

Efficiency in Indonesian Higher Education: Different Governance Leads to Different Performance

**Hisky Ryan Kawulur
Universitas Brawijaya**

**Erwin Saraswati
Universitas Brawijaya**

**Abdul Ghofar
Universitas Brawijaya**

**Arum Prastiwi
Universitas Brawijaya**

This study aims to analyze cost efficiency's performance when producing university outputs from 45 public universities in Indonesia. A stochastic cost frontier multiproduct with six key performance indicators and annual public spending was used as the output and input for the analysis. This study finds that cost efficiency's score is high, compared to one in a previous study. Higher education using the Public Service Agency management pattern has the highest efficiency score compared to establishments with Work Unit and Legal Entity management patterns. This study has several implications; first, the need for effective management patterns; second, the re-evaluation of the privatization policy; and third, improvement in education's output or input.

INTRODUCTION

Efficiency is an important issue in the performance management of public higher education. The more efficient the performance, the better the ability to produce an output with fewer inputs (Staňková & Hampel, 2021). The analysis of efficiency also describes past economic performance and future policy directions (Lewis & Dundar, 1999; Sav, 2016). The demand for efficiency from the education sector continues to grow because the new public management concept states that public higher education must be efficient, accountable, and transparent in managing its inputs and outputs (Lorenz, 2012; Salminen, 2003).

Previous research has proven that performance inefficiencies are still present in many universities, in both developed and developing countries. Most public universities in the US are inefficient at using spending inputs to produce outputs in education and research (Titus *et al.*, 2017). Universities in Italy and Germany are unable to manage their salary and research costs (Agasisti & Gralka, 2019). In the context of developing countries, such as Indonesia, efficiency is still a big problem for public higher education. Some leading universities have problems in managing resources to produce world class university outputs

(Mahmudah & Lola, 2016). The same thing also happens in eight teacher training universities as they struggle to produce their educational output (Jati, 2015).

Most researchers in the past used stochastic frontier analysis (SFA) to evaluate performance efficiency. This approach is considered suitable for research concerning public higher education since it employs multiple inputs and outputs (Agasisti & Belfield, 2014; Agasisti & Haelermans, 2016; Robst, 2001). However, consensus among academics on the use of input and output indicators has not been achieved (Gralka, 2018a). Bolli *et al* (2016) for example, used the number of students as an output, while other researchers, such as Kulshreshtha & Nayak (2015), used that indicator as an input. The amount of research funding was used as an output by Titus *et al* (2021), but used as an input by Bertoletti & Johnes (2021). The absence of rules in this regard has increased researchers' subjectivity in choosing inputs and outputs (Agasisti & Gralka, 2019). Previous studies focused on the use of education and research dimensions as outputs (D'elia & Ferro, 2021), while aspects such as teaching, the institution's quality, and community service rarely received attention from researchers (Gralka, 2018b).

This study uses SFA, while the higher education key performance indicator (HE-KPI) is used as the output and total cost as the input. The HE-KPI is an output standard that is regulated nationally. The standard regulates the similarity of the output among higher education institutions, which is the comprehensive indicator. This indicator consists of the graduates' readiness, the students' activities, the lecturers' activities, the lecturers' qualifications, research and service, and the institutions' cooperation. Total cost is all the expenses paid by the university to get the HE-KPI output. The SFA is used in this study to respond to the research of Ulkhaq (2021) which used data envelopment analysis (DEA) to examine Indonesia's education system. This study aims to analyze and compare the level of cost efficiency of public higher education in Indonesia.

The contribution of this study is, first, providing empirical evidence on the impact of public higher education's privatization on organizational performance; second, providing a basis for decisions about the amount of funds to be distributed to, and spent by, the universities; third, becoming a new alternative in performance evaluation processes for public higher education; and, fourth, providing guidance to researchers who consider outputs in the national scope and dimensions in a more comprehensive way in the SFA model.

Indonesian Higher Education Industry

The education system in Indonesia is regulated by Law No. 12 of 2012, which explains the objectives, authority, and governance of all forms of higher education, i.e. universities, institutes, and polytechnics. With the enactment of this law, the Indonesian government expected to be able to create competitive, characterized, and beneficial resources for community and national progress. Therefore, the Ministry of Education, Culture, Research, and Technology, as the nation's representative for education, issued Regulation Number 3 of 2021 regarding the new performance measure for public higher education establishments, namely the HE-KPI. This performance indicator was expected to transform Indonesia's higher education system, so it becomes more adaptive to the current time and is able to provide more concrete outcomes for the community to win the global competition in this digital era.

The HE-KPI was designed to increase the relevance between the public higher education being provided and the needs of industry, business, and the world of work, which has been neglected by the universities. The HE-KPI has three main dimensions: The quality of the graduates, the quality of the lecturers, and the quality of the curriculum. The dimensions are translated in more detail into eight performance indicators; they are graduates' readiness, students' activities, lecturers' activities, lecturers' qualifications, research and service, institution's cooperation, learning methods, and accreditation. They form the annual output of the business operations of Indonesian public higher education providers. The ministry, at the end of the year, will evaluate the achievement of each HE-KPI that has been planned by the public higher education establishments. In this study, public higher education establishments are considered to be cost minimizers, meaning that they maximize the HE-KPI with minimal costs. This assumption is supported by government regulations that require public higher education institutes to be managed based on the principle of efficiency.

In addition to designing the HE-KPI, the ministry also continues to encourage and facilitate changes in the management pattern of public higher education institutes. Based on the regulation of the Directorate General of Higher Education, there are three types of public higher education management; they are the Work Unit (known as SATKER), the Public Service Agency (known as BLU) and the Legal Entity (known as PTN-BH). In 2021 there were 68 public higher education establishments in Indonesia consisting of 24 SATKER, 33 BLU, and 11 PTN-BH. The difference between these three lies in the level of managerial autonomy and flexibility. PTN-BH is the most independent of all in managing its academic and non-academic affairs. In terms of academics, a PTN-BH is allowed to open and close study programs, determine the requirements for new students, and arrange learning processes without involving the government. In non-academic matters, a PTN-BH can independently determine the fee for the education services it provides, and it has full autonomy in managing its financial affairs, staffing systems, and budgeting. Meanwhile, BLU and SATKER are limited in the management of both areas. The autonomy obtained by PTN-BH is proportional to the reduced input of funds from the government. The government requires PTN-BHs to finance their educational activities by themselves, except for the salaries of lecturers and staff.

The government's implementation of the free learning policy has encouraged the privatization of public higher education. In the Indonesian context, privatization is interpreted as a change in status and management patterns toward greater autonomy (Azra, 2008). The policy of independent learning makes it easier for BLU and SATKER to convert into PTN-BH. The more flexible pattern of university management allows public higher education providers to change themselves and become market oriented, which is expected to be useful for improving their educational performance (Kelsey, 1998). This study assumes that different management patterns will result in different cost management capabilities. PTN-BH is expected to have higher cost efficiency than SATKER and BLU.

RESEARCH METHOD AND DATA

This study used the SFA approach in calculating efficiency because the predictive ability of the approach is obtained from its parametric function. The model used in this study was the SFA translog multiproduct cost frontier, suggested by Agasisti (2016) and Kumbhakar & Knox (2000). The translog function has a higher degree of flexibility and is often used to analyze efficiency in public higher education establishments (see Fahmy-Abdullah *et al.*, 2021; Ferro & D'elia, 2020; Giraleas, 2021; Gralka, 2018a; Titus *et al.*, 2021; Vamosiu *et al.*, 2018). In 2021, based on data from the Ministry of Education, Culture, Research, and Technology, there were 68 public higher education establishments in Indonesia. The sample of this research comprised those who had complete HE-KPI data; the criterion was adopted based on the information from the website of the Ministry of Education, Culture, Research, and Technology (<https://pindai.kemdikbud.go.id/>). Based on that criterion, 45 public higher education establishments were selected as the sample for further analysis; they comprised nine SATKER, 26 BLU, and 10 PTN-BH.

The data of this study were analyzed in two stages. First, the parameter values were calculated from each variable using the maximum likelihood estimator (Belotti *et al.*, 2013). This calculation aimed to estimate the non-linear relationship between the HE-KPI's output and annual expenditure. Second, the value of cost efficiency was calculated using the technique developed by Battese & Coelli (1988). The efficiency value showed the best expenditure management for producing the HE-KPI. The cost frontier model in this study was as follows.

$$C_i = C(y_{(k)i}) \quad (1)$$

or

$$C_i = \sum_k \alpha_k y_{k(i)} + \frac{1}{2} \sum_k \beta_k y_{k(i)}^2 + \sum_k \sum_w \phi_{kw} y_{k(i)} y_{w(i)} + \varepsilon_i$$

$$\varepsilon_i = u_j + v_i \quad (2)$$

C_i was the total expenditure of public higher education i , $Y_{k(i)}$ was the HE-KPI output of public higher education providers, β was the unknown parameter, and ϵ_i was the stochastic error term consisting of the efficiency components of U_i and V_i . In developing the SFA model, this research used the regulation of the Ministry of Education, Culture, Research, and Technology's Regulation Number 3 of 2021, which regulates the similarity of performance outputs. The output data were obtained from the HE-KPI's achievement data of public higher education providers in 2021. The use of the HE-KPI dimensions was in accordance with Checkoway (2001), Marginson (2007) and (Predazzi, 2012) who stated that there were three major missions that must be achieved by universities in their operation, namely educating, researching, and serving the community. Of the eight HE-KPI, this study used six performance indicators because the mission of public higher education was reflected in HE-KPI numbers 1 to 6. The input of total costs was proxied by total public spending in one year. The input data were obtained from the performance reports of the public higher education providers in 2021. The use of total expenditure in the cost frontier has been applied by many researchers to model SFA (Agasisti & Gralka, 2019; D'elia & Ferro, 2021; Fu *et al.*, 2019; Titus *et al.*, 2021; Vamosiu *et al.*, 2018).

TABLE 1
COST MODEL OF PUBLIC HIGHER EDUCATIONS

Variable	Operationalization	Description
Total cost	Total annual expenses of public higher education providers	Total expenses of a university for one year. This indicator describes all costs paid by the university to produce the HE-KPI output
Graduates absorbed by industry	Total number of graduates who get a job, continue their studies, become entrepreneurs	Total number of graduates who wait less than 6 months after graduation before getting a job, less than 12 months after graduation before continuing their studies, and less than 6 months before starting their own business after graduation
Students engaged in off-campus activities	Total number of students who take part in the MBKM program and attain awards of excellence	Total number of students who participate in eight off-campus activity programs or won national-level competitions
Lecturers engaged in off-campus activities	Total number of lecturers who carry out three primary missions in other campuses and in QS100 campuses, and who become practitioners and mentors for competing students	Total number of lecturers who teach, conduct research, and serve at universities which are included in the top 100 according to the QS World University Rankings, work in industry, and become student mentors in national competitions
Lecturers' qualifications	Total number of lecturers with doctoral degrees or certificates of competence	Total number of lecturers with doctoral degrees and who have certificates of competence recognized by the government

Research output	Total of SCOPUS/WOS-indexed research and service	Total of the research output and service included in global indices, such as SCOPUS and Web of Science, and used by the community
Institution's cooperation	Total number of study programs collaborating with partners	Total number of study programs that collaborate with parties outside the campus

Source: Guidelines for Public Higher Educations performance indicators

RESULTS AND DISCUSSION

To get a comprehensive picture regarding the condition of higher education in Indonesia, the results and discussion of this study are described based on three managerial patterns, i.e., PTN-BH, BLU, and SATKER.

TABLE 2
DESCRIPTIVE STATISTICS

Variables	PTN-BH		BLU		SATKER	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Graduates absorbed by industry	2,680	1,000	1,427	1,607	368	385
Students engaged in off-campus activities	6,835	5,701	7,592	14,791	922	753
Lecturers engaged in off-campus activities	742	339	302	301	109	110
Lecturers' qualifications	1,109	377	528	230	242	171
Research output	5,566	2,237	3,841	2,186	1,714	1,123
Institution's cooperation	53	21	37	22	21	12
Total cost (IDR)	1,435	571	605	272	268	180

Note: Total cost in billion IDR

Based on Table 2, the average PTN-BH had better HE-KPI performance than BLU and SATKER. In 2021 the PTN-BH was able to produce 2,680 graduates who found jobs, opened businesses, and continued their studies. Then, the PTN-BH produced 742 lecturers who were active in off-campus activities and 1,109 lecturers with doctoral degrees. High performance was also found in their research output and collaborations. PTN-BH produced 5,566 international research papers and 53 partnerships. In terms of students who were active in off-campus activities, BLU had a superior performance, as 7,592 students participated in the MBKM, literally translated as freedom to learn – independent campus, a program launched by the Ministry of Education, Culture, Research, and Technology. In terms of expenditure, the achievement of the HE-KPI by the PTN-BH was proportional to the costs incurred. They spent IDR 1.4 trillion annually, while BLU and SATKER spend IDR 268 to 605 billion to produce their HE-KPI. This more flexible management pattern also played a role in achieving the HE-KPI's performance. PTN-BH could independently spend funds to support their HE-KPI achievement.

The descriptive statistics show that the data distribution was homogeneous in PTN-BH, BLU and SATKER. Several universities with PTN-BH status, such as Universitas Indonesia and Universitas Gadjah Mada had similar percentages of graduates being absorbed. This was also the case with SATKER and BLU, whose HE-KPI outputs were similarly distributed. In accordance with the regulations regarding salaries and performance allowances, lecturers are entitled to a fixed salary and other income, which is paid monthly. Payments to lecturers can be in the form of salaries, lecturer certification allowances, and performance allowances. The amount of take-home pay received by lecturers is based on their rank, class, and teaching

load. Lecturers with doctoral degrees have a larger scope of work, such as teaching master and doctoral students, so public higher education providers spend more on salaries and allowances.

Table 3 shows the estimated relationship between the HE-KPI outputs and total costs. The ability of each output to change the cost structure needs to be discussed. The results of this study indicated that, in general, the HE-KPI outputs could increase the annual costs that must be paid by public higher education establishments. Lecturers' qualifications were significant at the 1% level. This indicated that the greater the number of lecturers there were who held doctoral degrees, the greater the spending would be. This also indicated that public higher education institutions had to spend a lot of money to pay salaries and allowances for lecturers with doctoral qualifications.

TABLE 3
COST FRONTIER ESTIMATIONS

Variables	Coefficient	Std. Dev.
Log graduates absorbed by industry	-2.397**	1.047
Log students engaged in off-campus activities	1.480	.841
Log lecturers engaged in off-campus activities	-3.712*	1.129
Log lecturers' qualification	5.266*	1.489
Log research output	1.195	2.033
Log institution's cooperation	1.852**	0.944
Log graduates absorbed by industry squared	-0.825	0.110
Log students engaged in off-campus activities squared	-0.969	0.110
Log lecturers engaged in off-campus activities squared	-0.154	0.129
Log lecturers' qualification squared	-0.299	0.468
Log research output squared	0.245	0.547
Log institution's cooperation squared	-0.964	0.259
Log graduates absorbed by industry * Log students engaged in off-campus activities	0.213*	0.073
Log graduates absorbed by industry * Log lecturers engaged in off-campus activities	-0.307*	0.123
Log graduates absorbed by industry * Log lecturers' qualification	0.423	0.226
Log graduates absorbed by industry * Log research output	-0.849	0.215
Log graduates absorbed by industry * Log institution's cooperation	-0.628	0.150
Log students engaged in off-campus activities * Log lecturers engaged in off-campus activities	0.516	0.049
Log students engaged in off-campus activities * Log lecturers' qualification	-0.262	0.145
Log students engaged in off-campus activities * Log research output	-0.719	0.133
Log students engaged in off-campus activities * Log institution's cooperation	-0.935	0.061
Log lecturers engaged in off-campus activities * Log lecturers' qualification	0.248	0.203
Log lecturers engaged in off-campus activities * Log research output	0.511	0.274
Log lecturers engaged in off-campus activities * Log institution's cooperation	0.140	0.142

Log lecturers' qualification * Log research output	-0.637*	0.237
Log lecturers' qualification * Log institution's cooperation	0.899	0.196
Log research output * Log institution's cooperation	-0.249	0.211
Constant	1.285*	2.801
Sigma2	0.168*	0.032
Observation	45	

Note: * significant at 1% level,

** 5%

Institution's cooperation was significant at the 5% level, indicating that the more cooperation a study program had, the greater the annual fee paid by the public higher education provider. This was caused by the impact of the implementation of the MBKM policy. Since the policy was launched in 2020, public higher education providers in Indonesia have been required to implement it in their teaching and learning processes. They are required to provide facilities and places so that students can carry out activities outside their campus, such as doing internships, joining village development programs, teaching in educational institutions, and others. To encourage the achievement of the MBKM, public higher education providers allocate funds to establish relationships with various partners.

Some HE-KPI outputs were found to have no relationship with total costs. Students taking part in the MBKM did not increase the spending of public higher education providers. A survey conducted by the Ministry of Education, Culture, Research, and Technology in 2021 found that the MBKM programs that most students from the public higher education institutions joined were internships and certified independent study programs. These programs provide opportunities for students to work in industry and to take short courses and bootcamps organized by industrial partners. The participating students and public higher educations do not need to pay to join them. The ministry provides incentives such as educational funding aids, allowances, and accommodation for students who take part in the MBKM.

International research output did not increase the costs to be paid by public higher education establishments. In the context of Indonesia, in general, articles published in international journals (SCOPUS/WOS) are mandatory research outputs; they are funded by the Ministry of Education, Culture, Research, and Technology, not by the public higher education institutions. Research and service expenditures made by the public higher education institutions only require lecturers to publish research outputs in a national indexed journal, namely SINTA. Another thing that could be observed from the parameter estimation results was that the Sigma2 value was positive and significant. This value suggested cost inefficiency in the model. This proved that public higher education institutions did not make any attempt to minimize costs.

Table 4 shows the efficiency value of each public higher education institution in Indonesia. The value ranged between 0 and 1, from inefficient to very efficient (Kumbhakar & Knox, 2000). The average efficiency value was 0.86, which was quite high compared to the results of previous studies by Agasisti & Ricca (2016) and Bayraktar *et al* (2013). One thing that is of concern, in the context of public higher education in Indonesia, is that the government has built a competitive climate which encourages output achievement. In 2021 the Ministry of Education, Culture, Research, and Technology formed the PTN-BH, BLU and SATKER league. This league presents HE-KPI achievement competitions between universities in the same managerial type. The winner gets an incentive in the form of an increase in its annual operational assistance fund, which is quite large. In addition to the incentive, the winner is also given prestigious awards that can enhance the image of the university. This scheme, according to Agasisti & Haelermans (2016) is able to encourage the efficiency of the performance of public higher education institutions.

TABLE 4
EFFICIENCY SCORE

Type	Observation	Mean	Min	Max
PTN-BH	10	0.717	0.455	0.965
BLU	26	0.914	0.801	0.978
SATKER	9	0.855	0.491	0.940
Total	45	0.858	0.455	0.978

Note: Efficiency score calculated based on the management patterns of public higher educations

Another finding is that privatization has had a different impact on cost efficiency. Autonomous PTN-BH turned out to have poorer cost management capabilities (0.71) than SATKER (0.86) and BLU (0.91). According to the agency theory of Jensen & Meckling (1976), asymmetric information will make the allocation of spending and the achievement of organizational goals deviate from what is desired by the principal. When the government disburses education funds without having complete information regarding the activities of the university (in the case of PTN-BH), control over cost management will be lost thereby reducing cost efficiency. Complete control and information (in the case of BLU and SATKER) will make expenditure allocations more efficient, and the level of the output will be increased (Schmidt, 1996). Moral hazard problems with the expenditure in certain cases will reduce the efficiency value in the absence of government involvement (Laffont & Tirole, 1991). Another thing that can reduce efficiency is the tendency to focus on finding funding sources, instead of educational outputs. This is frequent found in privately managed universities (Davidovitch & Iram, 2014).

Additional Analysis

Being less efficient due to cost minimization avoidance, i.e., having an efficiency value of < 1 , is an indication that particular public higher education institutions spend more than the allowed stochastic frontier point. This study performs an additional analysis to calculate the optimum expenditure for public higher education institutions. The optimum spending value is the ideal guideline for producing the HE-KPI outputs.

TABLE 5
OPTIMUM PUBLIC SPENDING

Type	Observation	Mean	Min	Max
PTN-BH	10	1,014	642	2,372
BLU	26	553	252	1,323
SATKER	9	212	54	460
Total	45	587	54	2,372

Note: Mean, minimum, and maximum values in billion IDR

Table 5 shows that the total optimum expenditure was IDR 587 billion. According to the managerial pattern, the optimum spending was IDR 1.014 trillion for PTN-BH, IDR 553 billion for BLU, and IDR 212 billion for SATKER. This indicated that public higher education providers must have reduced their actual spending between 10% and 42% in 2021 to generate their HE-KPIs.

CONCLUSION

This study analyzes the cost efficiency level of 45 public higher education establishments in Indonesia and compares their efficiency values according to their managerial pattern. Using the stochastic cost frontier model, this study finds that the cost efficiency value for public higher education establishments in Indonesia

is quite high. Effective government policies have become the main drivers behind the efficiency scores. If the goal of the efficiency improvements is to minimize costs, public higher education establishments with the BLU managerial pattern offer the best value, followed by SATKER and PTN-BH. Regarding the maximum amount required to generate the HE-KPI, this study finds that the annual expenditure varies greatly, depending on the pattern of management.

The implication of this research is for the organization and management of public higher education establishments. First, the different efficiency values between the managerial patterns indicate the need for a management model that can minimize the tradeoffs between autonomy and control. Further evaluation of the impact of different managerial patterns is needed. Second, the universities' privatization policy that encourages BLU and SATKER to become PTN-BH needs to be re-evaluated. The poor cost management capability of the PTN-BH shows that the government's belief that the privatization of public higher education establishments can increase the efficiency and effectiveness of Indonesia's education mission is incorrect. Third, the poor efficiency (efficiency value of < 1) indicates the need for performance improvements in public higher education. The enhancement should be made either to maximize the output or to minimize the input. For example, public higher education establishments can optimize their performance-based budgets by evaluating the expenditure and outputs that they want to achieve.

This study has several limitations. First, the secondary data used in this research are not able to clearly describe the relationship between expenditure inputs and HE-KPI outputs. The efficiency value can be biased if the output is not produced from the actual inputs used. Future studies need to use more appropriate data collection methods such as direct surveys. Second, the translog cost frontier model applied in this research does not include the input price in the equation, so the estimations were limited to technical efficiency. Future studies require more price inputs such as the average salary of lecturers/staff, third party donations, or research funds from the government. The inclusion of price inputs in the model enables researchers to estimate allocative efficiency, namely the right proportion of inputs to minimize total public spending. Third, heterogeneity issues such as location, accreditation, and the status of the public higher education establishments were not considered in this study. D'elia & Ferro (2021) and Gralka (2018b) mentioned that it is important for researchers to incorporate heterogeneity into their models to avoid bias in their efficiency. Future studies need to include the issue of heterogeneity in calculations using the cost frontier model.

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