Higher education Public Service Agency (PSA) Efficiency Analysis Using Two Stage Analysis Envelopment Data

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Abstract: This study aims to look at the Public Service Agency (PSA) efficiency score of Higher education and examine the factors that affect the efficiency of PSAeducation performance. This study was conducted on 34 PSA Higher education which is within the authority of higher education for two years of observation, namely 2017 and 2018. The data used in this study is secondary data. The method used is Data Envelopment Analysis to find out the efficiency score in the first stage of PSA and examine the factors affecting efficiency using multiple regression analysis in the second stage. The results of phase one showed that in 2017 the number of inefficient Higher education PSA was 27 PSA, while in 2018, it was 20 PSA spread across western, central, and eastern Indonesia. However, there are 6 Higher education PSA that can maintain efficiency scores in two years of observation. The results of phase two show that the number of faculties is a factor that negatively affects the efficiency level of PSA Higher education. Measurement results by the DEA method show that there is still room for PSAHigher education to improve its efficiency. PSAHigher education can utilize the existence of faculties through innovation of services to the community, such as the provision of scholarships to students or financial courses for free business activities in the community.

Keywords: Data Envelopment Analysis, Efficiency, Regression

1. Introduction

Bureaucratic reform is an effort made by the government in realizing good government governance, one of which is providing public services. Excellent service to meet the needs and expectations of the community should be provided by the government as a government duty as a regulator (Hadi, 2018). The New Public Management (NPM) concept becomes a solution for the government in providing services to the community.

The new paradigm in Indonesia was realized with the establishment of a Public Service Agency.

Implementation of PSA financial management pattern is dominated by government agencies in the education sector and hospitals that play a major role in improving community welfare (Warta Ekonomi, 2016). The growth of PSA, especially in the education sector, every year is increasing; in 2015, the number of High Pendikan PSAis 73 PSA; 3 years later, namely in 2018, the number of PSA increased to 92 PSA(Source Directorate of PSA). The increase in the number of PSA must certainly be accompanied by good financial management as well. The principle of PSA financial management is one of them is efficient management. Therefore, the measurement of the efficiency level of HIGHER EDUCATIONPSA becomes an important thing to be considered.

Data Envelopment Analysis (DEA) is one of the alternatives that can be used to measure efficiency levels. Abbott and Doucouliagos, 2003; Saputra, 2018; Jati, 2015; Ahmi et al., 2018; and Duan, 2016) has researched to measure the university's top efficiency levels with the DEA method.

Saputra (2018) has researched the efficiency of higher education PSA using the one-stage Data Envelopment Analysis method. The study only used the results of the DEA score to find out the level of efficiency then continued with sensitivity analysis to determine the factors that affect the efficiency of higher education PSA. The number of data samples used only as many as 21 universities during 2013.

This study is different from the research conducted by Saputra (2018) because it is more comprehensive in

determining the factors that affect the efficiency of higher education PSA.

This research will answer research questions about how efficiency in colleges uses two stages of the DEA. In the first stage, the DEA method generates a relative efficiency score for each DMU.Because the resulting efficiency is relative, it is necessary to do the next stage of regression analysis using variables derived from DEA calculations and previous research results consisting of international accreditation, number of laboratories, number of faculties, and international research. The goal is to find out the factors that affect the efficiency level of higher education PSA. Furthermore, an analysis of factors that affect efficiency will be done using multiple regression analysis.

2. LITERATUR REVIEW

2.1. Agency Theory

A contract between one person (principal) or more will give rise to a bonded agency relationship with another person (agent) to provide services, including authorizing the decision-making made by the agent (Jensen and Meckling, 1976). However, in its implementation, there are often problems in the agency relationship. Agency Theories arise when the principal delegates his business management to the agent (Setiany & Wulandari, 2015). (Zelmiyanti, 2016) said agency relations do not only apply in the private sector; the public also applies these agency relationships. In the world of bureaucracy/government, the government, as an agent, is responsible for providing welfare and services for the public because the budget used by the government comes from public levies. Regional Autonomy is another example of the application of agency theory to the public sector. The Agency Theory is done so that services to the community can be held effectively to reduce bureaucratic processes. In addition, it provides space for agencies located in the area to manage the organization for which it is responsible. The government seeks to use various strategies to provide welfare to gain the full trust of the public, especially related to the provision of services. One of them is to use the concept of New Public Management in public management.

This research will answer research questions about how efficiency in colleges uses two stages of THE DEA. In the first stage, the DEA method generates a relative efficiency score for each DMU. Because the resulting efficiency is relative, it is necessary to do the next stage of regression analysis using variables derived from DEA calculations and previous research results consisting of international accreditation, number of laboratories, number of faculties, and international research. The goal is to find out the factors that affect the efficiency level of HIGHER EDUCATIONPSA. Furthermore, an analysis of factors that affect efficiency will be done using multiple regression analysis.

2.2. New Public Management

Management practices in the public sector that have not been maximized compared to management practices in the private sector are one of the reasons for the presence of the concept of New Public Management (NPM) (Syahidah et al., 2015). NPM emphasizes more in the provision of services that are valuable to the community (Fakhrul 2015). Public-Private Partnership is one of the proofs of the implementation of NPM in Indonesia (Puspawati, 2016). So that with the implementation of NPM, it is expected that performance productivity and efficiency levels can increase. In addition, the management of education, in particular, will be better with applying npm concepts, especially in (Pramono, 2014). The Public Service Agency in Indonesia is also one of the manifestations of the NPM concept. Article 2 of Government Regulation of the Republic of Indonesia Number 23 of 2005 concerning Financial Management of Public Service Agency mentions the purpose of PSA formation is to increase services to the community. In addition to productivity and economics, inflexible financial management can be realized, especially in healthy business practices. So that the ambition to educate the life of the nation and advance the general welfare can be implemented. Thus it is expected that stake leaders have managed the organization efficiently and effectively to produce maximum performance (I. Waluyo, 2011; Firm, 2016). The efficiency of an activity or a job can be realized if optimal results (output) will be obtained because the organization can use maximum resources (input) (Ahmi et al., 2018).

2.3. Efficiency

The efficiency of a unit is usually interpreted by the unit's success in producing as much output as it comes from a given series of inputs (Farrel, 1957). Efficiency is also a comparison between the use and substantial resources plan (Setiawan &Yosan, 2017). Thus, efficiency can be interpreted as the effort made to maximize certain inputs to produce a certain output. Every organization or entity will strive to do its job efficiently. The organization is efficient if it can expend as little movement, effort, time, and fatigue as possible (Hamsinah, 2018). In addition, the causative factors of inefficiency can be analyzed by identifying the allocation of inputs and outputs used by organizations (Lumban Gaol & Negoro, 2017).

Efficiency measurement is important for the private sector, but the government sector must also carry out efficiency measurements on the performance that has been implemented.

Efficiency Measurement is a form of accountability of the government's activities as an agent to the public (principle) for managed funds, the service provided, and its performance. Efficiency Measurement is done to reduce the occurrence of problems in agency relations as expressed by (Setiany&Wulandari, 2015). In the context of government, such accountability is called government accountability. Israwan et al. (2016) say that the frontier approach can be used as an alternative to measuring efficiency. This approach is divided into two, namely:

2.3.1.Parametic frontier approach

Population parameters used in research are conditions that must be met in this approach. Some of the methods used in this approach include Stochastic Frontier Analysis (SFA) and Distribution Free Analysis (DFA).

2.3.2.Non-parametic frontier approach

The population parameters used in the study do not become absolute requirements that must be met in this approach. Data Envelopment Analysis (DEA) is the method used in this approach.

2.4. Data Envelopment Analysis

The Envelopment Analysis data emerged along with research conducted by Charnes, Cooper, and Rhodes (1978); they researched efficiency in evaluating entities engaged in the public domain using linear programming. The entity to be measured in efficiency is expressed as decision-making units (DMU's), including the inputs and outputs it has (Charnes, Cooper, & Rhodes, 1978). Examples of DMU's or decision-making units can be manufacturing, departments in a large organizational unit such as PSAHigher education, hospitals, banks, or individuals such as medical personnel (Niswati, 2014). Efficiency measurements in the DEA apply only in the context of the units analyzed, not applicable to industry as a whole or theoretically. The DEA will produce a relative efficiency score. Relative Efficiency score means that the resulting efficiency only compares between the units observed as observation samples only. There are two DEA approaches in measuring technical efficiency: input-oriented and output-oriented (output approach) (Afonso &aubyn, 2005).

Furthermore (Afonso & Aubyn, 2005) said the input approach is used for companies that will take efficiency measurements to determine the number of inputs that must be reduced proportionally without changing the amount of output available.

Conversely, if the company reviews the amount of output that must be reduced by maintaining the number of inputs owned, then the output approach becomes the right method. The use of DEA, both input-oriented and output-oriented, will show the same set of DMU's efficient DMU's and DMU's that are inefficient. Two types of models can be used in applying DEA as expressed by (Sari & Saraswati, 2017), namely:

2.4.1.Model DEA CCR (Charnes –Cooper – Rhodes)

Each DMU studied will be compared to the entire DMU, with the requirements of the DMU's internal conditions being the same. Measurement of manufacturing companies' level of performance efficiency will be more precise results if using CCR models. This model considers that each input addition must affect the addition of one output;

in other words, the output ratio is constant factoring. CCR is also called constant return to scale.

2.4.2. Model DEA BCC (Banker – Charnes– Cooper)

In contrast to the CCR model, the BCC model is also called variable return to scale, meaning that between the input and the output owned is not always related, each addition of one input without requiring one output. The characteristics of companies engaged in service can be this BCC model as an alternative option to analyze efficiency. The role of human resources influences the BCC model in running this business. Although there are other factors such as capital, cash, and other factors, these factors are not the main factors that play a role for the business to run well. Efficiency measurement is technically the flagship of this DEA method because the DEA only considers the absolute value of a variable (Zanufa S &Saraswati, 2017).

2.5. Two Stage Data Envelopment Analysis

Efficiency calculations can be further done using the DEA's Two Stages approach to obtain better results. The efficiency score of the DEA (first stage) result is used as a dependent variable, while the non-discretionary variable is used as an independent variable. The efficiency score obtained in the first stage is aggregated using tools to obtain results that affect efficiency. OLS regression is often used to analyze dependent and independent variables' influence (Fatimah & mahmudah 2017).

2.6. Literature Review

This study is different from the previous research conducted by Saputra (2018) because further development has been carried out with changes in the number of samples, namely as many as 34 research samples and observation years as many as two years of observation. In addition to variables used as inputs and outputs and researchers using different variables. Abbot & Doucouliagos (2003) conducted a study of 36 universities spread across Australia in 1995. Data were obtained in annual university reports and the Australian Department of Education, Training, and Labor reports. Abbot & Doucouliagos (2003) uses non-current asset values, operational expenditures, non-academic staff, and the number of academic staff as variable inputs in their research. While the number of applicants for undergraduate and post-graduate levels, the cost for research, the number of undergraduates and post-graduate levels, and the numbers of students are used as output variables. The study results showed that, in general, Australian universities have operated at a relative level of efficiency compared to other universities.

The cost of research is a variety that affects efficiency even though the resulting efficiency value is relative and not absolute. Saputra (2018) research 21 universities that have changed their status to PSAin 2013 using the DEA method. The input variables used include the number of lecturers, the realization of spending, and the number of students. While the amount of income and the number of graduates becomes the variable output in his research. The study results stated that of the 21 higher education PSA studied, 11 PSA Higher education has been efficient, and ten other higher education PSA is inefficient in performing its performance. The number of students as variable input becomes a factor that affects the level of efficiency. Sasongko et al. (2015) measure the efficiency level against the use of public funds in IPB University. Exam fees, honor guides and examiners, education service fees, lecturer and practicum honors, tuition and practicum fees, maintenance and procurement costs, print and book fees, student aid were used as input variables in the study. In contrast, international student achievement, national student achievement, graduate quality (GPA), length of the study period, number of student graduates is used as an output variable.

In this study, the DEA score became variable dependent. While the number of education personnel, international accreditation of departments, the number of laboratories, the number of lecturers remains selected as variables independent in the study.

DEA first phase results showed that during the period 2012 to 2014, 54.29% of departments in IPB University were already managed efficiently, while the inefficient ones were 45.71%. International Accreditation and The number of education personnel affect efficiency in phase two of Data Envelopment Analysis.

2.7. Thinking Designation

Based on the problem formulation that has been written before, this study conducted an Efficiency Analysis of the Higher education General Service Agency Using Two Stages Data Envelopment Analysis. Illustration of previous thoughts is presented as follows:

2.7.1.Higher education PSA Efficiency based on DEA scores

Efficiency measurements of Higher education PSA can use the Data Envelopment Analysis method to produce efficiency scores on objects used as research. Efficiency scores are obtained from the results of comparisons between inputs and outputs used. Input factors that affect the DEA score are the number of students and the number of lecturers as used by Jati (2015), Saputra (2018), and (Ahmi et al., 2018) in his research. Another input factor affecting DEA scores is fixed assets such as Abbott & doucouliagos (2003) used in his research. Another input factor affecting the DEA score is income funds, such as those used by Selim & Bursalıoğlu (2015). In addition to input factors, there is also output to measure the efficiency level of higher education PSA. The output factor affecting the level of efficiency of a DMU is the number of student graduates as used by Saputra (2018) in his research. Meanwhile, the amount of research produced by PSA Higher education became another output factor that contributed to the DEA score, as stated by (Ahmi et al., 2018) in his research.

2.7.2.Efficiency of Higher education PSA Management

PSA Higher education is said to work more optimally if it can utilize input and output resources. Fewer inputs are used to produce maximum output, indicating the PSA has been managed efficiently. Ahmi et al. (2018) expressed that work or activity performed efficiently can be expressed as a form of success in using existing resources (inputs) to produce optimal output. In addition to knowing the factors that cause the inefficiency of higher education PSA, as Lumban Gaol & Negoro (2017) stated, if the company can identify the allocation of inputs and outputs used, it can be further analyzed the factors causing inefficiencies.

2.7.3.Influence of International Accreditation on DEA Scores (efficiency)

International accreditation is the recognition by an independent institution of a university that provides an assessment of a university's performance. International accreditation will impact universities to be more professional in managing their institutions so that good governance will improve the efficiency of the university. In line with (Nurharjanto et al., 2018), good governance is part of efforts to improve efficiency and competitiveness and maximize organizational performance following predetermined goals. International accreditation has been used by Sasongko et al. (2015) which state that international accreditation is a factor that affects the level of efficiency of the department.

2.7.4.Effect of Laboratory Numbers on DEA Scores (efficiency)

A laboratory is a place for students and lecturers to develop knowledge that has been owned. The number of laboratories owned by the university will result in research that benefits the community. Following what was conveyed by Fakhrul (2015) that New Public Management implemented with PSA emphasizes the provision of services that are of value to the community. According to Sasongko et al. (2015), the number of laboratories does not affect efficiency.

2.7.5.Effect of Faculty Count on DEA Score (efficiency)

The number of faculties owned by PSA Higher education is a managed means to provide services to the community, especially in the management of education, So it is expected that the life of the nation and state can be better, especially in the development of human resources (Pramono, 2014). The number of faculties is following the results of Selim & bursalıoğlu (2015) research which suggested that the number of faculties negatively affects efficiency.

2.7.6.Effect of International Research Numbers on DEA Scores (efficiency)

The amount of international research is a factor that can make a university-managed efficiently. The growing number of international studies produced proves the university can use its research funds optimally. However, this is contrary to the research conducted by Selim & Bursalıoğlu (2015), which said that the number of international studies does not affect efficiency.

2.8. Research Model

Based on previous research, the influence between inputs and outputs is described in the frame of mind in figure 1.

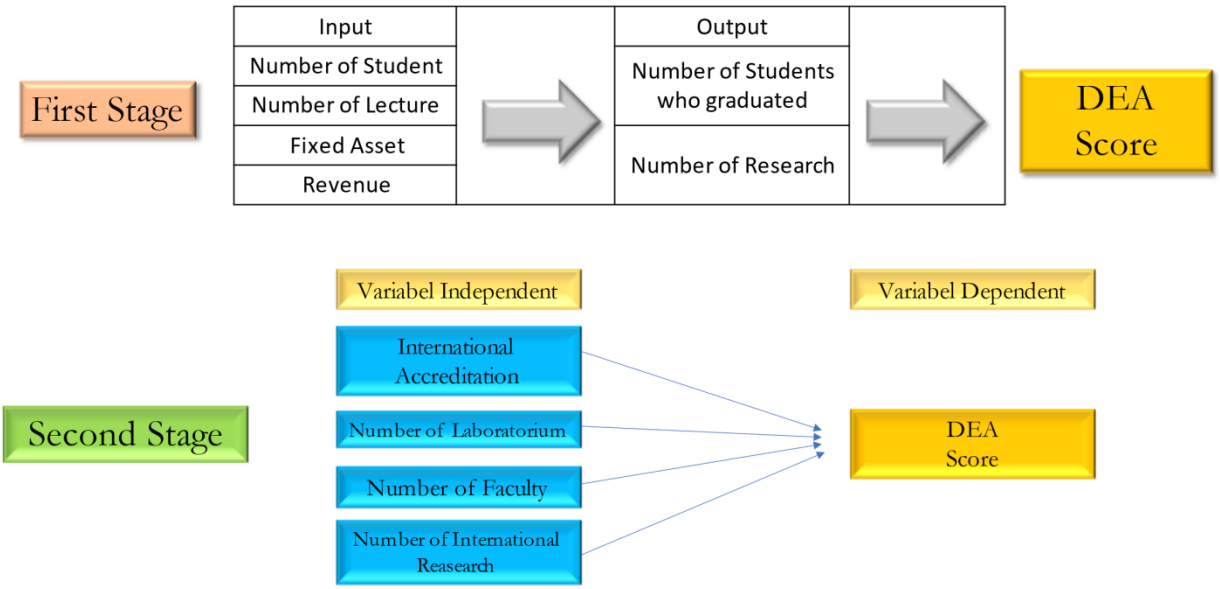

Figure 1. Research Model

Hypotheses that can be taken on the basis of research findings are:

No	Hypotheses	Additional Information
1	H1	International accreditation is influential significant DEA score (efficiency)
2	H2	Number of laboratories significant between scores DEA (efficiency)
3	H3	Number of significantly influential faculties DEA score (efficiency)
4	H4	Number of International Research significant effect on the score DEA (efficiency)

3. RESEARCH DESIGN

3.1. Objects and Years of Research

The population used is a college that uses a PSA financial management pattern of 91 units. The sample used in this study was as many as 34 universities within the Ministry of Higher education during 2017 and 2018. This study aimed to examine causality relationships to find the fullness of variable independent to dependent variables.

3.2. DEA model

The BCC/Variable Return to Scale model with an input orientation became the method chosen in this study. The reason for using the model, to find out how much the amount of input can be reduced to produce a relative level of efficiency (Sunarto, 2010). Stern, et., al. (1994) suggests that the number of DMU is at least three times greater than the total number of input and output variables available. The number of inputs used by the author is four

variables, while for output, there are two variables. If the input is multiplied by the output, then the minimum DMU sample used must be 8. Whereas if the number of inputs and outputs is summed then multiplied by 3, then the minimum number of DMU samples used is 18. This research using 34 samples from 91 populations, so the adequacy of the number of DMU according to the two experts.

3.3. Input and Output Variables

A total of 4 input variables and two output variables are used to polish the DEA score. While measuring variables that affect the DEA score, this study uses four independent variables.
These variables include:

Input variables:

Number of students

The number of students is the number of learners at the higher education level registered as new learners. The number of new students has a dimension of learners who enroll in PSA status universities under the authority of DIKTI, be it Diploma, Strata 1, Strata 2, or Strata 3. In 2017 and 2018. Following Law No. 12 of 2012 on Higher education, students are one of the elements that are very important in the learning process in college. Variabel is as used by Jati, 2015; Saputra, 2018; and Ahmi et al., 2018 in their research.

Number of Lecturers

The number of permanent and non-permanent lecturers (honorees) who work throughout the PSA of Higher education becomes one of the variable inputs used. The year of observation of this variable is in 2017 and 2018.The transfer of knowledge as one of the functions of lecturers is the reason for choosing the number of lecturers as input variables. This is as used by Jati, 2015; Saputra, 2018; and Ahmi et al., 2018) in his research.

Fixed Assets

The fixed assets used in the study were the value of buildings and buildings owned by the entire college in 2017 and 2018. Fixed asset values are included as input variables because buildings and buildings are used in the student learning process, and a means in academic services, like Abbott & Doucouliagos (2003) used in their research.

Revenue

Revenue becomes one of the components used to finance the operation of higher education PSA. Business income from services provided by PSA Higher education in 2017 and 2018 became another variable input used in this study. Revenue is as used by Selim & Bursalıoğlu (2015).

The output variable consists of:

Number of students who graduated

The first output variable used in the study was the number of students who graduated in all levels of education at PSA colleges in 2017 and 2018. The number of graduates is used as the output of universities in learning activities. The result of these learning activities is the number of graduates. The Variable is as used by Saputra (2018) in his research.

Research

Another output variable used in the study was the number of studies conducted at universities in 2017 and 2018. Research is incorporated into the output variable because research is one of the main points of tri dharma college. Variable is as used by Ahmi et al. (2018) in their research.

Independent Variables

Independent variables are used based on research conducted by Sasongko et al. (2015) and Selim &Aybarc (2015).

International Accreditation

International accreditation is the recognition of educational institutions provided by the competent body due to the assessment that the institution has met the specified quality requirements /criteria (Ministry of Research, 2019). Further accreditation is addressed to educational institutions and not to graduates. This is as used by Sasongko et al. (2015) and Selim &Bursalıoğlu (2015), in their research.

Number of laboratories

The number of laboratories used in this study is a laboratory owned by the college. The laboratory is incorporated into independent variables because the laboratory is a means that is used as a learning resource for students and classroom learning to meet the needs in producing research output. Variabel is as used by Sasongko et al. (2015) in their research.

Number of faculties

The number of faculties is the number of faculties contained in one college. Variabel is as used by Selim &Bursalıoğlu (2015) in their research.

International Amount of Research

The amount of international research is the number of studies that have been accredited in international journals. Variabel is as used by Selim & Bursalıoğlu (2015) in their research.

3.4. Data Collection Techniques

The data used in this study is the analysis of secondary data, which is data obtained or collected by researchers from various existing sources (researchers as second hand). Secondary data in the study was obtained from PSAfinancial statements, PSAservice performance data, PSACost and Budget Plan (RBA) documents, and PSAHigher education accreditation report. The research instrument used is documentation of financial statement documents and other documents from PSAto measure the efficiency of the PSA.

3.5. Analytical Methods

Analysis of data in research using the Two-Stage Data Envelopment Analysis (DEA) method. In the first phase, research was conducted to obtain a DEA efficiency score. Then the results of the DEA efficiency score will be analyzed to find out other variables that affect the DEA efficiency score with the following regression model:

$$\theta_i = a + \beta 1x1 + \beta 2x2 + \beta 3x3 + \beta 4x4 + e$$

θ_i	=	DMU efficiency score
β	=	The beta coefficient of each variable
X1	=	International Accreditation Value Of A Higher education PSA
X2	=	Number of laboratories owned by PSA Higher education
X3	=	Number of faculties
X4	=	Number of international research

Data processing uses the help of DEA software in DEA Solver based on references from William W. Cooper, Lawrence M. Seiford, and Kaoru Tone (2006). The regression stage uses IBM SPSS Statistic 22 application.

4. RESULTS

4.1. Descriptive Statistics

From the results of 34 PSA Higher education, descriptive statistics in the form of mean data, maximum value, and minimum value of the variables used in this study can be summarized in the table below.

No	University	2017	2018
1	Nusa Cendana University	0.28	0.53
2	Halu Oleo University	0.34	0.53
3	Mataram University	0.52	0.66
4	Tadulako University	0.42	0.80
5	Riau University	0.68	0.63
6	Syiah Kuala University	0.74	0.60
7	Lampung University	0.63	0.74
8	Negeri Gorontalo University	0.66	0.74
9	Sam Ratulangi University	0.64	0.80
10	Malang State Polytechnic	0.56	0.95
11	Tanjung Pura University	0.60	1
12	JenderalSoedirman University	0.79	0.82
13	Bengkulu University	0.74	0.88
14	SebelasMaret University	0.81	0.82
15	Yogyakarta State University	0.70	0.94
16	Brawijaya University	0.68	1
17	Jambi State University	0.89	0.79
18	Pattimura University	1	0.72
19	Sriwijaya University	0.82	0.95
20	Mulawarman University	0.87	0.91
21	Sultan AgengTirtayasa University	0.80	1
22	Makassar State University	0.88	0.93
23	Surabaya State University	0.94	0.93
24	Andalas University	0.88	1
25	Semarang State University	0.89	1
26	Jakarta State University	0.90	1
27	Medan State University	0.93	1
28	Ganesha University Of Education	0.98	1
29	Malang State University	1	1
30	Open University	1	1
31	Udayana University	1	1
32	Padang State University	1	1
33	Bandung State Manufacturing Polytechnic	1	1
34	National Development University of Veterans of East Java	1	1

Tabel 1 . University DEA Score Results

The table shows that the number of universities has been efficient in 2017 and increased in 2018 to 14 universities. The increase in average efficiency score in 2018 is in line with the decrease in the number of non-efficiency universities (<1 score), from 27 PSA Education Higher in 2017 became 20 PSA Higher education in 2018. Meanwhile, the number of Higher education PSA with a full efficiency score (score = 1) increased from 7 PSA of Higher education in 2017 to 14 efficient higher education PSA in 2018.

PSA Higher education in the western region of Indonesia has a higher efficiency score than the central and eastern regions, both in 2017 and in 2018. Efficiency score indicates that higher education PSA in the western region has a relatively better performance than higher education PSA in the central and eastern parts of Indonesia, in line with research conducted by Jati (2015).

Efficiency score can be due to access to resources, infrastructure, and bureaucracy that are more affordable in the western region of Indonesia than the central and eastern regions of Indonesia. In addition, this is also reinforced by paying attention to the number of DMU distributions used in this study. The distribution of DMU in the western part of Indonesia is greater than the other two regions, namely as many as 23 DMU. Efficiency score, of course, will affect the calculation of the DEA score whose calculation is based on the calculation of relative values among the DMU itself. PSA Higher education in the western region sampled in this study mostly has succeeded in managing the organization to produce a good performance, evidenced by more efficient results than the rest of Indonesia. Thus the university has implemented the concept of NPM following its objectives so that organizations that have been given autonomy as public policy managers realize efficiency, especially in public services (Fakrul, 2015). The efficiency score proves that universities with PSA status implement NPM mechanisms to improve their performance productivity to positively impact efficiency (Nur et al. l, 2015).

4.2. Higher education PSA Efficiency Analysis

4.2.1. Higher education PSA Case Study That Has Full Efficiency Score

As discussed in the previous section, *The Open University* is one of the universities located in western Indonesia that maintained full efficiency (score 1) in 2017 and 2018. Efficiency Score shows that relatively the *Open University* has the best performance among all universities that are the research object. *The Open University* has become a benchmark for 25 other universities in 2017 and 2 other universities in 2018. The table below is the output of the DEA Solver application that presents the Open University efficiency calculation results.

Tabel 2 DEA results *Open University* of 2018

DMU I/O	Score Data	Projected Value	Diff.
Number of Students	1		
Fixed Asset (in million rupiahs)	71.677	71.677	0
Number of Lectures	3.421.870	3.421.870	0
Revenue (in million rupiahs)	683	683	0
Number of students who graduated	1.018.211	1.018.211	0
Number of Researche	73.240	73.240	0
	320	320	0

From the results of the DEA calculations, it can be seen that with four variations of inputs used and two output variables produced, the Open University has achieved a full efficiency score (score 1). The projection is a recommendation for improvement DMU that can be seen as the input used and the output produced. The results indicate that no inputs need to be reduced nor outputs that the Open University needs to augment to achieve efficiency. The results follow the efficiency score obtained by the Open University so that this DMU does not need to improve. The results of data processing using input-based DEA methods that the Open University can manage input resources, namely the number of students (Jati, 2015; Saputra, 2018; Ahmi et al., 2018). In addition to permanent lecturers (Jati, 2015; Duan &Deng, 2016), the university gained a relative efficiency level in this study. The efficiency value presented because it is relative and not absolute is one of the limitations of the DEA method (Niswati, 2014).

4.2.2. Higher education PSA Case Studies That Have Low Efficiency Criteria

Furthermore, discussions will be conducted on universities that have not reached full efficiency. *Nusa Cendana University* is a college that is unable to achieve full efficiency during the observation year. Here are the DEA results on Nusa Cendana University in 2018

Tabel 3. DEA results Nusa Cendana University 2018

DMU I/O	Score Data	Projected Value	Diff.
Number of Students	1		
Fixed Asset (in million rupiahs)	71.677	71.677	0
Number of Lectures	3.421.870	3.421.870	0
Revenue (in million rupiahs)	683	683	0
Number of students who graduated	1.018.211	1.018.211	0
Number of Researche	73.240	73.240	0
	320	320	0

The table presents the detailed output of THE DEA Solver for the University of Nusa Cendana. It appears that the Higher education PSA obtained an efficiency score of 0.53. The score can be interpreted that the efficiency level is 53%, so there is still room for improvement of the inefficiency of 47%. The table shows that the input used in the form of new student numbers owned by The University of Nusa Cendana is 8,416 students; the difference in numbers shows 3,490 students and a projected value of 4,476 students. The results can be interpreted that the University of Nusa Cendana can achieve the same output if it accepts 4,476 new students. When viewed from the income input variables, this university has not made one of these variables that can be utilized to the maximum. The table shows that the use of input in the form of income owned by the University of Nusa Cendana is 176,004 (in millions of rupiah). Able to show the performance of Mataram University efficiently so that to reach an efficient level, this DMU must reduce its revenue by 54% or by 98,824 (in millions of rupiah), resulting in a projected value of 81,180 (in millions of rupiah). These results can be interpreted that the University of Nusa Cendana can achieve the same output if it can utilize revenue of Rp 81,180 (in millions of rupiah).

4.3. Benchmarking at an Efficient University

In addition to the information in the form of efficiency scores, slack, and projected value, the DEA produces peers and lambda weights. In DEA, peers always refer to DMU that has reached a level of full efficiency, and DMU that has not been efficient should model DMU that has obtained full efficiency to increase its efficiency. The DEA Solver application has facilitated benchmarking calculations and displayed results that describe universities that are a reference for other universities to work efficiently. To provide a more comprehensive picture of how a university is used as a reference for other universities, a case study will be conducted using a sample of universities that have been discussed previously, namely the University of Nusa Cendana. The case study was conducted in 2018. It appears in the table below that The University of Nusa Cendana has five universities that are the reference, which has the closest distance to DMU.

Tabel 3. Reference University

Reference University	**Fixed Asset Input (in millions of rupiah**	**Lamda**	**Projected Value (in millions of rupiah)**
Malang State University	5.720.068	3,5%	203.140
Brawijiya University	7.108.259	2%	120.353
Sultang Agung Tirtayasa University	662.201	20%	132.235
Tanjung Pura University	22.179.073	1,5%	334.231
Bandung State Manufacturing Polytechnic	668.182	73%	489.633
Total		100%	1.279.595

Thus decision-makers can use both qualitative and quantitative information on the five efficient universities to improve the performance of Nusa Cendana University. Lambda weight shows the weight of information of each university that is a reference for the University of Nusa Cendana. In this case, Malang State University weights 0.035 (3.5%), Universities Brawijaya weights 0.02 (2%). Sultan Agung Tirtayasa University has a weight of 0.2 (20%), Tanjung University Pura has a weight of 0.015 (1.5%), and Bandung State Manufacturing Polytechnic has a weight of 0.73 (73%). The higher the weight of the university that is a reference, the more relevant information for the DMU that is inefficient. Lambda weights can also be used to determine the input value used (projected value)

by Cendana University. The actual use of fixed asset inputs appears in the table above column (2). In the year of the observation, Malang State University used 5,720,068 (in millions of rupiah), Brawijaya University 7,108,259 (in millions of rupiah), Sultan Agung Tirtayasa University 662,201 (in millions of rupiah), Tanjung Pura University 22,179,073 (in millions of rupiah), and Bandung State Manufacturing Polytechnic 668,182 (in millions of rupiah). The result of multiplication between the lambda column weight (3) and the actual input used will produce a projection tilapia for the University of Nusa Cendana to be declared column efficient (4). The value of 1,279,595 (in millions of rupiah) shows an amount almost equal to the projection value produced directly by the DEA, which is 1,279,595 (in millions of rupiah). The same method can be used on other input variables.

4.4. Two Stage DEA

Envelopment Analysis data has not generally considered factors that specifically affect efficiency. Therefore, a second stage analysis is needed in this study to examine factors that affect efficiency. The next analysis used multiple regressions. Multiple regression analysis is used to examine factors that affect the efficiency of HIGHER EDUCATION PSA. The factors specified in this study differ from the input and output variables used in the DEA; the factors are International Accreditation (IA), Number of Labs (NL), Number of Faculties (NF), and Number of International Research (NIR). At the same time, the Y variable in this analysis is the efficiency score obtained from the results of the DEA analysis.

Tabel 4. Multiple Regression Analysis Result

Model		Unstandarized Coefficients		Std Coefficients		
		B	Standard Error	Beta	T	Sig.
1	Constant	105.384	9.114		11.563	.000
	International Accreditation Value Of A Higher education PSA	-5.268	5.397	-.112	-.976	.333
	Number of laboratories owned by PSA Higher education	.058	.065	.122	.892	.376
	Number of faculties	-2.783	.745	-.466	-3.736	.000
	Number of international research	.019	.011	.215	1.708	.093

Four independent variables will be tested statistically using the t statistical test to show how far it affects one independent variable. Using the significance of level 0.05 (α = 5%) for the number of international research, laboratories, international accreditation, and faculties. If the t-count < t-table, the independent variable partially does not affect the dependent variable (hypothesis rejected). If t-calculate > t-table, then the independent variable partially affects the dependent variable (accepted hypothesis). The strength of the relationships that occur between each variable independent of the dependent variable is as follows:

a. Based on the first hypothesis researchers proposed, international accreditation variables did not affect DEA scores. The regression analysis also explains that the variable number of international studies has a value of t-count -976 smaller than t-table 2.3849 and obtained a significance value of 0.333 > 0.05. It can therefore be concluded that the first hypothesis was rejected.
b. The variable of the number of laboratories has an at-count value of 0.892 smaller than t-table 2.3849 and obtained a significance value of 0.376 > 0.05. Therefore it can be concluded that the number of laboratories does not affect the DEA score. Therefore, the second hypothesis was rejected.
c. The results of the third hypothesis showed that the number of faculties affected the DEA score. The number of faculties has an at-count value of -3,736 greater than t-table 2.3849 and obtained a significance level of 0.05 (0,000<0.05). Therefore the hypothesis is accepted. The direction of the effect is negative.
d. The fourth hypothesis is described in the variable number of international studies, which has an at-count value of 1,708 smaller than t-table 2.3849 and obtained a significance value of 0.215, smaller than the significance level of 0.05. So it can be concluded that the number of international studies does not affect the DEA score. The fourth hypothesis was rejected.

5. CONCLUSION

This study answers questions about the efficiency rate of HIGHER EDUCATION PSA as many as 34 from 2017 to 2018.

Based on the discussion and some of the descriptions above, the research conclusions are as follows:

a. In 2017, the number of inefficient Higher education PSA was 27 PSA while in 2018, it was 20 PSA. However, there is 6 PSA Higher education that can maintain efficiency scores in two years of observation.
b. Higher Education PSA has not been managed efficiently; this is seen from the number of higher education PSA used as research material mostly does not work efficiently because the score is compiled according to the DEA below 1. During the two years of observation, only six universities effectively managed the resources to produce relative efficiency levels. The universities are Malang State University, Open University, Udayana University, Padang State University, Bandung State Manufacturing Polytechnic, East Java Veteran National Development University.
c. International accreditation does not affect efficiency. International accreditation is limited to completing the requirements for international accreditation applications only. International accreditation should improve the business process of university performance.
d. The number of laboratories does not affect efficiency. The existence of laboratories has not been able to function optimally to support students and lecturers in developing their knowledge.
e. The number of faculties becomes a factor that affects the efficiency of HIGHER EDUCATION PSA. The direction of the influence is negative, meaning that the more faculty owned by PSA Higher education is inversely proportional to efficiency. However, this does not necessarily make the college reduce the number of faculties owned to be able to increase its efficiency. Colleges can improve the cost structure of faculty that are currently still in operation.
f. The increasing number of international research published on a university does not necessarily make the college efficient. The cost required in the process of publishing an international journal is very large. Thus the more research produced will be directly proportional to the cost required.

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