EKUILIBRIUM : JURNAL BIDANG ILMU EKONOMI VOL. 13 NO 1 (2018): PAGE. 1-10

EKUILIBRIUM

JURNAL BIDANG ILMU EKONOMI

HTTP://JOURNAL.UMPO.AC.ID/INDEX.PHP/EKUILIBRIUM

Investigating Performance Installation of Hospital Room Surgery of Six Hospitals in Special Region of Yogyakarta by Using Data Envelopment Analysis Model Constant Return to Scale

Bhimo Rizky Samudro[1]*, Yogi Pasca Pratama[2]

Universitas Sebelas Maret[1,2]

Kesatuan Intelektual Masyarakat Independen (KIMI) Institute[1,2]

Abstract

This study aims to investigate the efficiency level of hospital surgery hospital installation in Special Region of Yogyakarta Province. Research conceptual constructs are based on input and output performance in institutional performance processes. This research approach uses positivist pattern and is derived by quantitative method. This is to explain the efficiency pattern of the installation of hospital and private hospital surgery rooms. The quantitative method chosen is the concept of Data Envelopment Analysis (DEA). The results showed that 1) the installation of a private hospital surgery room tends to be more efficient than government property; 2) the installation of a special hospital surgical hospital is not absolutely more efficient than a public hospital. As a recommendation, this research provides scenario for setting input usage for efficient performance.

Keywords: hospital, surgical room installation, efficient.

Abstrak

Penelitian ini bertujuan untuk menginvestigasi tingkat efisiensi instalasi kamar bedah rumah sakit di Propinsi D.I Yogyakarta. Konstruksi konseptual penelitian berbasis pada performa input dan output dalam proses kinerja institusi. Pendekatan penelitian ini menggunakan pola positivis dan diderivasikan dengan metode kuantitatif. Hal ini untuk menjelaskan pola efisiensi instalasi kamar bedah rumah sakit pemerintah dan swasta. Metode kuantitatif yang dipilih adalah dengan konsep Data Envelopment Analysis (DEA). Hasil penelitian menunjukkan bahwa 1) instalasi kamar bedah rumah sakit swasta cenderung lebih efsisien dibandingkan milik pemerintah; 2) instalasi kamarbedah rumah sakit khusus bedah tidak mutlak lebih efisien dibandingkan rumah sakit umum. Sebagai rekomendasi, penelitian ini memberikan scenario untuk pengaturan penggunaan input agar performa menjadi efisien.

Kata kunci : *rumah sakit, instalasi kamar bedah, efisien.*

*Corresponding Author: Bhimo Rizky Samudro
E-mail: bhimosamudro@staff.uns.ac.id

ISSN 1858-165X (Print)
ISSN 2528-7672 (Online)

INTRODUCTION

The hospital is an "organization of a non-profit making corporation", which means a business unit that aims not fully for profit. However, to maintain the continuity of business activities and development, efficient management is required. Efficient management will support the achievement of hospital goals in providing health services. The optimal health service to the community is a goal that a hospital must achieve. The optimization of health services from a hospital is influenced by the resources factor owned by the hospital itself. The level of optimization of health services in each hospital will be relatively different. This can happen because in reality the resource level of each hospital is also relatively different.

Based on functional activities in health services, the type of hospital in Indonesia can be divided into 2 (two):

1. Public hospitals: hospitals that provide health care for all areas of medical services.
2. Specialty hospitals: hospitals that provide specialized health services in one area of medical services

Whereas based on the ownership status, the type of hospital in Indonesia can be divided into 2 (two) namely public hospitals and private hospitals. For public hospitals can be further divided into 2 types:

1. Central public hospitals (RSUP): it is public hospitals located in each provincial capital and a referral hospital for cases that cannot be handled by regional public hospitals or private hospitals.
2. Regional public hospital (RSUD): it is public hospital located in each district.

Comparative analysis of optimization of health services between hospitals can be done based on the type of hospital distribution. In the analysis will be seen the ratio of efficiency level of each hospital in using the resources owned.

The efficiency of each hospital will describe the optimization of the hospital in using its resources to produce health service performance. From the comparison based on the division of the aforementioned types of hospital, it can be seen that some hospitals with the same purpose (providing health services to the community), will be able to have the same or different efficiency levels.

In this study, we use 6 (six) hospitals in Yogyakarta Special Province as our research object, which includes central government general hospitals (RSUP), local government general hospitals (hospitals), public private hospitals and private hospitals. We do not compare to their respective level of efficiency in general, but we only compare at the level of efficiency of the installation of the surgical room at each hospital.

The efficiency of the performance of the surgical room installation is assumed to be an element that can represent the efficiency of the hospital in general, since the intensity of use cases of surgical rooms in a hospital is quite dominant. Based on these arguments, research data variables will only be limited to the input (input) and performance (output) of the operating room installation.

LITERATURE REVIEW

Measurement of Labor Input Efficiency and Economic Value Added Value

Measurement of labor input efficiency to economic value added can be done with various approaches or methods. An analysis of the various methods to be used in the measurement of input efficiency (labor), must be kept in view given the bias effect in the conclusion. The basic method that can be used in measuring the efficiency of input to output is parametric method. Parametric analysis to measure the efficiency of labor input to economic sector added value (output), can be divided into two: ratio analysis and regression analysis. Ratio analysis can measure the efficiency level by comparing the number of outputs with the number of inputs. However, this analysis has weaknesses when there are many inputs and outputs used in the analysis (Kuncoro, 2002).

The second parametric analysis is a regression analysis, which compiles a model by assuming output as a function of several inputs. The output will be located as the dependent variable, while the input will be located as an independent variable. The regression equation will produce an estimate of the relation of output level generated from the input of a particular economic sector. Regression analysis can show the elasticity of the use of input to the output produced in an economic sector. The economic sector can be assessed efficiently if the output value generated in real terms is higher than the output value generated in the estimate. In line with ratio analysis, regression analysis also has weaknesses, it is unable to analyze conditions when there are many inputs and outputs.

On the other hand, nonparametric analysis can eliminate the constraints faced by parametric analysis to analyze the efficiency of the input level (labor) on the added value (output). One of the potential nonparametric analyzes that can be used is the Data Envelopment Analysis (DEA) method. The DEA method describes steps designed to measure the relative efficiency of a given economic unit with several other economic units in one observation, where they use the same type of input and output. The DEA model determines the relative efficiency ratios of the economic units (Efficiency of economic unit = total weighted output / total weighted input). DEA methods will be described more clearly in research methods.

The Nature of Data Envelopment Analysis (DEA)

In our investigation and analysis, this study will be based on the theory of Data Envelopment Analysis (DEA). The Data Envelopment Analysis (DEA) method was first introduced by A. Charnes, W.W. Cooper, and Rhodes (1978). The DEA method is used to analyze the relative efficiency of an Economic Activity Unit (UKE). DEA theory describes steps designed to measure the relative efficiency of a given economic unit with several other economic units in one observation, where they use the same type of input and output. Charnes, Cooper and Rhodes introduced the model using the assumption of Constant Return to Scale (CRS). The Constant Return to Scale (CRS) assumption explains that if every input of the UKE is multiplied by a certain value, then the output will increase as much as the increase in input. DEA method assuming CRS is also called CCR model which comes from the initials of the developer's name, Charnes, Cooper, Rhodes (CCR).

The DEA model determines the relative efficiency ratios of the economic units (Efficiency of economic unit = total weighted output / total weighted inputDEA determines the size for inputs and outputs of non-negative economic units and each economic unit must be able to use the same size for its ratio evaluation (total weighted output / total weighted input ≤ 1).

Formulation of DEA *Constant Return to Scale (CRS)*

The objective function of linear programming in the DEA model will be the efficiency ratio (total weighted output / total weighted input). The efficiency ratios will be compared with other sample efficiency ratios (which serve as benchmark / refference sets) of the most efficient (100%). From the comparison result we get multiplier multiplier value γ (shadow price). The shadow price figure is used as a basis for adjusting inputs and outputs of less efficient economic units to efficient. The formulation of the purpose function is indicated by (PAU, 2000):

Maximize Zk = $\dfrac{\sum_{r=1}^{s} Urk.Yrk}{\sum_{i=1}^{m} Vik.Xik}$

The DEA formulation which is the transformation of the linear program is:

maximize Zk = $\sum_{r=1}^{s} Urk.Yrk$, (by using constraint) :

$$[\mathrm{P}kj].UrkY.rj - \sum_{i=1}^{m} VikXij \leq 0;\ j = 1,\ldots.n$$

$$[qk]\sum_{i=1}^{m} VikXik = 1$$

$$Urk \geq 0; r = 1,\ldots s$$

$$Vrk \geq 0;\ j = 1,\ldots m$$

Description

n = the number of economic unit

i =input i

k= economic unit k

m = the number of input

r =output r

j= economic unit j

s = the number of output

V and U = weight / size

HYPOTHESIS

1). Instalasi kamar bedah rumah sakit milik pemerintah relatif lebih efisien dibandingkan instalasi kamar bedah rumah sakit milik swasta. The installation of a state hospital surgery room is relatively more efficient than those in a private hospital.

2). Instalasi kamar bedah rumah sakit khusus (bedah) relatif lebih efisien dibandingkan instalasi kamar bedah rumah sakit umum. Installation of a special hospital surgery (surgical) room is relatively more efficient than general hospital surgery room installation.

METHOD

This study utilizes data envelopment analysis (DEA) by using quantitative data to support qualitative analysis result.

The instrument of the study is the implementation of linear programming formulation-based data envelopment analysis (DEA). The implementation of DEA concept in the study is described as follows:

Model maximization for 1 unit of surgical room installation activities

Max-Z (RS 1) : Out1 + Out2

Constraint : RS1 Out1+ Out2 – Jmdkt – Altm ≤ 0

RS2 Out1+ Out2 – Jmdkt – Altm ≤ 0

RS3 Out1+ Out2 – Jmdkt – Altm ≤ 0

RS4 Out1 +Out2 – Jmdkt – Altm ≤ 0

RS5 Out1 + Out2 – Jmdkt – Altm ≤ 0

RS6 Out1 + Out2 – Jmdkt – Altm ≤ 0

C7 Jmdkt + Altm = 1

Description:

(Hospital 1 – Hospital n): (Installation of hospital surgical room)

C7 :(added constraint)

Out1 and Out2 : output 1 and output 2.

Jmdkt : medical work hours

Altm : medical devices

RESULT AND DISCUSSION

To test the hypothesis, Data Envelopment Analysis formulation concept is used. The analysis model of the study is described below:

a) **RSPKU Muhammadiyah Bantul (code: RSPKB).**
Max-Z : 103 Out1 + 848 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 2288 Jmdkt + 205 Altm = 1

b) **RSKB Sudirman (code: RSKBS)**
Max-Z : 78 Out1 + 480 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 2496 Jmdkt + 450 Altm = 1

c) **RSU Wates (code : RSUW)**
Max-Z : 86 Out1 + 988 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 3900 Jmdkt + 850 Altm = 1

d) **RSU Bantul (code: RSUB)**
Max-Z : 150 Out1 + 1318 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 5460 Jmdkt + 912 Altm = 1

e) RSKB Patmasuri (code : RSKBP)

Max-Z : 44 Out1 + 328 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 1560 Jmdkt + 600 Altm = 1

f) RSU Dr. Sardjito (code : RSUPS)

Max-Z : 333 Out1 + 4235 Out2

Constraint : RSUB 150 Out1+1318 Out2 – 5460 Jmdkt – 912 Altm ≤ 0

RSUW 86 Out1+988 Out2 – 3900 Jmdkt – 850 Altm ≤ 0

RSUPS 333 Out1+ 4235 Out2 – 35558Jmdkt – 3000Altm ≤ 0

RSKBS 78 Out1 + 480 Out2 – 2496 Jmdkt – 450 Altm ≤ 0

RSKBP 44 Out1 + 328 Out2 – 1560 Jmdkt – 600 Altm ≤ 0

RSPKB 103 Out1 + 848 Out2 – 2288 Jmdkt – 205 Altm ≤ 0

C7 35558 Jmdkt + 3000 Altm = 1

Analysis and Hypothesis Test

The analysis above will be measured by using CMOM computer program and the following paragraph is the result:

a) RSU PKU Muhammadiyah Bantul has an efficient operation room installation. This can be seen from the results of the objective function of value; it is valued 1 or 100% and has the result of the value of shadow price 1 on the extra constraint (C7). Therefore, the installation of the surgical room at RSU PKU Muhammadiyah Bantul is able to produce output optimally with the input used.

b) RSKB Sudirman has a less efficient operating room installation. This can be seen from the value of objective function value (the result is 0.6942 or 69.42%) and has the result of shadow value; it is 0.6942 on the extra constraint (C7). To improve the efficiency (reaching 100%), RSKB Sudirman surgery room installation can use 2 ways:

- By reducing each input by 100% - 69.42% = 30.58% and maintaining its output, 100% efficiency is achieved in serving patients who aged (less than) <15 years old have 78 cases / year and (more than) > 15 years old have 480 cases / year can be done using the formulation of 2496 x 0.6942 = 1732 physician hours / year and medical devices that values Rp.450.000.000 x 0.6942 = Rp 312.000.000 / year.
- By reducing each input by 100% - 68.35% = 31.65% and maintaining its output, 100% efficiency is achieved in serving patients who are (less than) <15 years old have 86 cases / year and those who are (more than) > 15 years old have 988 cases / year can be done using 3900 x 0.6835 = 2672 physician hours / year and medical devices that value Rp.850.000.000 x 0.6835 = Rp 580.975.000 / year.
- By using the multiplier of 1.1651 referring to RSU PKU Muhammadiyah Bantul (based on economic unit of efficiency reference), therefore it uses fewer inputs than before (see appendix 7)

that is 1.1651 x 2288 = 2666 physician / year and medical device 1,1651 x Rp.205.000.000 = Rp.239.000.000 can serve patient who are (less than) <15 years old that is equal to 1,1651 x 103 = 120 case / year (increasing output) and those who are (more than) >15 years old equal to 1,1651 x 848 = 988 cases / year (maintaining the output).

c) RSU Bantul has a less efficient operating room installation. This can be seen from the value of objective function value (= 0.6513 or 65.13%) and has the result of the value of shadow price, 0.6513 on the extra constraint (C7). To improve the efficiency (reaching 100%), surgical room installation RSU Bantul can use 2 ways

- By reducing each input 100% - 65.13% = 34.87% and maintaining its output, 100% efficiency is achieved in serving patients who are (less than) <15 years old have 150 cases / year and those who are (more than) >15 years old have 1318 cases / year can be done by using 5460 x 0.6513 = 3556 physician / year and medical devices that values Rp.912.000.000 x 0.6513 = Rp 594.000.000 / year.
- By using the multiplier of 1.5542 which refers to RSU PKU Muhammadiyah Bantul (economic unit of reference efficiency), then it uses fewer inputs than before (see appendix 7) that is 1.5542 x 2288 = 3556 physician / year and medical device of 1,5542 x Rp.205.000.000 = Rp.319.000.000 can serve patient aged (less than) <15 years old equal to 1,5542 x 103 = 160 case / year (increase output) and those who are (more than) >15 years old equal to 1,5542 x 848 = 1318 cases / year (maintaining the output).

d) RSKB Patmasuri has a less efficient operating room installation. This can be seen from the value of the objective function value (= 0.6265 or 62.65%) and has the value of shadow price = 0.6265 on the extra constraint (C7). To improve the efficiency (reach 100%), RSKB Patmasuri surgery room installation can use 2 ways

- By reducing each input by 100% - 69.42% = 37.35% and maintaining its output, 100% efficiency is achieved in serving patients <15 year old classification has 44 cases / year and >15 years old 328 cases / year can be done using 1560 x 0.6265 = 977 physician / year and medical devices that value Rp.600,000,000 x 0.6265 = Rp 376.000.000 / year.
- By using the multiplier of 0.4272 which refers to RSU PKU Muhammadiyah Bantul (economic unit of reference efficiency), then it uses fewer inputs than before (see appendix 7) that is 0.4272 x 2288 = 977 physician / year and medical device 0.4272 x Rp.205.000.000 = Rp.88.000.000 can serve patients <15 years old values 0.4272 x 103 = 44 cases / year (maintaining output) and age> 15 years old of 0.4272 x 848 = 362 cases / year (increasing the output).

e) Dr. Sardjito has an inefficient operating room installation. This can be seen from the result of the objective function value (= 0.3413 or 34.13%) and has the result of the value of shadow price is 0.3413 on the extra constraint (C7). To improve its efficiency (reaching 100%), installation of surgical room of Dr. Sardjito can use 2 ways,

- By reducing each input by 100% - 34.13% = 65.87% and maintaining its output, 100% efficiency is achieved in serving patients <15 years old of 333 cases / year and> 15 years old of 4235 cases / year can be done using 35558 x 0.3413 = 12136 physician / year and medical devices worth Rp 30,000,000,000 x 0.3413 = Rp 1,024,000,000 / year.
- By using the multiplier of 4.9941 which refers to RSU PKU Muhammadiyah Bantul (economic unit of efficiency reference), using fewer inputs

than before (see appendix 7) of 4.9941 x 2288 = 11427 physician / year and medical device 4,9941 x Rp.205.000.000 = Rp.1.024.000.000 can serve patient <15 years old 4,9941 x 103 = 514 case / year (increase output) and age> 15 years 4,9941 x 848 = 4235 case / year (maintaining output).

Table 1. Efficiency, Reference efficiency, Multiplier, and Status

*See Appendix 1

Based on the above analysis, the discussion about the efficiency of the installation of hospital surgery room in Yogyakarta Special Province in 2016 with a sample of 6 (six) hospitals, some points are drawn.

First, the installation of private hospital surgical rooms is more efficient than the installation of public hospital surgical room.

This can be demonstrated from the calculation results indicating that the relative efficiency level of PKU Muhammadiyah Bantul Public Hospital (a sample of private hospitals is 100% compared to public hospitals, such as Wates Hospital (68.35%) or even Dr. Sardjito Hospital (34 , 13%).

This is is in line with Halme and Korhonnen (1998) and Thanasoullis et al (2016), where private sector positions tend to be more efficient in giving services.

On the other hand, Kalhor et.al (2016) research shows that the private sector has not always been more efficient than the public sector.

Second, the installation of a surgical room in specialty-private hospital was not always more efficient than the installation of a hospital general surgery room.

This can be seen from the relative efficiency level of PKU Muhammadiyah Bantul Public Hospital (public hospital) is higher than RSKB Sudirman (specialty hospital), although in other cases the efficiency level of RSKB Sudirman (69,42) were above RSU Wates (68,35).

Ministry of Health and district health offiuce should provide supervision to the management of government hospitals for more comprehensive administrative and financial management of hospital hospitals (particularly for the installation of surgical rooms).

The development of the establishment of the hospital should be directed to the diversification of services (especially surgery), for instance, there are various kinds of surgical services in a hospital.

This is in line with Samudro (2005) and Personal (2004) study, where both studies see that the element of managerial oversight becomes a crucial aspect in the management of service institutions / industries. Therefore, there is efficiency in the procurement of medical devices (no tools are idle) and can absorb doctors from various disciplines of surgery (unemployed medical personnel can be minimized).

CONCLUSION

The conclusion of this research revelas:

1. The private sector is still dominant compared to the government in the context of health services (especially the installation of the surgical room).. The dominance referred to in this case is the

performance in the management of their production inputs.

2. The pattern of specifications in health services has not guaranteed a performance in the context of the use of inputs and outputs to be more efficient.

REFERENCES

Coelli, T.J.(1996) "A Giude to DEAP 2.1 Program: A Data Envelopment Analysis Program, Centre for Efficiency and Productivity Analysis (CEPA), Working Paper, USA.

Halme, Merja & Pekka Korhonen.,(1998) *"Restricting Weights in Value Efficiency Analysis",* Interim Report, IR-98-104, IIASA, Laxenburg, Austria.

Halme, Joro, & Koivu. (1998) "*Dealing with Interval Scale Data in Data Envelopment Analysis"*, Interim Report, IR-98-112, IIASA, Laxenburg, Austria.

Kalhor, R., Amini, S., Sokhanvar, M., Lotfi, F., Sharifi, M., & Kakemam, E. (2016). Factors affecting the technical efficiency of general hospitals in Iran: data envelopment analysis. *The Journal Of The Egyptian Public Health Association*, *91*(1), 20-25.

Kuncoro, H. (2002), "Evaluasi Sektor Dalam Kebijakan Upah Minimum Regional (UMSR) Dengan Metode DEA", Media Ekonomi Vol 8 No.3, Desember 2002.

Pribadi, Krishna N..(2004) "Pengukuran Kinerja Wilayah Kabupaten/Kota dalam Industri Manufaktur: Aplikasi Metode Data Envelopment Analysis (DEA) untuk Wilayah Kabupaten/Kota di Jawa Barat tahun 1987, 1992, dan 1997", Jurnal IPB, Bogor, 2004.

Pusat Antar Universitas Studi Ekonomi Universitas Gadjah Mada (2000)., "Metodologi Empiris Data Envelopment Analysis", Modul PAU UGM, Yogyakarta, 2000.

Samudro, B. R.,(2005) "Analisis Kinerja Industri Manufaktur di Wilayah Propinsi: Aplikasi Data Envelopment Analysis (DEA) Model Constant Return to Scale (CRS) dan Variabel Return To Scale (VRS) di Propinsi Jawa Tengah Tahun 2004, Makalah Seminar Nasional UNPAR, 2005

Sasono, A., et al., (1994), Pembaruan Sistem Upah, Departemen Tenaga Kerja dan CIDES, Jakarta,.

Sengupta, Jati K. (2000), *"Dynamics and Stochastic Efficiency Analysis"*, Economics of Data Envelopment Analysis, World Scientific Publishing Co, Singapore, 2000.

Thanassoulis, E., De Witte, K., Johnes, J., Johnes, G., Karagiannis, G., & Portela, C. S. (2016). Applications of data envelopment analysis in education. In *Data Envelopment Analysis* (pp. 367-438). Springer US.

Appendix 1

Installation of Surgical Room at 6 (six) Hospital in Special Region of Yogyakarta Province in 2016

No	Hospital	Efficiency Value	Efficiency Reference	Multiplier	Hospital Status
1	RSU PKU Muhammadiyah Bantul	100%	None	None	Private
2	RSKB Sudirman	69,42%	RSU PKU	0,757	Specialty-Private
3	RSU Wates	68,35%	RSU PKU	1,1651	Public
4	RSU Bantul	65,13%	RSU PKU	1,5542	Public
5	RSKB Patmasuri	62,65%	RSU PKU	0,4272	Specialty-Private
6	RSUP Dr. Sardjito	34,13%	RSU PKU	4,9941	Public

Source: analyzed data