0.9671        | 1.0000 | 1.0000 | 0.9801        | 1.0000 | 1.0000 | 1.0000        | 0.9998 | 0.9998 |
| Kab. Gresik    | 0.9924        | 0.9999 | 1.0000 | 0.9907        | 0.9999 | 0.9999 | 0.9930        | 0.9994 | 0.9994 |
| Kab. Sidoarjo  | 0.9636        | 1.0000 | 1.0000 | 0.9598        | 1.0000 | 1.0000 | 0.9549        | 0.9994 | 1.0000 |
| Kab. Mojokerto | 1.0000        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 | 0.9973        | 1.0000 | 1.0000 |
| Kab. Jombang   | 0.9544        | 1.0000 | 1.0000 | 0.9608        | 1.0000 | 1.0000 | 0.9629        | 0.9997 | 0.9997 |
| Kab. Bojonegoro | 0.9892        | 0.9999 | 0.9999 | 0.9850        | 0.9999 | 0.9999 | 0.9776        | 0.9999 | 0.9999 |
| Kab. Tuban     | 1.0000        | 0.9996 | 0.9997 | 0.9964        | 0.9997 | 0.9997 | 1.0000        | 0.9995 | 0.9995 |
| Kab. Lamongan  | 1.0000        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 | 1.0000        | 0.9997 | 0.9997 |
| Kab. Madiun     | 0.9458        | 1.0000 | 1.0000 | 1.0000        | 1.0000 | 1.0000 | 1.0000        | 0.9996 | 0.9996 |
| Kab. Ngawi     | 0.9555        | 1.0000 | 1.0000 | 0.9473        | 1.0000 | 1.0000 | 0.9399        | 0.9995 | 0.9995 |
| Kab. Magetan   | 1.0000        | 0.9998 | 0.9999 | 1.0000        | 0.9999 | 0.9999 | 1.0000        | 0.9996 | 0.9996 |
| Kab. Ponorogo  | 0.9324        | 0.9999 | 1.0000 | 0.9285        | 1.0000 | 1.0000 | 0.9012        | 0.9998 | 0.9998 |
| Kab. Pacitan   | 0.9744        | 0.9999 | 0.9999 | 0.9821        | 0.9999 | 0.9999 | 0.9593        | 0.9999 | 0.9999 |
| Kab. Kediri    | 0.9419        | 1.0000 | 1.0000 | 0.9366        | 1.0000 | 1.0000 | 0.9252        | 0.9996 | 0.9996 |
| Kab. Nganjuk   | 0.9219        | 1.0000 | 1.0000 | 0.9209        | 1.0000 | 1.0000 | 0.9083        | 0.9997 | 0.9997 |
| Kab. Blitar    | 0.9241        | 0.9994 | 0.9995 | 0.9233        | 0.9996 | 0.9996 | 0.9102        | 1.0000 | 1.0000 |
| Kab. Tulungagung | 0.9716     | 0.9997 | 0.9997 | 0.9682        | 0.9998 | 0.9998 | 0.9393        | 0.9998 | 0.9998 |
| Kab. Trenggalek | 0.9802       | 0.9990 | 0.9990 | 0.9732        | 0.9991 | 0.9991 | 0.9587        | 0.9998 | 0.9998 |
| Kab. Malang    | 0.9857        | 0.9995 | 0.9995 | 0.9823        | 0.9996 | 0.9996 | 0.9802        | 0.9997 | 0.9997 |
| Kab. Pasuruan  | 0.9196        | 1.0000 | 1.0000 | 0.9070        | 1.0000 | 1.0000 | 0.9074        | 0.9987 | 0.9987 |
| KABUPATEN/KOTA | 2016/2017 | 2017/2018 | 2018/2019 |
|----------------|-----------|-----------|-----------|
| Kab. Probolinggo | 0.9629    | 0.9982    | 0.9983    |
| Kab. Lumajang    | 1.0000    | 0.9997    | 1.0000    |
| Kab. Bondowoso   | 0.9058    | 0.9986    | 0.9987    |
| Kab. Situbondo   | 0.9749    | 0.9984    | 0.9984    |
| Kab. Jember      | 1.0000    | 0.9997    | 0.9987    |
| Kab. Banyuwangi  | 0.9555    | 0.9998    | 0.9999    |
| Kab. Pamekasan   | 0.8494    | 1.0000    | 1.0000    |
| Kab. Sidoarjo    | 0.9043    | 0.9980    | 0.9996    |
| Kab. Mojokerto   | 0.9936    | 0.9999    | 1.0000    |
| Kab. Blitar      | 1.0000    | 0.9987    | 0.9997    |
| Kab. Probolinggo | 0.9828    | 0.9987    | 0.9995    |
| Kota Surabaya    | 0.9555    | 1.0000    | 1.0000    |
| Kota Malang      | 0.9550    | 0.9988    | 0.9966    |
| Kota Madura      | 1.0000    | 0.9998    | 0.9999    |
| Kota Kediri      | 0.9728    | 0.9986    | 0.9996    |
| Kota Mojokerto   | 0.9936    | 0.9999    | 1.0000    |
| Kota Blitar      | 1.0000    | 0.9987    | 1.0000    |
| Kota Probolinggo | 0.9828    | 0.9987    | 0.9995    |
| Kota Surabaya    | 0.9645    | 0.9972    | 1.0000    |
| Kota Malang      | 0.9008    | 0.9980    | 0.9982    |
| Kota Sidoarjo    | 0.9403    | 1.0000    | 1.0000    |
| Kota Mojokerto   | 0.9424    | 0.9975    | 0.9984    |
| Kota Jombang     | 0.9408    | 0.9991    | 0.9991    |
| Kota Bojonegoro  | 0.9095    | 0.9990    | 0.9991    |
| Kota Tuban       | 0.9636    | 0.9981    | 0.9990    |
| Kota Lamongan    | 0.9764    | 1.0000    | 1.0000    |
| Kota Madura      | 0.9413    | 0.9996    | 1.0000    |
| Kota Ngawi       | 0.8736    | 1.0000    | 1.0000    |
| Kota Magetan     | 0.9624    | 0.9997    | 0.9997    |
| Kota Ponorogo    | 0.9196    | 0.9976    | 0.9976    |
| Kota Pacitan     | 0.9108    | 0.9980    | 0.9982    |
| Kota Kediri      | 0.9189    | 0.9975    | 0.9977    |
| Kota Nganjuk     | 0.9365    | 0.9956    | 0.9959    |
| Kota Blitar      | 0.8886    | 0.9977    | 0.9977    |
| Kota Tulungagung | 0.9714    | 0.9975    | 0.9976    |
| Kota Trenggalek | 1.0000    | 0.9963    | 0.9964    |
| Kota Malang      | 0.8970    | 0.9960    | 0.9960    |
| Kota Pasuruan    | 0.8456    | 1.0000    | 1.0000    |
| Kota Probolinggo | 0.9570    | 0.9940    | 0.9953    |
| Kota Lumajang    | 1.0000    | 0.9953    | 1.0000    |
| Kota Bondowoso   | 0.9464    | 0.9953    | 0.9955    |
| Kota Situbondo   | 1.0000    | 0.9939    | 0.9940    |
| Kota Jember      | 0.8922    | 0.9956    | 0.9956    |
| Kota Banyuwangi  | 0.9088    | 0.9972    | 0.9974    |
| Kota Pamekasan   | 1.0000    | 0.9995    | 0.9969    |
| Kota Sampang     | 0.7939    | 1.0000    | 1.0000    |
| Kota Sumenep     | 1.0000    | 0.9965    | 0.9965    |
| Kota Bangkalan   | 0.8501    | 0.9990    | 0.9995    |

Table 3. The values of TCE, TSE, and OE Output Oriented VRS for Junior High/Equivalents

| KABUPATEN/KOTA | 2016/2017 | 2017/2018 | 2018/2019 |
|----------------|-----------|-----------|-----------|
| Kota Surabaya  | 0.7286    | 1.0000    | 1.0000    |
| Kota Malang    | 0.9508    | 0.9992    | 0.9994    |
| Kota Madura    | 1.0000    | 0.9975    | 1.0000    |
| Kota Kediri    | 0.9770    | 0.9965    | 0.9999    |
| Kota Mojokerto | 1.0000    | 0.9982    | 0.9988    |
| Kota Blitar    | 1.0000    | 0.9952    | 1.0000    |

Table 4. The values of TCE, TSE, dan OE Output Oriented VRS for High School/Equivalents
but also by scale efficiency. It can be said that most of the efficiency values are not only influenced by pure technical efficiency but also by scale efficiency. This condition means that the ratio of increase in output is smaller than the ratio of increase in input and it can be said that most of the efficiency values are not only influenced by pure technical efficiency but also by scale efficiency.

### Efficiency Calculation with DEA-CRS

The calculation of efficiency with the DEA-CRS model in this study is only used to analyze the overall efficiency. There are 4 cities/regencies that have perfect overall efficiency (θ = 1) in three consecutive academic years at Elementary, Junior High, and High School or its equivalents.

### Scale Efficiency Analysis

Table 6. Scale Efficiency in Each Level of Education

| Education Level | Scale Efficiency |  |
|-----------------|------------------|---|
|                 | DRS              | CRS | IRS |
| Elementary/Equivalent | 83 | 31 | 0 |
| Junior High School/Equivalent | 89 | 25 | 0 |
| Senior High School/Equivalent | 91 | 23 | 0 |
| Total            | 263             | 79  | 0  |
| Percentage       | 76,90%          | 23,10% | 0,00% |

Most education operation in East Java is on a decrease return to scale (DRS), with 76.90% of the total value. This condition means that the ratio of increase in output is smaller than the ratio of increase in input and it can be said that most of the efficiency values are not only influenced by pure technical efficiency but also by scale efficiency.
**Peer Group Analysis**

Based on the results of peer group for all levels of education, for cities/regencies that are not efficient at technical cost efficiency can refer to Madiun City, Pamekasan Regency, and Trenggalek Regency. Meanwhile, peer group for technical system efficiency refer to Blitar City, Mojokerto Regency, and Pacitan Regency. Overall efficiency can refer to Blitar City, Batu City, and Gresik Regency.

![Figure 4. Peer Group for Technical Cost Efficiency](image)

![Figure 5. Peer Group for Technical System Efficiency](image)

![Figure 7. Peer Group for Overall Efficiency](image)

**Improvement Targets Analysis**

Inefficient DMUs will get a target of improvement in each of their variables. Even though this research using an output oriented model, the target of improvement could still be a decrease in input due to the slack value for negative input. This study uses two types of targets.
Strong Projection (SP) = Initial value + proportionate + slack movement

Weak Projection (WP) = Initial value + proportionate

Table 7. Lowest Technical Cost Efficiency Improvement Target at Elementary School Level

| Kab. Pamekasan | EFA   | TSR   | CSR   | NER   |
|----------------|-------|-------|-------|-------|
| Initial Data   | Rp355,782 | 93,145 | 52,945 | 81,020 |
| Proportionate  | -     | 16,133| 9,170 | 14,033 |
| Slack          | -     | -     | 8,168 | -     |
| Weak Projection| Rp355,782 | 109,278 | 62,115 | 95,053 |
| Strong Projection| Rp355,782 | 109,278 | 70,283 | 95,053 |

Analysis of Variable Influence on Regency/City Efficiency

The percentage of the influence of variables in determining the efficiency of a DMU is obtained by calculating the average value of each improvement targets and then averaged again. After calculating the average of all variable indicators, the highest average value is the Education Fund Allocation (EFA), which means that EFA has the most influence on the efficiency of education in East Java. Therefore, it is important to re-evaluate the education budget allocation and re-allocate the budget in several districts/cities adjusting to the needs in carrying out education in each district/city in East Java.

Table 8. Variables Most Affecting Efficiency Value of Education Implementation in Each Level

| Variables | Education Level | Academic Year | Rank |
|-----------|-----------------|---------------|------|
|           | ES | JHS | SHS | Average | 2017 | 2018 | 2019 | Average |       |
| EFA       | -6,669% | -8,288% | -3,166% | -6,041% | -3,744% | -6,345% | -8,035% | -6,041% | 1     |
| TSR       | -0,716% | 0,698% | 6,098% | 2,027% | 3,581% | 1,483% | 1,016% | 2,027% | 4     |
| CSR       | -0,343% | 1,389% | 5,954% | 2,333% | 4,925% | 2,330% | -0,255% | 2,333% | 3     |
| NER       | 1,129% | 1,769% | 6,976% | 3,291% | 4,314% | 3,947% | 1,613% | 3,291% | 2     |
| SCR       | 0,333% | 3,628% | 0,292% | 1,418% | 0,647% | 0,667% | 2,939% | 1,418% | 5     |
| DR        | 0,048% | 0,190% | 0,217% | 0,152% | 0,131% | 0,175% | 0,149% | 0,152% | 6     |

Conclusion

Based on the results of performance efficiency value calculation in the education sector in East Java, the perfect cost technical efficiency value (θ = 1) in 3 consecutive academic years is found in 3 cities/regencies at the levels of Elementary, Junior High, and High School or equivalent. For technical efficiency of the system, there are 7 cities/regencies at the elementary level, and 5 cities/regencies at the junior high and senior high school levels or equivalent. Meanwhile, overall efficiency is found in 11 cities/regencies for elementary school level, 7 cities/regencies for junior high school level, and 8 cities/regencies for senior high school level or equivalent.

Based on the analysis of the influence of variables on the performance efficiency value of the education sector in East Java, it shows that the Education Fund Allocation (EFA) is the most influential indicator. Therefore, it is necessary to calculate in detail the allocation of the education budget that adjusts
to the needs of education in East Java at each level so that the allocation of these funds can be right on target. Based on the peer group results for districts / cities that are not yet efficient on technical cost efficiency can refer to Madiun City, while for technical system efficiency and overall efficiency it can refer to Blitar City.

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