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Facultad de Ingeniería Industrial - UNMSM

Technical Efficiency of Public Universities in Peru

MARCO ANTONIO TELLO MIRANDA [1]
JOSÉ OVIDIO FLORES GUTIÉRREZ [2]

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ABSTRACT

Deficiencies in the quality of higher education are among Peru's main weaknesses according to the world competitiveness ranking. Therefore, this study determined the technical efficiency (TE) of Peruvian public universities using data envelopment analysis (DEA). In addition, it analyzed the relationships between the experience and education quality of the institutions, and TE. The study covered the 42 public universities registered for 2016, which were measured in terms of one input and two outputs. It was concluded that Peruvian public universities have production functions of constant returns to scale (average OTE = 56.8 %), which served as a basis for classifying institutions into four categories according to their strategic orientations (high or low) towards research or universal education. It was also found that no relationship exists between TE and the experience or education quality of the institution.

Keywords: university; data envelopment analysis (DEA); benchmarking; quality; experience.

INTRODUCTION

A number of economic theories strongly maintain that the future of a country's economy depends on the investment in and development of education, science and technology (Abdurakhmanova et al., 2020; Macilwain, 2010), which implies that education is a significant variable in the development of any nation, since human capital is crucial for socio-economic growth and, hence, for sustainable development (Wodon, 2019; Blecich, 2020). Therefore, a country's education policy must prioritize the enhancement of education quality in all its branches, coordinating public policies to optimize infrastructure, as well as the quality of teacher training and performance, among other important goals (Buckle & Creedy, 2019; Zhao, 2020).

Measuring and improving the efficiency of university performance is considered a relevant topic in developed countries (Kumar & Thakur, 2019; Jiang et al., 2020) and of special interest in public management (Ayaviri & Zamora, 2016). Similarly, public universities in Latin American countries acknowledge the need for changes and adaptation to new trends in higher education worldwide, which increasingly demand greater efficiency and quality in the services offered (Torres et al., 2019).

According to the World Competitiveness Ranking 2019, Peru ranked 65th and its main weaknesses remain in the following pillars: institutions, unlicensed universities, infrastructure, education, and innovation capability, among others (Schwab, 2019). Several authors have also reported deficiencies in Peruvian higher education (Lavalle & de Nicolas, 2017; Nunez & Cornejo, 2018), therefore, this research aims to determine technical efficiency (TE) in Peruvian public universities by means of the mathematical technique known as Data Envelopment Analysis (DEA), used to measure and evaluate the results obtained in productive

1 Degree in Chemical Engineering from Universidad Nacional Mayor de San Marcos (Lima, Peru). Currently working as teacher at the CERSEU of the School of Industrial Engineering of UNMSM. (Lima, Peru).
ORCID: https://orcid.org/0000-0002-4759-5772
Corresponding author: marco.tello@unmsm.edu.pe

2 PhD in Engineering from Universidad de Valladolid (Spain). Currently working as postgraduate professor at Universidad Nacional Mayor de San Marcos (Lima, Peru).
ORCID: https://orcid.org/0000-0001-5019-2635
E-mail: floresjoseovidio@gmail.com

units by comparing their productivity levels (Sigler, 2004; Rojas, 2010; Torres et al., 2018). Additionally, the existing relationships between the experience and education quality of the institutions, and technical efficiency are determined.

Higher education is of vital importance for the sustainable development of countries, and therefore the efficiency of its system should be considered a priority. In this context, this research aims to determine the technical efficiency (TE) of public universities in Peru; in addition, it intends to analyze the relationship between ET and the experience and education quality of the institutions.

This research study introduces a DEA model with a single input and two outputs that represent the relevant variables for the system analysis, which is particularly useful in contexts of scarce or limited information —very common in developing countries—. An easy-to-use, simple tool called Matrix of strategic orientation towards research and universal education (MOEIM, by its Spanish acronym) is elaborated based on the results of the DEA model, providing a comprehensive view of the positioning of universities in terms of their relative efficiency. The MOEIM provides a comprehensive overview of the positioning of universities in terms of their relative efficiency, which is relevant for guiding decision-making in universities and in the institutions that design and implement public policies focused on higher education. This tool is complemented by the benchmarking plan based on the DEA technique.

Data Envelopment Analysis (DEA)

According to Buitrago et al. (2017), DEA is a technique used to measure relative efficiency in educational organizations; it is important to note that it was first used to measure educational efficiency in North American schools (Rhodes, 1978). Its accuracy in measuring the decision-making unit under evaluation, as well as its inputs and outputs, stands out among its strengths; accordingly, following application of the technique, efficient and inefficient units can be classified, and reference pairs can be assigned to provide guidelines for improving inefficient units and establishing goals for the correct use of resources.

Based on a study on public universities in Spain by Salas-Velasco (2020), DEA is a good instrument for the comparative evaluation of higher education. In our context, by using inputs and outputs, DEA can identify technically efficient institutions that may act as benchmarks for ranking universities; in addition, it allows to identify the factors negatively impacting technical efficiency of the universities under evaluation.

Castañeda (2019) states that DEA is a widespread mathematical programming technique devised by Charnes et al. (1978) and improved by Banker et al. (1984) to evaluate variable returns to scale. DEA generalizes Farrell (1957) single-output/input technical efficiency measure to the multiple-output/multiple-input cases (Charnes et al., 1994; Cooper et al., 2006). Organizations or units that are measured using DEA are referred to as “decision making units” (DMUs) and, according to Cooper et al. (2006), a DMU is considered efficient if no other DMU can produce more outputs using an equal or lesser amount of inputs.

Technical efficiency aims at maximizing the results of the DMU based on the resources used (Campoverde et al., 2019). Thus, a university is efficient when it manages to obtain maximum levels of outputs (or outputs) for a given level of inputs or, alternatively, when it is able to minimize the level of inputs for a given level of output. The main contribution of DEA consists of establishing, empirically or practically, a reference pattern via a production frontier, against which the DMU is compared to determine whether it is efficient or not. Thus a relative efficiency is established, where the estimation of the frontier serves to estimate ET. Farrell (1957) provided a method to calculate and classify efficiency into technical and allocative efficiency, formulating precepts on the constant returns to scale of technology and a convex isoquant to the origin that has a positive slope.

In summary, a production function, which indicates the maximum amount of output generated by each input, must be defined to perform an efficiency analysis. Additionally, the characteristics of the process and the sector to which the DMUs under analysis belong should be outlined.

To associate the production function with the variables that reflect technology and enable the most efficient production of DMUs, such characterization should include the technology applied in the production process, and the inputs and outputs of the system. This approach can be understood in relation to outputs or inputs, so that an output-oriented application (as in this research) would show the maximum production that can be achieved with a particular combination of factors; while an input-oriented analysis would reveal the minimum requirements of inputs, combined in a given proportion, to achieve a specific output level (Escalona, 2013).

Technical efficiency can also be called overall technical efficiency (OTE) and it consists of pure technical efficiency (PTE) and scale efficiency (SE), so that OTE = PTE x SE. Therefore, to determine whether the production technology applied by universities have variable returns to scale, two models are applied: constant returns to scale (CRS), which corresponds to the OTE frontier; and variable returns to scale (VRS), which corresponds to the PTE frontier (Blecich, 2020). Should differences be detected between the two measurements for a particular university, it is assumed that there are scale inefficiencies, which values are attributed to the discrepancy between the CRS and VRS measurements. Thus, the scale efficiency measure is obtained as a result of the quotient between the OTE measure and the PTE measure. In summary, PTE evaluates the university's technical efficiency as a specific result of the organization's management without considering the size of the organization (Martin and Roman, 2010), whereas scale inefficiencies are losses caused by failure to operate at the optimal production size. Then, it follows that a university can be technically efficient and still have the possibility to improve its performance if the decision is made to exploit economies of scale (Coelli et al., 1998, p. 4).

Therefore, those universities that achieve values of 100% (or 1) for a given type of performance (CRS or VRS) against which they are being compared will be efficient and, therefore, are considered to be above the production frontier or to be part of it. In contrast, values below 100% (100% > x ≥ 0) denote inefficiencies and, as such, will be located below the production frontier.

Peruvian Higher Education System

Arias (2019) reported that towards the end of 2019, the Superintendencia Nacional de Educación Superior Universitaria (SUNEDU)[3] should have completed the licensing process for the remaining Peruvian universities. Research is one of the indicators of education quality and is a requirement for university licensing. It must be conducted professionally at the universities and, given that there is little research, it constitutes the main difficulty encountered by some universities

In Peru, university education is not compulsory and, hence, represents an educational option for people who graduate from the basic education system and intend to pursue professional, artistic or technical studies (Díaz, 2008). Consequently, the demand for university education can be estimated in terms of the number of people who, after completing secondary school, continue higher education by applying to any educational institution or, more restrictively, in terms of the number of individuals who apply and are admitted.

3 Public body in charge of regulating higher education in Peru.

METHODOLOGY

This is a quantitative, applied research, with a descriptive and correlational scope, and a non-experimental and cross-sectional design. The sample comprised the 42 Peruvian public universities registered for 2016 (Table 1), details of which were obtained from each university's website and also provided by SUNEDU (2018).

Based on a model proposed by Ramírez and Alfaro (2013), slightly modified to measure the research function, the only input used was the budget in millions (MM) of soles of each university and two outputs: the number of researchers assigned to the Renacyt program (formerly Regina) and the number of undergraduate, master's and doctoral students enrolled. Other inputs, such as number of professors, have a high correlation with the budget in public universities. Additionally, it was not possible to specify the number of articles per university published in indexed journals because they are not available, as mentioned above.

Variables to be correlated with TE were seniority (years), representing the institution's experience, and educational quality measured with a proxy variable, such as the place occupied by the institution in the ranking of universities by the CSIC (2019), which ranges from 1 to 25000, where 1 is the most desirable score. To establish positive relationships with the OTE, we inverted the ranking values, applying the inverse function (1/ranking), and then determined the percentage of the relative participation of each university (world ranking index) in the total values of the inverse function, which guarantees that the higher the value, the higher the quality of the educational institution.

Data Processing and Analysis Technique

DEA was applied. Arieu (2004) states that this analysis allows for the identification of the "best performance", thereby making it possible to use the benchmarking technique, as opposed to regression analysis, which is based on "average performance". In addition to measuring relative efficiency, DEA provides:

Table 1. *List of the 42 Peruvian Public Universities Under Study.*

University	Acronym	Quadrant (strategy matrix)*
Universidad Nacional Mayor de San Marcos	UNMSM	2
Universidad Nacional Agraria La Molina	UNALM	2
Universidad Nacional de Ingeniería	UNI	2
Universidad Nacional de San Antonio Abad del Cusco	UNSAAC	3
Universidad Nacional de Trujillo	UNT	2
Universidad Nacional de San Agustín	UNSA	1
Universidad Nacional Santiago Antúnez de Mayolo	UNASAM	4
Universidad Nacional del Altiplano	UNA	1
Universidad Nacional de la Amazonía Peruana	UNAP	2
Universidad Nacional Pedro Ruíz Gallo	UNPRG	4
Universidad Nacional Federico Villarreal	UNFV	4
Universidad Nacional del Callao	UNAC	4
Universidad Nacional Hermilio Valdizán	UNHEVAL	4
Universidad Nacional Jorge Basadre Grohmann	UNJBG	3
Universidad Nacional de Cajamarca	UNC	3
Universidad Nacional de Piura	UNP	4
Universidad Nacional Autónoma de Chota	UNACH	3
Universidad Nacional de San Martín	UNSM	3
Universidad Nacional de San Cristóbal de Huamanga	UNSCH	4
Universidad Nacional Agraria de la Selva	UNAS	2
Universidad Nacional Daniel Alcídes Carrión	UNDAC	4
Universidad Nacional de Tumbes	UNTumbes	2
Universidad Nacional del Centro del Perú	UNCP	4
Universidad Nacional San Luis Gonzaga	UNICA	3
Universidad Nacional de Huancavelica	UNH	3
Universidad Nacional de Educación Enrique Guzmán y Valle	UNE	3
Universidad Nacional José Faustino Sánchez Carrión	UNFJFSC	4
Universidad Nacional Micaela Bastidas de Apurímac	UNAMBA	1
Universidad Nacional Toribio Rodríguez de Mendoza de Amazonas	UNTRM	2
Universidad Nacional del Santa	UNS	2
Universidad Nacional de Ucayali	UNU	3
Universidad Nacional José María Arguedas	UNAJMA	3
Universidad Nacional Amazónica de Madre de Dios	UNAMAD	4
Universidad Nacional de Moquegua	UNAM	3
Universidad Nacional Intercultural de la Amazonía	UNIA	3
Universidad Nacional de Cañete	UNDC	3
Universidad Nacional de Jaén	UNJ	4
Universidad Nacional Tecnológica de Lima Sur	UNTELS	1
Universidad Nacional de Barranca	UNAB	4
Universidad Nacional de Juliaca	UNAJ	3
Universidad Nacional de Frontera	UNF-S	2
Universidad Nacional Autónoma de Alto Amazonas	UNAAA	2

* Classification based on Figure 1.

Source: SUNEDU (2016).

1. An empirical envelope surface, which represents the behavior of the best performers
2. An *efficient metric* to compare results.
3. Efficient projections on the frontier for each inefficient DMU.
4. An efficient reference set for each DMU, defined by the efficient units closest to it. (Arieu, 2004, p. 3)

SPSS Statistics 25 software was used for descriptive and correlational analysis, while Frontier Analyst software developed by Banxia Software was used for data processing with the DEA.

RESULTS

Descriptive Statistics for Inputs and Outputs

As OTE has a normal distribution ($p > 0.05$), whereas the PTE and EE values do not ($p < 0.05$), the Mann-Whitney U test was used to contrast the hypothesis stating that the distributions of the CRS and VRS models come from the same population (Martín, 2006; Martín, 2008). Results show that they are indeed equal ($p > 0.05$), which is evidence that constant returns to scale prevail in the Peruvian public university education sector. Table 2 presents the results of the OTE, the current levels of inputs and outputs, and the respective benchmarking plan on potential output improvement for 42 Peruvian public universities, as well as the variables that will also be correlated with the OTE.

Figure 1 shows the Matrix of strategic orientation towards research and universal education (MOEIM, by its Spanish acronym) of 42 Peruvian public universities. This matrix overlaps the graph of the universities' production frontier, developed by dividing the outputs by the input, so that for each DMU we estimated 1. the number of Renacyt researchers per 100 million soles of budget (Renacyt_100MMSoles on the Y-axis), and 2. student enrollment per million soles of budget (Enrollment/million soles on the X-axis). It is observed that the production frontier line (output-oriented model) links the efficient universities (UNMSM, UNTELS and UNASAM), while the inefficient universities are located below this frontier.

The MOEIM was divided into four quadrants based on the average values of each variable analyzed (see Appendix 1). Accordingly, in the case of the Renacyt researchers variable, the institution has a high research orientation (indicative of research quality) when the average value is above the mean and low orientation when it is below the mean. As for the case of the enrollment variable, the institution has a high orientation to universal education (high level of student enrollment) when the average value is above the mean and low when it is below the mean, although it could also be categorized as high and low orientation teaching orientation, as has been done in other countries (Shamohammadi & Oh, 2019).

The first quadrant (upper right) includes research-oriented and universal education-oriented institutions, led by UNTELS. The second quadrant (upper left) includes universities with a high research orientation, with UNMSM and UNALM leading with the highest scores; also, those universities with a low orientation towards universal education are also located in this quadrant. The third quadrant (lower left) includes universities with a low orientation towards both research and universal education, which is the worst case among the four types of performance analyzed. Finally, the fourth quadrant (lower right) includes universities with a low orientation towards research but a high orientation towards universal education, led by UNASAM.

Shapiro-Wilk test statistically corroborated that the variables experience (seniority) and education quality (ranking) of the institution do not have normal distributions ($p < 0.05$), so they were correlated with OTE using Spearman's Rho coefficient (Table 3). Results indicate that the TE of public universities in Peru is not correlated to experience or education quality.

DISCUSSION

Research on the education sector and, particularly, on higher education, is of utmost importance in light of the existence of public policy guidelines aimed at improving higher education developed by prestigious international and national institutions such as UNESCO, UNICEF, the World Bank, UNFPA, UNDP (2015) and SUNEDU (Arias, 2019), to name a few. Putting these guidelines into practice would make it possible to capitalize on the great comparative and competitive advantages, as well as to achieve sustainable development in Peru.

Among the main problems encountered when analyzing efficiency in universities is the existence of a wide variety of inputs and outputs in the literature (Huamaní et al., 2016; Nieto, 2016; Blanco et al., 2019; Shamohammadi, & Oh, 2019; Mojahedian et al., 2020), in addition to the difficulties in measuring

Table 2. *Efficiency, Current Levels and Potential Output Improvement for 42 Peruvian Public Universities and Variables to Correlate with the OTE.*

		Current Input and Output Levels			Targets (growth)		Variables to Correlate	
ACRONYM	OTE (%)	Budget (MM S/)	Renacyt (No.)	Enrollment (No.)	Renacyt (No.)	Enrollment (No.)	Seniority (years)	World Ranking
UNMSM	100.0	418.7	280	41011	0	0	469	1470
UNALM	92.8	130.6	81	7303	6	5487	118	2966
UNI	44.1	252.8	70	12914	89	16353	144	3044
UNSAAC	49.7	174.3	24	21988	24	22249	328	3432
UNT	71.8	156.3	56	19215	22	7554	36	3631
UNSA	73.2	189.2	58	28520	21	10457	192	4623
UNASAM	100.0	49.1	6	13603	0	0	43	5982
UNA	60.2	177.3	42	23175	28	15314	164	6125
UNAP	57.6	77.0	17	9819	13	7233	59	6225
UNPRG	54.7	109.6	6	16618	7	13743	50	6647
UNFV	58.9	154.5	1	25201	18	17599	57	6918
UNAC	76.5	79.9	4	16921	6	5200	54	7027
UNHEVAL	62.7	68.2	0	11838	8	7042	56	7585
UNJBG	39.1	74.5	8	7401	12	11524	49	8013
UNC	46.3	77.4	8	9381	9	10896	58	8109
UNP	49.3	145.8	6	19933	12	20466	59	8642
UNACH	30.7	16.2	1	1319	2	2981	10	9036
UNSM	37.0	61.6	4	6138	7	10448	41	10319
UNSCH	61.3	74.9	6	12649	4	7993	343	11088
UNAS	41.0	52.6	10	4033	14	5796	56	11590
UNDAC	47.6	66.9	1	8825	7	9716	55	11967
UNTumbes	41.8	44.9	9	3372	13	4699	36	3631
UNCP	91.3	99.9	13	24977	1	2391	58	8109
UNICA	42.8	118.3	4	14045	10	18737	65	12578
UNH	44.0	59.4	6	6818	8	8671	30	12595
UNE	32.9	85.1	0	7753	10	15822	198	12865
UNFJFSC	73.6	80.4	0	16390	10	5885	52	12965
UNAMBA	86.4	21.5	9	3298	1	521	20	13566
UNTRM	67.5	43.7	16	4501	8	2168	19	13617
UNS	53.5	33.8	7	3971	6	3458	36	13653
UNU	47.0	49.8	3	6462	3	7292	41	14293
UNAJMA	33.4	15.3	1	1356	2	2702	16	15023
UNAMAD	51.7	24.3	0	3475	3	3246	20	16366
UNAM	24.8	29.4	3	1518	9	4612	15	16867
UNIA	31.5	21.3	3	1299	7	2823	20	19332
UNDC	46.4	9.0	1	1077	1	1243	11	20754
UNJ	79.5	8.1	0	1783	1	459	12	21602
UNTELS	100.0	12.3	4	3034	0	0	19	22067
UNAB	74.2	8.9	0	1835	1	637	10	22078
UNAJ	23.4	20.5	1	1263	3	4146	13	22095
UNF-S	55.6	9.0	2	1062	2	848	10	23112
UNAAA	28.3	5.4	1	157	3	399	13	24174
Totales	-	3407.7	772	427251	411	298810	-	-
Media	56.8	81.1	18	10173	10	7115	-	-

OET: overall technical efficiency; MMS/.: millions of soles; No.: number of individuals.

Source: Prepared by the authors.

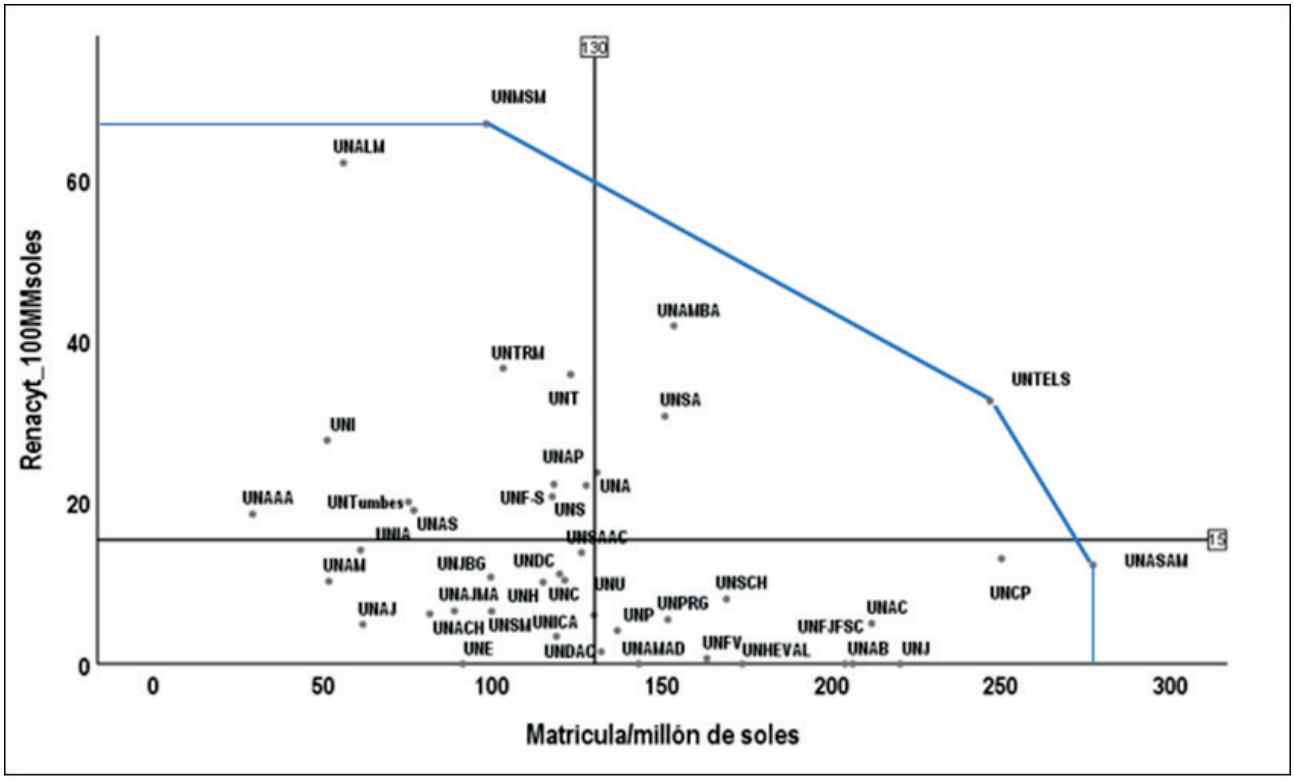

Figure 1. Matrix of strategic orientation towards research and universal education (MOEIM) of 42 Peruvian public universities.

Note: The line joining the three efficient universities represents the production frontier.

Source: Prepared by the authors.

Table 3. *Spearman's Rho Correlations Between Experience and Education Quality and OTE*

Variables related to the OTE	Rho and Significance	OTE
Experience (seniority)	Correlation Coefficient	0.232
	Sig. (2-tailed)	0.140
Education Quality (university ranking)	Correlation Coefficient	0.298
	Sig. (2-tailed)	0.055

Source: Prepared by the authors.

them in some cases (Gómez, 2010; Ayaviri & Zamora, 2016; Buitrago et al., 2017). It was therefore decided to use the model of Ramírez and Alfaro (2013), slightly modified, to measure the research function. The original model was successfully used in 25 Chilean universities. In this model, other inputs such as teachers, estimated in terms of their salaries, have a high correlation with the budget, thus advising against its use, as it contributes very little to the results. The model was also output-oriented, as is customary in the university sector, due to the fact that, in most cases, inputs are not controlled by the universities studied —this is more evident in public institutions whose main objective is to achieve the best possible value in outputs as they are financed by the State (Buitrago et al., 2017).

Upon justifying the orientation of the model to be used, the production frontiers of the CRS and VRS models were determined, as has been done in previous studies (García & Palomares, 2008; Agasisti et al., 2011; Buitrago et al., 2017). Moreover, the hypothesis according to which Peruvian public universities exhibit production functions of constant returns to scale was accepted. A statistical demonstration of which of the production frontiers was the most appropriate was carried out in this research, just as in Martín (2008); other studies on efficiency

have calculated the two types of frontier, failing to demonstrate statistically which one prevails (Haider et al., 2019). This demonstration was based on a nonparametric statistical test which allowed us to prove that CRS prevails, a model that has been employed by other authors (Pino et al., 2010).

Based on the CRS (OTE ratio) and the product-oriented model, a 56.8% of TE was estimated for public universities in Peru during 2016. Although in different contexts, this is a low value compared to that reported by other authors. For instance, Ramírez and Alfaro (2013) reported an average efficiency of 80.89% in public and private universities in Chile. Very similar values were obtained by Navarro et al. (2016) when they applied a DEA model to a group of 32 public universities in Mexico and obtained an OTE of 80.7%.

As for Peru, Nunez and Cornejo (2018) conducted an efficiency study in 42 public and private universities and reported efficiency values of 55.2% and 58.9% for public universities in two out of the four DEA models they evaluated. Such values are higher than those reported for private institutions and are very similar to those obtained in our research, thereby confirming a highly heterogeneous educational sector.

The ET results also enabled the elaboration of a matrix that served as a basis for classifying institutions into four categories according to their strategic orientation (high or low) towards research or universal education. This dichotomy is very present in higher education, especially in Latin America (Cabrera et al., 2014; García de Fanelli, 2017), and, as such, has also been reported in Peru (Lavalle & de Nicolas, 2017; Nunez & Cornejo, 2018).

The relationship between TE of Peruvian public universities and the experience of the educational institution (seniority) was also analyzed; the result obtained by applying Spearman's Rho correlation test indicates that there is no correlation between TE of Peruvian public universities and experience, a fact that confirms the findings of Coria (2019), who found no relationship between TE of Argentine public universities and the seniority of the same.

Similarly, the relationship between TE of Peruvian public universities and the quality of the institution, based on the university ranking prepared by the CSIC (2019), was also analyzed. Spearman's Rho coefficient test was found that the TE of Peruvian public universities is not correlated to the education quality of the institution. This result disagrees with those of other researchers who reported a positive relationship between efficiency and university rankings, among them the Shanghai ranking (Blanco et al., 2019), possibly due to the fact that they evaluated the 50 best universities in the world. Likewise, Huamaní et al. (2016) demonstrate the feasibility of this relationship, as the place occupied in the rankings is a solid indicator of education quality (Lavalle & de Nicolas, 2017).

Finally, an improvement plan was proposed based on the DEA methodology and can be applied as a benchmarking tool (Avkiran, 1999; Zhu, 2009, p. 131), particularly in the case of universities (Shamohammadi & Oh, 2019). This plan was sufficiently demonstrated, as efficient universities that would function as leaders (benchmarks) for inefficient universities could be identified.

CONCLUSIONS

- Peruvian public universities have constant returns to scale production functions (average OTE = 56.8%), used as a basis for classifying institutions into four categories according to their strategic orientations (high or low) towards research or universal education.
- Technical efficiency of Peruvian public universities is not related to the institution's experience.
- Technical efficiency of Peruvian public universities is not related to the quality of education.
- Restricted access to publications or patents developed by universities is considered a limitation and should be addressed in future research. The data are only available in the institutional portals. More inputs and outputs can also be included, in order to compare the results with those of this model involving few variables and, additionally, it is important to compare public and private education.

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APPENDIX

Appendix 1. *Characterization of universities according to MOEIN results.*

Universities located in the second quadrant				
Acronym	**Budget (MM S/)**	**Renacyt (Nro.)**	**Enrollment (Nro.)**	**OTE**
UNAP	77.0	17	9819	57.6
UNT	156.3	56	19215	71.8
UNF-S	9.0	2	1062	55.6
UNS	33.8	7	3971	53.5
UNTRM	43.7	16	4501	67.5
UNMSM	418.7	280	41011	100.0
UNAS	52.6	10	4033	41.0
UNTumbes	44.9	9	3372	41.8
UNALM	130.6	81	7303	92.8
UNI	252.8	70	12914	44.1
UNAAA	5.4	1	157	28.3
Average	111.3	50	9760	
Total	1224.8	549	107358	
% of total	35.9%	71.1%	25.1%	

Universities located in the first quadrant				
Acronym	**Budget (MM S/)**	**Renacyt (Nro.)**	**Enrollment (Nro.)**	**OTE**
UNTELS	12.3	4	3034	100,0
UNAMBA	21.5	9	3298	86.4
UNSA	189.2	58	28520	73.2
UNA	177.3	42	23175	60.2
Average	100.1	28	14507	
Total	400.3	113	58027	
% of total	11.7%	14.6%	13.6%	

Universities located in the third quadrant				
Acronym	**Budget (MM S/)**	**Renacyt (Nro.)**	**Enrollment (Nro.)**	**OTE**
UNIA	21.3	3	1299	31.5
UNSAAC	174.3	24	21988	49.7
UNDC	9.0	1	1077	46.4
UNJBG	74.5	8	7401	39.1
UNC	77.4	8	9381	46.3
UNAM	29.4	3	1518	24.8
UNH	59.4	6	6818	44.0
UNAJMA	15.3	1	1356	33.4
UNSM	61.6	4	6138	37.0
UNACH	16.2	1	1319	30.7
UNU	49.8	3	6462	47.0
UNAJ	20.5	1	1263	23.4
UNICA	118.3	4	14045	42.8
UNE	85.1	0	7753	32.9
Average	58.0	5	6273	
Total	812.1	67	87818	
% of total	23.8%	8.7%	20.6%	

Universities located in the fourth quadrant				
Acronym	**Budget (MM S/)**	**Renacyt (Nro.)**	**Enrollment (Nro.)**	**OTE**
UNCP	99.9	13	24977	91.3
UNASAM	49.1	6	13603	100.0
UNSCH	74.9	6	12649	61.3
UNPRG	109.6	6	16618	54.7
UNAC	79.9	4	16921	76.5
UNP	145.8	6	19933	49.3
UNDAC	66.9	1	8825	47.6
UNFV	154.5	1	25201	58.9
UNJ	8.1	0	1783	79.5
UNAB	8.9	0	1835	74.2
UNFJFSC	80.4	0	16390	73.6
UNHEVAL	68.2	0	11838	62.7
UNAMAD	24.3	0	3475	51.7
Average	74.7	3	13388	
Total	970.5	43	174048	
% of total	28.5%	5.6%	40.7%	

Total number of universities (inputs and outputs).

	Budget (MM S/)	**Renacyt (Nro.)**	**Enrollment (Nro.)**
Total	3407.7	772	427251
%	100.0%	100.0%	100.0%

Total number of universities (inputs and outputs).