Aggregate Efficiency of Higher Education Management under Coordination of Private Universities Area Using DEA in Determining Strategic Innovation

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Abstract

It should be 3078 higher education institutions in Indonesia, with student population of approximately 6.7 million people, which consists of five types institutions, namely: university, institute, colleges, academy and polytechnic. Ministry of education and culture management divided the management of higher education into 12 regions of coordination of private universities (Kopertis). Each Kopertis region had a number higher education institutions, number of lecturers and students in varying number. The number of faculty qualifications by level of education also vary from educated of D3(diploma) up to S3(doctoral). As a result of the learning process, also produced varying the number of graduates. With the variety of input factors in producing graduates as output factors, as aggregate in Kopertis region, as relatively, is there any area of Kopertis that has not been efficient implementation?. By using Data Envelopment Analysis (DEA), it is resulting three Kopertis regions obtained efficient in managing of public higher education and six Kopertis region efficient in managing of private higher education. From the findings of this study, for kopertis has not been efficient in managing, it will be determined strategic innovation in order to improve the efficiency in managing of higher education institutions under kopertis.

Keywords: Efficiency, Data envelopment analysis, kopertis

INTRODUCTION

Indonesia population approximately 230 million people, has 3078 higher education institution (Pusat Data, 2012), which consists of five types institutions, namely: university, institute, colleges, academy and polytechnic. The number of registered students were 5.616.670 people, 1.142.835 people as new students, while only 738.260 people graduated (data of 2011/2012), means only approximately 10.9% of the total number of students. In this case the output that comes out is still far below the student input. So that as the aggregate, only reached 64.6% efficiency. It is easy to understand, because of the variability in the quality of higher education that are represented at the level of accreditation of higher education at study program and institutional level. Coupled with the quality of the new students entry. From the data BAN-PT (BAN-PT website, 2015), at least 163 higher education institutions that have been accredited institution, in percentage was 5.3%. And besides that there were still thousands of study program who had not been A or B accredited. For that, we need some strategic innovation to improve institutional accreditation and study programs accreditation. Here strategic innovation needs to be developed from the study program, higher education institutions up to the Kopertis and ministry of education and culture.

Education is essentially a production system, involving a transformation process which produces quality graduates as an effective workforce, as well as research and community service (Panday, 2014). In the educational process, requiring a variety of factors of production inputs such as educational institutions, faculties, curriculum and syllabus, facilities and infrastructure, non-educational personnel to produce quality graduates. The production process of the higher education system can be described in Figure-1 (Panday, 2014). To run the production system, each institution of higher education has varies greatly in its management, because has various constraints such as lack of fulltime faculties, limited funds to support the educational process, limited of facilities and infrastructure, so that produce graduates who are diverse in terms of quality and quantity.

Figure-1. Higher education Input-Proses-Output System

For those reasons, the ministry of education and culture, has issued various regulations that strengthen national education legislation and law of teachers and lecturers, so that each institution of higher education become to high-quality education and producing quality graduates. The government has determined 8

standards of education, there were (Standar Nasional Pendidikan, 2005): standard of content, standard of process, standard of management, standards of lecturer and staff, standard of facilities and infrastructure, standards of financing, standards of graduates and the standards of research and community service. For the standard of lecturer, the government required a minimum educational qualification as S2 educated in their field (Undang-undang Guru dan Dosen, 2005), has a National Lecturer Identification Number (NIDN), and has a functional position. The faculty who are taking classes S2 (masteral degree) and S3 (doctoral degree) are required to publish their research in international journals (Sistem Pendidikan Nasional, 2003). All requirements to be a lecturer, force feeling in the current is that burdensome for lecturers and of course also for higher education institutions.

As illustrated, education data in Indonesia presented at Table 1 to Table 5 which have been derived from (Pusat data, 2012). The amount of existing universities can be seen in Table 1, which also shown that most higher education institutions in Indonesia are Academies and Colleges. Out of 478 universities, 52 are public Universities, while the rest 426 are managed privately.

Table-1 Type and number of higher education in Indonesia

Types of higher education	Total of higher education	Number of public higher education	Number of private higher education
University	478	52	426
Academy	1094	0	1094
Institute	57	7	50
Polytechnic	175	32	143
Colleges	1366	1	1365
Total	3170	92	3078

The number of lecturers for higher education institutions is shown in Table 2.

Table-2 Number of lecturers at public and private HE

Types of higher education	Total of lecturer	Number of lecturer in public HE	Number of lecturer in private HE
University	115.232	48.119	67.113
Academy	16.423	0	16.423
Institute	8.924	3.844	5.080
Polytechnic	10.234	5.898	4.336
Colleges	42.131	117	42.014
Total	192.944	57.978	134.966

There are 192.944 lecturers and with approximately 6.759.505 students, thus, the ratio of lecturers to students is 1: 35 Considering that the average provision ratio is 1:30, this condition didn't fulfil the requirement, but in reality, the ratio varies at each university. However, when taking into account educational background accordance to

laws of teachers and lecturers, eligible lecturers are limited to those with masters or doctoral degrees, including specialist-1 and specialist-2, so that the lecturer to student ratio becomes ineligible according to the National Education Standard (NES) (Standar Nasional Pendidikan, 2005).

To meet the requirements in managing the higher education, still very many institution which do not meet these requirements. However, education must remain running.

Easy to see efficiency, can be calculated from the number of students entering and graduating. Number new student in table-3, number registered student in table-4 and number of graduate student in table-5.

Table-3 Number of new student at public and private HE

Types of higher education	Total of new student	Number of new student in public HE	Number of new student in private HE
University	817.979	453.013	364.966
Academy	79.249	0	79.249
Institute	60.269	22.815	37.454
Polytechnic	39.378	20.854	18.524
Colleges	145.960	350	145.610
Total	1.142.835	497.032	645.803

In the new admissions, private higher education students receive much more than the public higher education.

Table-4 Number of registered student at public and private HE

Types of higher education	Total of registered student	Number of registered student in public HE	Number of registered student in private HE
University	3.629.115	1.664.737	1.964.378
Academy	360.713	0	360.713
Institute	228.437	74.587	153.850
Polytechnic	159.147	76.033	83.114
Colleges	1.239.258	1.034	1.238.224
Total	5.616.670	1.816.391	3.800.279

At private higher education, student has registered almost twice than at the public higher education. It seen, private higher education has a greater capacity than public higher education capacity. Efficient of public higher education graduates is 66.04%, while the efficiency of private higher education is 63.49%. Efficiency here is only calculated from graduate students to new students, not taking into account other of production inputs factors in the educational process.

Table-5 Number of student graduate at public and private HE

Types of higher education	Total of student graduate	Number of student graduate in public HE	Number of student graduate in private HE
University	521.218	300.468	220.750
Academy	45.988	0	45.988
Institute	28.267	11.810	16.457
Polytechnic	26.359	15.850	10.509
Colleges	116.428	113	116.315
Total	738.260	328.241	410.019

Seeing efficiency is still less than one (1) or less than 100%, its indication, any other of production inputs factors that have not been used optimally.

Coordination of private universities (Kopertis), assist, supervise and monitor the course of higher education in each Kopertis region. With the imperfections in the management department at each institution of higher education, as aggregate, it is very interesting to study, how the aggregate efficiency between regions of Kopertis in producing graduates of higher education as relatively?

REVIEW OF LITERATURE

Efficiency is often associated with the performance of an organization because efficiency reflects the ratio between the output to the input. In the many literatures, the efficiency is also often associated with productivity because both are equally variable rate input to output. Understanding productivity in contrast with the notion of efficiency. Productivity is calculated by dividing the output to input, while the efficiency is input divided by output. Figure 1 illustrates the relationship between inputs, processes and outputs in calculate of efficiency and productivity.

Figure-2 Input dan Output relation

Efficiency and productivity is an index that shows the results of the comparison between the output and input. Both of these ratios indicate that the efficiency or productivity index can be controlled by manipulating the input or output management, or even both at once. Efficiency and productivity can be used to measure the performance of various activities both economic activity, social, cultural etc. Efficiency in an effort to achieve maximum results with the use of available resources, which include natural resources, capital, and people within a certain time. An activity can be called efficient if attempts have been made, providing maximum output, both of quantity and quality. An activity can also be said to be efficient if the minimum

effort can achieve a certain output. Effort encompasses the material, mind, physical energy, space, and time. Efficiency is the ratio between the output to the input. In addition there is an optimum efficiency is the best ratio between output and input. According Yazar Oscan A. (2008), the concept of efficiency can be translated into technical efficiency, the efficiency of scale (scale efficiency), cost efficiency (price efficiency) and allocative efficiency. Measurement of efficiency can be done by various methods, namely ratio analysis, least-squares regression (LSR), total factor productivity (TFP), stochastic frontier analysis (SFA), and data envelopment analysis (DEA). Of all the ways the calculation efficiency, DEA is the most appropriate method for this study, because the DEA uses many inputs and many outputs.

Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a non-parameter approach to evaluate the performance of a set of homogeneous entities called Decision Making Units (DMU) where there are lots of inputs and outputs, each of which have different weights (weighted multiple inputs and weighted multiple outputs). This method was first discovered by Charnes, Cooper and Rhodes (CCR) (Charnes et al., 1978) with the aim to maximize the efficiency of DMU are assessed from some set of entities. The term decision making units can be used to represent non-profit institutions such as schools, hospitals, government output of the institution will usually difficult to quantify the value of money.

In this study, the DMU will represent Kopertis. The weights of each input and output is very varied, which is determined from the importance of the input and output of the DMU.

DMU will have a value of 100% efficiency when there is the most forward position. Comparative efficiency value will be provided by the DEA following conclusions and efficiency of each DMU. Efficiency and productivity assessment factors are influenced by the input and output variable amount. The calculation of the efficiency of Universities mostly apply Data Envelopment Analysis (DEA) (Ahn et al., 1988).

If there are four input which becomes the input of the DEA then there are four linear programming equations to be solved for each DMU (in this case is Kopertis) to determine the distance:

$$\left. \begin{aligned} D_0^t [x^{t+1}, u^{t+1} / CRTS]^{-1} &= \text{Max } \lambda \\ \text{Subject untuk } \sum \lambda_i x_i^t &\leq x^{t+1} \\ \sum \lambda_i u_i^t &\geq \lambda u^{t+1} \\ \lambda &\geq 0 \end{aligned} \right\} \text{----- (1)}$$

$$D_0^{t+1}[x^t, u^t / CRTS]^{-1} = \text{Max } \lambda$$

Subject untuk $\sum \lambda_i x_i^t \leq x^t$
 $\sum \lambda_i u_i^t \geq \lambda u^t$
 $\lambda \geq 0$

----- (2)

$$D_0^{t+1}[x^{t+1}, u^{t+1} / CRTS]^{-1} = \text{Max } \lambda$$

subject untuk $\sum \lambda_i x_i^{t+1} \leq x^{t+1}$
 $\sum \lambda_i u_i^{t+1} \geq \lambda u^{t+1}$
 $\lambda \geq 0$

----- (3)

$$D_0^t[x^t, u^t / CRTS]^{-1} = \text{Max } \lambda$$

subject untuk $\sum \lambda_i x_i^t \leq x^t$
 $\sum \lambda_i u_i^t \geq \lambda u^t$
 $\lambda \geq 0$

----- (4)

Where K, N, M, and T represent number of kopertis, input, output and time periode of sample. In this study K = 12, N = 8, M = 1 and T = 1, Time Period: t = 2011 and λ 's is intencity parameter. To twelve linear equations required for each unit of production (total production of each Kopertis of this study). DEA has been widely used in various organizations or companies to measure the efficiency of organizations / companies. Several studies relating to the use of DEA on educational issues conducted by Handaru Jati. (April, 2015), using DEA to assess the efficiency of the University LPTK in Indonesia, Martin Flégl & Kristýna Vltavská(2013) measure the Efficiency at Faculties of Economics in the Czech Public Higher Education Institutions, Zara Daghbashyan(2011) using DEA in The Economic Efficiency of Swedish Higher Education Institutions, Emilio Martin (2003), applying the Data Envelopment Analysis Methodology in the Performance Assessment of the Zaragoza University Departments, Altamirano-Corro et al (2012), have measured the institutional efficiency using data envelopment analysis and analytic hierarchy process in the case of a Mexican University.

METHODOLOGY

This study used Data Envelopment Analysis. The data used are secondary data from Indonesian education statistics report for the period 2011-2012. The data collected were data of number of higher education institutions, number of new students, number of students registered, number of graduates, number of lecturers, number of lecturers with D3, number of lecturers with S1 / D4(bachelor degree/ Diploma), number of lecturer with S2(masteral degree), number of lecturer with S3(doctoral degree), number of lecturers with SP(Specialist) , number of lecturers with Profession and the amount of part timer lecturer for each kopertis region. All these data are grouped in Kopertis region. The data will be made and calculated in four files:

1. Scenario-1, the cumulative data across higher education (public and private)
2. Scenario-2, public higher education data only
3. Scenario-3, private higher education data only
4. Scenario-4, public higher education data and private higher education data

Thus there are four results will count of the efficiency.

All data, input and output variables are defined as follows:

Tabel-6 Variable name and variable orientation

Variable Name	Variable orientation	Variable type
Number of institution	INPUT	STANDARD
Number of New student	INPUT	STANDARD
Number of Student registered	INPUT	STANDARD
Number of Graduates	OUTPUT	STANDARD
Number of Lecturer	INPUT	STANDARD
Number of D3 Lecturer	INPUT	STANDARD
Number of D4/S1 Lecturer	INPUT	STANDARD
Number of S2 Lecturer	INPUT	STANDARD
Number of S3 Lecturer	INPUT	STANDARD
Number of Sp Lecturer	INPUT	STANDARD
Number of Profesion Lecturer	INPUT	STANDARD
Number of Part time Lecturer	INPUT	STANDARD

Calculation of relative efficiency using software OSDEA (Open Software Data Envelopment Analysis). This study is limited to the technical efficiency.

RESULT AND DISCUSSION

From data collection, tabulated in the table, presented at the attachment of this paper. Results of aggregate efficiency of the management of higher education in Indonesia in each of Kopertis area shown in the table-7.

Table-7 Computation result of efficiency for each scenario

	Scenario-1	Scenario -2	Scenario -3	Scenario -4	
	Total HE	Public HE	Private HE	Public + Private HE	
DMU Name	Objective Value	Objective Value	Objective Value	Objective Value	Objective Value
kopertis-1	0,907444305	0,775052129	1	0,775052129	1
kopertis-2	1	0,898662698	1	0,898662698	0,973639954
kopertis-3	1	1	1	1	0,713763143
kopertis-4	0,98571232	0,910175812	0,866388724	0,910175812	0,800418134
kopertis-5	1	0,811510086	1	0,811510086	1
kopertis-6	1	0,69140696	1	0,690250501	1
kopertis-7	0,834076162	0,661017792	1	0,661017792	0,95982266
kopertis-8	0,999285264	0,614438341	1	0,614438341	1
kopertis-9	0,93423763	0,74185278	0,947161098	0,74185278	0,947161098
kopertis-10	1	0,933724044	0,88929505	0,933724044	0,850561765
kopertis-11	1	1	1	1	1
kopertis-12	1	1	1	1	1

In table 7, shown that management of higher education in each Kopertis region, which is efficient for each scenario, providing the efficiency value as 1. While in-efficiency has a value less than 1. In Scenario 1, for the cumulative data of higher education, in terms of managing of higher education, Kopertis regions that had have efficient, are 7 areas, namely: Kopertis-2, Kopertis-3, Kopertis-5, Kopertis-6, Kopertis-10, Kopertis-11 and Kopertis-12. Five Kopertis of the rest have not efficient. In this study, mean 7 Kopertis those are efficient, it is efficient in terms of use of production inputs factors, namely the number of higher education, the number of faculty and number of student as shown in the slack table below:

Table-8 Slack of Scenario -1

DMU Name	Number of Institution	New Student	Registered student	Graduate	Number of Lecturer	D3 Lecturer
kopertis-1	237,81	0	222.931,78	0	12.443,27	123,89
kopertis-2	0	0	0	0	0	0
kopertis-3	0	0	0	0	0	0
kopertis-4	112,95	0	97.336,17	0	7.254,41	51,29
kopertis-5	0	0	0	0	0	0
kopertis-6	0	0	0	0	0	0
kopertis-7	57,45	0	72.782,38	0	7.731,87	22,63
kopertis-8	75,21	0	103.453,69	0	7.029,39	0
kopertis-9	60,43	0	109.992,79	0	4.859,06	0
kopertis-10	0	0	0	0	0	0
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

(continue of table-8)

DMU Name	D4S1 Lecturer	S2 Lecturer	S3 Lecturer	Sp Lecturer	profesi Lecturer	Part timer Lecturer
kopertis-1	4.623,53	3.081,90	139,43	41,71	190,94	4.241,87
kopertis-2	0	0	0	0	0	0
kopertis-3	0	0	0	0	0	0
kopertis-4	2.100,89	1.966,54	1.845,95	0	-	1.304,04
kopertis-5	0	0	0	0	0	0
kopertis-6	0	0	0	0	0	0
kopertis-7	1.158,40	4.163,33	889,67	0	49,97	1.364,45
kopertis-8	2.009,33	3.568,21	465,73	0	84,62	901,99
kopertis-9	1.905,02	1.520,68	720,93	0	127,54	586,09
kopertis-10	0	0	0	0	0	0
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

In scenario 1, the factor that efficient in use of production inputs is the number of new students, it seen from slack value equal to zero are related with factors of production output is the number of students graduate.

At slack table, which contains zero, meaning the use of production factors is efficient, while if not zero, meaning the use of production inputs factors inefficient. The number listed for that have not efficient is the residual / slack of the production inputs factors.

This can be interpreted as relatively to scenario 1, there are the production factors have not efficient to use in the five Kopertis regions.

In scenario 2, where the calculation of the efficiency of the data only for public higher education. Computation results shown only 3 Kopertis regions have efficient those are Kopertis-3, Kopertis-11 and Kopertis-12. Whereas for other Kopertis shown have not efficient.

Table-9. Slack of Scenario -2

DMU Name	Number of institution	New Student	Registered student	Graduate	D3 lecturer	D4S1 Lecturer
kopertis-1	4,03	0	15.781,29	0	1,55	405,55
kopertis-2	2,44	2.045,44	14.813,71	0	10,01	0
kopertis-3	0	0	0	0	0	0
kopertis-4	0,37	6.370,99	0	0	4,27	175,01
kopertis-5	1,94	0	18.772,94	0	2,43	169,12
kopertis-6	3,47	0	16.058,59	0	3,44	214,62
kopertis-7	6,46	0	28.836,85	0	0	370,50
kopertis-8	4,58	0	7.201,43	0	1,23	275,07
kopertis-9	4,49	0	15.622,69	0	3,47	590,75
kopertis-10	3,20	132,17	24.987,72	0	2,18	0
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

(continue of table-9)

DMU Name	S2 Lecturer	S3 Lecturer	Sp Lecturer	Profesi Lecturer	Part timer Lecturer	Number of Lecturer
kopertis-1	2.109,69	388,43	109,54	143,29	0,48	3.158,54
kopertis-2	881,50	293,07	0	34,02	0	1.218,60
kopertis-3	0	0	0	0	0	0
kopertis-4	1.651,83	1.604,27	0	25,35	0	3.460,74
kopertis-5	1.458,99	733,77	42,83	1,11	1,17	2.409,42
kopertis-6	2.385,08	503,95	0	46,76	2,72	3.156,57
kopertis-7	2.681,77	839,12	74,09	113,50	9,82	4.088,80
kopertis-8	1.762,88	353,01	14,09	50,27	1,03	2.457,58
kopertis-9	2.649,33	760,87	0	112,39	0	4.191,00
kopertis-10	1.047,01	453,02	0	70,12	0	1.572,33
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

In table 9, slack of scenario-2, it seen, production inputs factors that efficient use are having a slack value of zero, while the use of production input factors that have not efficient, it slack value not equal to zero. The smallest slack is number of institutions, the number of lecturers with D3 and number of part-time lecturers, means the use of a third factors of production are already nearly efficient among public universities.

In scenario 3, where the Computation of relative efficiency among private universities, computation results indicate that 9 kopertis region have been efficient. While the rest

kopertis region have not efficient, those are kopertis-4, kopertis-9 and kopertis-10. The slack of scenario-3 at the table-10.

Tabel-10. Slack of Scenario -3

DMU Name	Number of institution	New Student	Registered student	Graduate	D3 lecturer	D4S1 Lecturer
kopertis-1	0	0	0	0	0	0
kopertis-2	0	0	0	0	0	0
kopertis-3	0	0	0	0	0	0
kopertis-4	0	0	13.714,90	0	52,86	33,59
kopertis-5	0	0	0	0	0	0
kopertis-6	0	0	0	0	0	0
kopertis-7	0	0,00	0,00	0	0,00	0,00
kopertis-8	0	0	0	0	0	0
kopertis-9	81,77	6.830,97	104.129,50	0	12,55	886,78
kopertis-10	54,55	0	4.521,20	0	5,78	53,51
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

(continue of table-10)

DMU Name	S2 Lecturer	S3 Lecturer	Sp Lecturer	profesi Lecturer	Part timer Lecturer	Number of Lecturer
kopertis-1	0	0	0	0	0	0
kopertis-2	0	0	0	0	0	0
kopertis-3	0	0	0	0	0	0
kopertis-4	299,81	318,11	29,03	-	300,63	1.034,03
kopertis-5	0	0	0	0	0	0
kopertis-6	0	0	0	0	0	0
kopertis-7	0	0	0	0	0,00	0
kopertis-8	0	0	0	0	0	0
kopertis-9	328,18	118,35	0	49,77	0	1.395,62
kopertis-10	0	0	0	49,61	0	108,90
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

At the table-10, slack of scenario-3, it seen production factors of inputs that efficient use are having a slack value of zero, while the use of production input factors have not efficient, it slack value not equal to zero. If compare to scenario-2, use of production input factor at scenario-3, more better than scenario-2. As relatively, management of higher education by private higher education more efficient compared to management of higher education by public higher education.

At scenario-4, where the computation of relative efficient among public higher education and private higher education, shown there are 3 kopertis regions for public higher education that have efficient (kopertis-3, kopertis11 dan kopertis-12) and 6 kopertis regions for private higher education that have efficient (kopertis-1, kopertis-5, kopertis-6, kopertis-8, kopertis-11 dan kopertis-12). Its means, there are 9 kopertis regions have efficient of 24 kopertis DMU. The slack of scenario-4 shown at table-11.

Tabel-11 Slack op Scenario -4

DMU Name	Number of institution	New Student	Registered student	Graduate	D3 lecturer	D4S1 Lecturer
kopertis-1	4,03	0	15.781,29	0	1,55	405,55
kopertis-2	2,44	2.045,44	14.813,71	0	10,01	0
kopertis-3	0	0	0	0	0	0
kopertis-4	0,37	6.370,99	0	0	4,27	175,01
kopertis-5	1,94	0	18.772,94	0	2,43	169,12
kopertis-6	3,10	0	15.901,87	0	3,42	211,30
kopertis-7	6,46	0	28.836,85	0	0	370,50
kopertis-8	4,58	0	7.201,43	0	1,23	275,07
kopertis-9	4,49	0	15.622,69	0	3,47	590,75
kopertis-10	3,20	132,17	24.987,72	0	2,18	-0
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0
kopertis-1A	0	0	0	0	0	0
kopertis-2A	101,09	0	85.444,09	0	17,76	1.722,37
kopertis-3A	100,24	4.662,34	0	0	96,04	2.796,45
kopertis-4A	58,12	0	0	0	49,45	17,22
kopertis-5A	0	0	0	0	0	0
kopertis-6A	0	0	0	0	0	0
kopertis-7A	0	20.141,90	29.132,00	0	77,16	0
kopertis-8A	0	0	0	0	0	0
kopertis-9A	81,77	6.830,97	104.129,50	0	12,55	886,78
kopertis-10A	66,94	575,13	316,66	0	10,84	0
kopertis-11A	0	0	0	0	0	0
kopertis-12A	0	0	0	0	0	0

(continue of table-11)

DMU Name	S2 Lecturer	S3 Lecturer	Sp Lecturer	profesi Lecturer	Part timer Lecturer	Num,ber of Lecturer
kopertis-1	2.109,69	388,43	109,54	143,29	0,48	3.158,54
kopertis-2	881,50	293,07	0	34,02	0	1.218,60
kopertis-3	0	0	0	0	0	0
kopertis-4	1.651,83	1.604,27	0	25,35	0	3.460,74
kopertis-5	1.458,99	733,77	42,83	1,11	1,17	2.409,42
kopertis-6	2.384,34	503,67	0	46,80	0	3.149,52
kopertis-7	2.681,77	839,12	74,09	113,50	9,82	4.088,80
kopertis-8	1.762,88	353,01	14,09	50,27	1,03	2.457,58
kopertis-9	2.649,33	760,87	0	112,39	0	4.191,00
kopertis-10	1.047,01	453,02	0	70,12	0	1.572,33
kopertis-11	0	0	0	0	0	0
kopertis-12	0	0	0	0	0	0

kopertis-1A	0	0	0	0	0	0
kopertis-2A	1.260,19	0	0	80,87	831,40	3.912,59
kopertis-3A	1.991,14	152,91	0	74,52	1.257,33	6.368,38
kopertis-4A	1.198,02	482,77	0	0	427,35	2.174,81
kopertis-5A	0	0	0	0	0	0
kopertis-6A	0	0	0	0	0	0
kopertis-7A	325,03	0	0	46,07	1.154,71	1.602,97
kopertis-8A	0	0	0	0	0	0
kopertis-9A	328,18	118,35	0	49,77	0	1.395,62
kopertis-10A	60,94	0	0	61,51	0	133,29
kopertis-11A	0	0	0	0	0	0
kopertis-12A	0	0	0	0	0	0

At the table-11 slack of scenario-4, it seen of production inputs factors that efficient use are having a slack value of zero, while the use of production input factors are have not efficient, it slack value not equal to zero. As relatively, production input factor that nearly efficient are number of institutions, number of lecturer with D3 educated, number of lecturer with SP educated and number of part time lecturer. Public higher education more efficient in use production input factor of number of institutions, number of lecturer with D3 educated, and number of part time lecturer compared to private higher education. Private higher education more efficient in use production input factor at number of lecturer with SP educated, compared to public higher education. Based on above scenario, use of production factor of lecturer with with S2, S3 and profession education have not efficient, its indicated by the slack number are still big.

Thus, the strategic innovation to improve the efficiency of education in each Kopertis are as follows:

1. Empower and increase the use of university lecturers with S2, S3 and professions eduaction.
2. Increase the use of idle capacity of facilities and infrastructure at each higher education institution.
3. Provide opportunities profusely, and systematically of the lecturer who will conduct further studies to pursue S2 (masteral degree) and S3(doctoral degree).
4. Conduct the bench marking education administration to the efficient of kopertis region.

CONCLUSIONS

1. In Scenario 1, for the cumulative data of higher education, in terms of the management of higher education, Kopertis regions that had have efficient are 7 areas, namely: Kopertis-2, Kopertis-3, Kopertis-5, Kopertis-6, Kopertis-10, Kopertis-11 and Kopertis-12. Five Kopertis of the rest have not efficient.
2. In scenario 2, shown only 3 Kopertis regions have efficient, those are Kopertis-3, Kopertis-11 and Kopertis-12. The rest of kopertis region have not efficient.
3. In scenario 3, indicate that 9 kopertis region have been efficient. While the rest of kopertis region have not efficient, those are kopertis-4, kopertis-9 and kopertis-10.

4. At scenario-4, shown there are 3 kopertis regions for public higher education that have efficient (kopertis-3, kopertis11 dan kopertis-12) and 6 kopertis regions for private higher education that have efficient (kopertis-1, kopertis-5, kopertis-6, kopertis-8, kopertis-11 dan kopertis-12). Its means, there are 9 kopertis regions have efficient of 24 kopertis DMU.
5. As over all, use of production input factors of lecturer with S2, S3 and profession education have not efficient, it seen by the slack number are still big.
6. Management of private higher education more efficient compared to management of public higher education.

REFERENCES

Ahn, T., Charnes, A. & Cooper, W.W. (1988). Some statistical and DEA evaluations of relative efficiencies of public and private institutions of higher learning. *Socio-Economic Planning Sciences*, Vol. 22, No. 6, pp. 259-269.

Altamirano-Corro et al .(2012).Measuring the institutional efficiency using data envelopment analysis and analytic hierarchy process: The case of a Mexican UniversityAltamirano-Corro Antonio. *African Journal of Business Management* Vol. 6(50), pp. 11923-11930, 19 December, 2012 .Available online at <http://www.academicjournals.org/AJBM>. DOI: 10.5897/AJBM10.770. ISSN 1993-8233 © 2012 Academic Journals

BAN-PT. Web site .(2015). <http://ban-pt.kemdiknas.go.id/>

Charnes, A.W., Cooper, W.W. & Rhodes, E.(1978). Measuring Efficiency of Decision Making Units. *European Journal of Operational Research*, Vol. 2, pp. 429-444.

Emilio Martin .(2003). An Application of the Data Envelopment Analysis Methodology in the Performance Assessment of the Zaragoza University Departments. Retrieved from: <http://www.dteconz.unizar.es/DT2003-06.pdf>

Handaru Jati.(April,2015). Penilaian efisiensi Universitas LPTK di Indonesia Dengan Menggunakan Data Envelopment Analysis. Program Studi Pendidikan Teknik Informatika, Universitas Negeri Yogyakarta. Retrieved from: <http://staff.uny.ac.id/sites/default/files/penelitian/Handaru%20Jati,%20ST.,M.M,%20M.T,%20Ph.D/Penilaian%20Efisiensi%20Universitas%20LPTK%20di%20Indonesia%20dengan%20Data%20Envelopment%20Analysis%20.pdf>

Martin Flégl & Kristýna Vltavská. (2013). Efficiency at Faculties of Economics in the Czech Public Higher Education Institutions: Two Different Approaches. Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Prague, Czech Republic. 2013 Online Published: September 26, 2013. doi:10.5539/ies.v6n10p1 URL: <http://dx.doi.org/10.5539/ies.v6n10p1>. *International Education Studies*; Vol. 6, No. 10; 2013. ISSN 1913-9020 E-ISSN 1913-9039 .Published by Canadian Center of Science and Education.

Ozcan, Yasar A. (2008), "Health Care Benchmarking and Performance Evaluation", Springer, New York

Panday, Rorim .(2014). Quality Assurance Implementation In Higher Education To Strengthen The Innovation Strategy In Facing Globalization: A Case Study. *Paper presented at ICOI-2014, 12-14 agustus,, De la Salle, Manila, Philipine*

Pusat Data dan Statistik Pendidikan.(2012).Statistik Perguruan Tinggi (PT) Tahun 2011/2012. Sekretaris Jenderal Kementerian Pendidikan dan Kebudayaan Republik Indonesia.

Sistem Pendidikan Nasional.(2003).Undang-undang Republik Indonesia Nomor 20 Tahun 2003 tentang Sistem Pendidikan Nasional

Standar Nasional Pendidikan.(2005). Peraturan Pemerintah Nomor 19 tahun 2005 tentang Standar Nasional Pendidikan.

Undang-undang Guru dan Dosen.(2005). Undang-undang Republik Indonesia Nomor 14 Tahun 2005 tentang Guru dan Dosen.

Zara Daghbashyan.(2011).The Economic Efficiency of Swedish Higher Education Institutions. Division of Economics CESIS, KTH, CESIS Electronic Working Paper Series.Paper No. 245.The Royal Institute of technology Centre of Excellence for Science and Innovation Studies (CESIS). <http://www.cesis.se>

ATTACHMENTS

Tabel-1 Cummulative data for all higher education

DMU Name	Number of institution	New Student	Registerd student	Graduate	Number of Lecturer	D3 lecturer
kopertis-1	360	87633	542990	57059	20290	179
kopertis-2	218	53800	341379	35933	11239	52
kopertis-3	339	303325	1029117	217643	22767	147
kopertis-4	496	138627	758489	86070	28795	123
kopertis-5	126	55196	244158	38866	9280	11
kopertis-6	253	89346	397460	57647	15101	58
kopertis-7	341	146746	693926	86298	25216	116
kopertis-8	146	41459	264087	28844	11210	21
kopertis-9	359	89427	582525	51288	21047	48
kopertis-10	258	61749	361260	39246	12345	39
kopertis-11	174	45032	256364	25728	9395	24
kopertis-12	100	30495	144915	13638	6259	6

(continue of table-1)

DMU Name	D4/S1 Lecturer	S2 lecturer	S3 Lecturer	Sp Lecturer	Profesi Lecturer	Part time Lecturer
kopertis-1	7062	6205	806	243	276	5519
kopertis-2	3600	4617	672	86	156	2056
kopertis-3	6808	9722	2258	682	227	2923
kopertis-4	8287	11840	3281	179	177	4908
kopertis-5	1840	5001	1509	138	50	731
kopertis-6	3667	8221	1304	131	231	1489
kopertis-7	6321	11676	2345	306	249	4103
kopertis-8	3246	5412	830	83	133	1485
kopertis-9	6594	8948	1800	98	291	3268
kopertis-10	3649	5650	950	77	220	1754
kopertis-11	2669	4392	542	29	74	1665
kopertis-12	1943	2646	220	11	17	688

Table-2 Public higher education data

DMU Name	Number of institution	New Student	Registerd student	Graduate	D3 lecturer
kopertis-1	6	27513	109744	18257	2
kopertis-2	7	20748	81362	10310	12
kopertis-3	5	170821	554952	146252	0
kopertis-4	8	54701	162949	30617	6
kopertis-5	3	20812	90746	14460	3
kopertis-6	6	31579	125898	18649	5
kopertis-7	11	41808	179448	23661	0
kopertis-8	8	18838	72920	9910	2
kopertis-9	11	39038	153100	21546	6
kopertis-10	10	30675	132944	18210	3
kopertis-11	10	25514	96034	11282	4
kopertis-12	7	14985	56294	5087	0

(continue of table-2)

DMU Name	D4/S1 Lecturer	S2 lecturer	S3 Lecturer	Sp Lecturer	Profesi Lecturer	Part time Lecturer	Number of Lecturer
kopertis-1	569	2976	645	213	191	4	4600
kopertis-2	378	2225	523	31	57	9	3235
kopertis-3	284	1577	893	445	38	21	3258
kopertis-4	860	4025	2172	96	62	16	7237
kopertis-5	243	1990	1013	107	6	4	3366
kopertis-6	367	3758	896	82	75	8	5191
kopertis-7	630	4443	1488	221	181	20	6983
kopertis-8	479	3043	673	72	86	4	4359
kopertis-9	1170	5050	1352	84	180	15	7957
kopertis-10	643	2992	767	54	98	9	4566
kopertis-11	711	2998	467	23	62	34	4299
kopertis-12	788	1929	184	10	14	2	2927

Table-3 Private higher education data

DMU Name	Number of institution	New Student	Registered student	Graduate	D3 lecturer
kopertis-1	354	60120	433246	38802	177
kopertis-2	211	33052	260017	25623	40
kopertis-3	334	132504	474165	71391	147
kopertis-4	488	83926	595540	55453	117
kopertis-5	123	34384	153412	24406	8
kopertis-6	247	57767	271562	38998	53
kopertis-7	330	104938	514478	62637	116
kopertis-8	138	22621	191167	18934	19
kopertis-9	348	50389	429425	29742	42
kopertis-10	248	31074	228316	21036	36
kopertis-11	164	19518	160330	14446	20
kopertis-12	93	15510	88621	8551	6

(continue of table-3)

DMU Name	D4/S1 Lecturer	S2 lecturer	S3 Lecturer	Sp Lecturer	Profesi Lecturer	Part time Lecturer	Number of Lecturer
kopertis-1	6493	3229	161	30	85	5515	15690
kopertis-2	3222	2392	149	55	99	2047	8004
kopertis-3	6524	8145	1365	237	189	2902	19509
kopertis-4	7427	7815	1109	83	115	4892	21558
kopertis-5	1597	3011	496	31	44	727	5914
kopertis-6	3300	4463	408	49	156	1481	9910
kopertis-7	5691	7233	857	85	168	4083	18233
kopertis-8	2767	2369	157	11	47	1481	6851
kopertis-9	5424	3898	348	14	111	3253	13090
kopertis-10	3006	2658	189	23	122	1745	7779
kopertis-11	1958	1394	75	6	12	1631	5096
kopertis-12	1155	717	36	1	3	1414	3332

Table-4 Public and private higher education data

DMU Name	Number of institution	New Student	Registered student	Graduate	D3 lecturer
kopertis-1	6	27513	109744	18257	2
kopertis-2	7	20748	81362	10310	12
kopertis-3	5	170821	554952	146252	0
kopertis-4	8	54701	162949	30617	6
kopertis-5	3	20812	90746	14460	3
kopertis-6	6	31579	125898	18649	5
kopertis-7	11	41808	179448	23661	0
kopertis-8	8	18838	72920	9910	2
kopertis-9	11	39038	153100	21546	6
kopertis-10	10	30675	132944	18210	3

kopertis-11	10	25514	96034	11282	4
kopertis-12	7	14985	56294	5087	0
kopertis-1A	354	60120	433246	38802	177
kopertis-2A	211	33052	260017	25623	40
kopertis-3A	334	132504	474165	71391	147
kopertis-4A	488	83926	595540	55453	117
kopertis-5A	123	34384	153412	24406	8
kopertis-6A	247	57767	271562	38998	53
kopertis-7A	330	104938	514478	62637	116
kopertis-8A	138	22621	191167	18934	19
kopertis-9A	348	50389	429425	29742	42
kopertis-10A	248	31074	228316	21036	36
kopertis-11A	164	19518	160330	14446	20
kopertis-12A	93	15510	88621	8551	6

(continue of table-4)

DMU Name	D4/S1 Lecturer	S2 lecturer	S3 Lecturer	Sp Lecturer	Profesi Lecturer	Part time Lecturer	Number of Lecturer
kopertis-1	569	2976	645	213	191	4	4600
kopertis-2	378	2225	523	31	57	9	3235
kopertis-3	284	1577	893	445	38	21	3258
kopertis-4	860	4025	2172	96	62	16	7237
kopertis-5	243	1990	1013	107	6	4	3366
kopertis-6	367	3758	896	82	75	8	5191
kopertis-7	630	4443	1488	221	181	20	6983
kopertis-8	479	3043	673	72	86	4	4359
kopertis-9	1170	5050	1352	84	180	15	7957
kopertis-10	643	2992	767	54	98	9	4566
kopertis-11	711	2998	467	23	62	34	4299
kopertis-12	788	1929	184	10	14	2	2927
kopertis-1A	6493	3229	161	30	85	5515	15690
kopertis-2A	3222	2392	149	55	99	2047	8004
kopertis-3A	6524	8145	1365	237	189	2902	19509
kopertis-4A	7427	7815	1109	83	115	4892	21558
kopertis-5A	1597	3011	496	31	44	727	5914
kopertis-6A	3300	4463	408	49	156	1481	9910
kopertis-7A	5691	7233	857	85	168	4083	18233
kopertis-8A	2767	2369	157	11	47	1481	6851
kopertis-9A	5424	3898	348	14	111	3253	13090
kopertis-10A	3006	2658	189	23	122	1745	7779
kopertis-11A	1958	1394	75	6	12	1631	5096
kopertis-12A	1155	717	36	1	3	1414	3332