PERFORMANCE EVALUATION USING THE DEA METHOD: A CASE STUDY OF ELECTRICITY COMPANIES IN INDONESIA

[1]Erni Puspanantasari Putri, [2]Jaka Purnama, [3]Bonifacius Raditya Sri Pramana Putra, [4]Agatha Hannabel Avnanta Puteri

[1,2,4]Department of Industrial Engineering, Faculty of Engineering, Universitas 17 Agustus 1945 Surabaya, [3]Department of Informatics Engineering, Faculty of Engineering, Universitas 17 Agustus 1945 Surabaya

Jl. Semolowaru 45, Surabaya 60118, Jawa Timur

[1]erniputri@untag-sby.ac.id , [2]jakapurnama@untag-sby.ac.id , [3]radityabf@gmail.com , [4]d.agatha44@gmail.com

Abstrak

Evaluasi kinerja bertujuan untuk terus memantau efisiensi dan keekonomian operasional perusahaan serta memberikan informasi bagi pengambilan keputusan perusahaan. Evaluasi kinerja yang memadai dan dapat diperbandingkan memerlukan suatu metode dan alat ukur, yang dapat mengukur kinerja perusahaan secara kompleks. DEA merupakan metode yang memungkinkan penggunaan karakteristik kuantitatif dan kualitatif. Perusahaan Listrik Negara (PLN) merupakan perusahaan yang berfokus pada bidang tenaga listrik untuk kepentingan masyarakat dan negara. Bidang usaha PLN terdiri dari usaha-usaha seperti: (i) produksi, transmisi dan distribusi tenaga listrik; (ii) perencanaan dan pembangunan tenaga listrik; (iii) pengusahaan dan pengembangan tenaga listrik; dan (iv) pengusahaan jasa-jasa di bidang tenaga listrik. Pertumbuhan ekonomi Indonesia sangat bertumpu pada kelistrikan. Tujuan penelitian adalah untuk mengevaluasi kinerja PLN di Indonesia dengan menggunakan metode DEA. DEA adalah metode pemrograman linier yang berhubungan dengan pengukuran kinerja. Pengukuran kinerja terdiri dari parameter input dan output. Evaluasi kinerja merupakan salah satu cara untuk mengidentifikasi efektif dan tidak efektifnya DMU. Dengan demikian, PLN sebagai motor penggerak perekonomian di Indonesia dapat berkembang dengan baik secara berkelanjutan. Hasil penelitian mengindikasikan DMU efisien memiliki prosentase sebesar 94% dan DMU tidak efisien sebesar 6%.

***Kata kunci**: DEA, DMU, efisiensi, evaluasi kinerja, PLN*

Abstract

Performance evaluation aims to continuously monitor the efficiency and economics of company operations and offers information for company decision-making. Adequate and comparable performance evaluation requires a method and measuring tool that can measure company performance in a complex manner. DEA is a method that allows the use of quantitative and qualitative characteristics. The State Electricity Company (PLN) is a company that focuses on the electric power sector for the benefit of society and the state. PLN's business sector consists of businesses such as: (i) production, transmission, and distribution of electric power; (ii) planning and development of electric power; (iii) exploitation and development of electric power; and (iv) business of services in the electricity sector. Indonesia's economic growth relies heavily on electricity. The aim of the research is to evaluate PLN's performance in Indonesia using the DEA method. DEA is a linear programming method that deals with performance measurement. Performance measurement consists of input and output parameters. Performance evaluation is one way to identify effective and ineffective DMU. In this way, PLN, as the driving force of the economy in Indonesia, can develop well in a sustainable manner. The research results indicated that efficient DMUs have a percentage of 94% and inefficient DMUs have a percentage of 6%.

***Keywords**: DEA, DMU, efficiency, performance evaluation, PLN*

INTRODUCTION

Performance evaluation is necessary for companies to determine efficiency, the effectiveness of sustainable use of operating costs, and to provide information for management decision-making. Performance evaluation can be used to improve company operations [1]. In addition to providing data for corporate decision-making, performance evaluation attempts to continuously check the economy and efficiency of business operations. Complex company performance must be measured using a methodology and measuring instrument for an adequate and comparable performance evaluation [2]. The consequent are some of the elements that make performance evaluation a major measurement system: (i) identifies decisions and communication processes as efforts related to company improvement; (ii) an effort to develop the company by establishing decisions and communication processes; (iii) a measure of company efficiency and effectiveness; and (iv) monitors its activities to achieve targeted goals and allocate resources efficiently. This condition can be achieved in several ways, namely by combining, separating, selecting, analyzing, interpreting, and disseminating appropriate data [3].

In general, companies require performance evaluations for company development. By evaluating performance, the company can obtain three benefits, namely: (i) the company's strengths and weaknesses can be well known; (ii) the company can organize its business to increase customer satisfaction; and (iii) companies can determine their business opportunities to obtain optimal profits. One way to measure performance is by data envelopement analysis, or DEA. The purpose of this technique is to compare different decision-making units (DMU). DMUs might be individuals, businesses, projects, firms, business units, or decision-making units [1]. The DEA approach permits the application of both quantitative and qualitative traits. If more information about operational and technical efficiency is desired, DEA can be used in addition to classic indicator analysis [2]. DEA is a linear programming method that deals with performance measurement. Performance measurement consists of input and output parameters. Inputs are aspects that must be minimized, such as costs, labor, materials, and so on. Output is an aspect that must be maximized, such as profits, income, products, and so on. Inputs and outputs are classified and selected before implementing DEA. DEA uses a decision-making unit (DMU) to describe every business action, process, and entity in the estimate [4].

The power industry's generation and transportation of electricity are inextricably linked. However, only a few studies have considered the combined performance of energy transmission and generating. This study employs network DEA models. The existing network DEA cross-efficiency models may have a key fault in that they often assume DMUs to be completely rational and overlook the potential impact of risk attitudes on DMUs, which might be critical to the evaluation process. Zhang et al. (2022) did a case study on China's electricity generation and transmission systems. Here's an overview of the important findings. In the first place, China improved overall over the analyzed period, with an annual growth rate of 2.84%. Within-group 2 was shown to be the most significant driver of technology diffusion, accounting for 63.32% of the overall Gini coefficient. Finally, considerable technique variability has been seen among the different DEA models, indicating that method selection is crucial for modelers doing empirical research [5].

Patyal et al. (2023) identify and contrast the performance efficiency of 48 energy distribution companies (EDCs) from 24 Indian states. The integrated DEA and IRP-TOPSIS approach was employed in this investigation to distinguish between efficient and inefficient EDCs. The research recommends that states provide Discoms operational and financial independence. EDC professionals will find the study useful in understanding their performance and developing appropriate plans based on efficiency assessments and their relative position to their peers. This study adds fresh information to the body of knowledge on the efficiency analysis of Indian EDCs and at the policy level by comparing them with their contemporaries [6].

Fallahi et al (2021) evaluated the 39 electricity distribution firms in Iran in terms of production and efficiency. The Ministry of Interior has divided Iran's 33 provinces into five zones in order to manage electricity and maximize the use of limited resources. By evaluating the performance of distribution companies in these areas, policymakers can obtain important information about these resources and improve their judgments. The productivity measurement shows that, rather than technological change, low efficiency change was the main cause of the slight increase in productivity change. There was financial statistical difference between the large and small enterprises when the hypothesis that they had statistically equal efficiency scores was tested. Furthermore, a further examination failed to find any differences between the companies at the provincial and urban levels [7].

The State Electricity Company (SEC) is a company that focuses on the electric power sector for the benefit of society and the state. SEC's business sector consists of businesses such as: (i) production, transmission, and distribution of electric power; (ii) planning and development of electric power; (iii) exploitation and development of electric power; and (iv) business of services in the electricity sector [8]. Indonesia's economic growth relies heavily on electricity. The SEC's role as a driving force for the economy is very important. The aim of the research is to evaluate SEC's performance in Indonesia using the DEA method. Performance evaluation is one way to identify effective and ineffective DMU. In this way, SEC, as the driving force of the economy in Indonesia, can develop well in a sustainable manner.

RESEARCH METHODS

The problem-solving phases in this research are as follows: (i) definition and research design; (ii) preparation, data collection, and evaluation; (iii) data processing; (iv) results analysis; and (v) conclusion. The classification of input and output data as well as the determination of input, output, and DMU (decision-making unit) data are among the stages of preparation, data collection, and data evaluation. The choice of variables (input and output) is the first step in the data processing process. The DEA approach is then applied to determine each DMU's efficiency score. A DEA approach focused on input minimization is shown in Equations 1 to 4, with output conditions set at the current level.

The n-designated DMUs, DMU0 is one. DMU0's r input and output are denoted as Xi0 and Yr0. The unknown weight, λj, is given (j = 1, ..., n). The θ represents the solution for the DEA model's effectiveness value. Reducing the current input level proportionately is not possible if θ* = 1. DMU0's location at the ideal criterion limit is displayed in this condition. The input can be decreased using the same percentage of θ* if θ* < 1. This indicates that DMU0 is located on the border. Consequently, a lower input can produce an output level equivalent to the original [4].

$\theta^* = \min \theta$

subjected to the following restrictions: (1)

$$\sum_{j=1}^{n} Xij\,\lambda j \leq \theta\, Xio, \qquad i = 1, \ldots, m \tag{2}$$

$$\sum_{j=1}^{n} Yrj\,\lambda j \geq Yro, r = 1, \ldots, s \tag{3}$$

$$\sum_{j=1}^{n} \lambda j = 1 \tag{4}$$

$\lambda j \geq 0 \quad j = 1, \ldots, n$

In Microsoft Excel spreadsheets, the input, output, and DMU data settings are made up of columns (i) DMU and DMU under evaluation data; (ii) input and output data; (iii) limitations and constraints; and (iii) efficiency score. Calculation of DMU efficiency using Microsoft Excel (Solver) Analysis of results, including: (i) analysis of efficient DMU; (ii) DMU analysis is inefficient; (iii) comparative analysis of DMU classification; (iv) analysis of the province's effectiveness and ineffectiveness; and (v) efforts to increase company effectiveness.

RESULTS AND DISCUSSION

Components of Data, Variables, and DMUs

Data from Indonesian electricity companies were used in this study. There are seven types of data, namely: (i) installed capacity of power plants (KTPL-ICPP); (ii) electric power generated (TLB-EPG); (iii) number of electricity customers (JPL-NEC);

(iv) number of workers (JTA-NW); (v) distributed electricity (LD-DE); (vi) value of distributed electrical energy (NELD-VDEE); and (vii) compensation for workers' services (BJTK-CWS) [9]. The data component on the number of electricity customers (JPL-NEC) consists of 6 groups, namely: household (JPL-KRT-H), industrial (JPL-KI-I), commercial (JPL-KK-C), social (JPL-KS-S), government buildings (JPL- KGP-GB), and public street lighting (JPL-PJU-PSL). The data component on the number of workers (JTA-NW) consists of three educational categories, namely: up to high school (JTA-SLTA-HS), undergraduate and diploma (JTA-SD-UD), and postgraduate (JTA-PS_P). The data component on distributed electricity (LD) consists of 6 groups, namely: household (LD -KRT-H), industrial (LD -KI-I), commercial (LD -KK-C), social (LD -KS-S), government buildings (LD – KGP-GB), and public street lighting (LD -PJU-PSL). The value of distributed electrical energy (NELD-VDEE) consists of 6 groups, namely household (NELD-KRT-H), industrial (NELD-KI-I), commercial (NELD-KK-C), social (NELD-KS-S), government buildings (NELD-KGP-GB), and public street lighting (NELD-PJU-PSL).

There are 34 decision making units (DMUs) based on provinces, including: Aceh (Ac), North Sumatra (SU), West Sumatra (SB), Riau (Ri), Jambi (Jm), South Sumatra (SS), Bengkulu (Bg), Lampung (Lp), Bangka Belitung (BB), Archipelago Riau (KR), DKI Jakarta (DKI), West Java (JB), Central Java (JT), D.I Yogyakarta (DIY), East Java (JTi), Banten (Bn), Bali (Bl), West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), West Kalimantan (KB), Central Kalimantan (KT), South Kalimantan (KS), East Kalimantan (KTi), North Kalimantan (KU), North Sulawesi (SU), Central Sulawesi (ST) , South Sulawesi (SS), Southeast Sulawesi (STe), Gorontalo (G), West Sulawesi (SB), Maluku (M), North Maluku (MU), West Papua (PB), and Papua (P). Tables 1, 2, and 3 illustrate how input-output variables and decision-making units (DMU) can be determined using this data.

Table 1. Components of Input Data and Variables

No.	Data Components	Units	Inputs	Variables
1.	KTPL-ICPP	MW	Inp_V1	X_V1
2.	TLB-EPG	GWh	Inp_V2	X_V2
3.	JPL-NEC	person	Inp_V3	X_V3
4.	JPL-KRT-H	person	Inp_V4	X_V4
5.	JPL-KI-I	person	Inp_V5	X_V5
6.	JPL-KK-C	person	Inp_V6	X_V6
7.	JPL-KS-S	person	Inp_V7	X_V7
8.	JPL- KGP-GB	person	Inp_V8	X_V8
9.	JPL-PJU-PSL	person	Inp_V9	X_V9
10.	JTA-NW	person	Inp_V10	X_V10
11.	JTA-SLTA-HS	person	Inp_V11	X_V11
12.	JTA-SD-UD	person	Inp_V12	X_V12
13.	JTA-PS_P	person	Inp_V13	X_V13

Table 2. Components of Output Data and Variables

No.	Data Components	Satuan	Input	Variabel
1.	LD-DE	GWh	Outp_V1	Y_V1
2.	LD-KRT-H	GWh	Outp_V2	Y_V2
3.	LD-KI-I	GWh	Outp_V3	Y_V3
4.	LD-KK-C	GWh	Outp_V4	Y_V4
5.	LD-KS-S	GWh	Outp_V5	Y_V5
6.	LD-KGP-GB	GWh	Outp_V6	Y_V6
7.	LD-PJU-PSL	GWh	Outp_V7	Y_V7
8.	NELD-VDEE	Million Rupiah	Outp_V8	Y_V8
9.	NELD-KRT-H	Million Rupiah	Outp_V9	Y_V9
10.	NELD-KI-I	Million Rupiah	Outp_V10	Y_V10
11.	NELD-KK-C	Million Rupiah	Outp_V11	Y_V11
12.	NELD-KS-S	Million Rupiah	Outp_V12	Y_V12
13.	NELD-KGP-GB	Million Rupiah	Outp_V13	Y_V13
14.	NELD-PJU-PSL	Million Rupiah	Outp_V14	Y_V14
15.	BJTK-CWS	Thousand Rupiah	Outp_V15	Y_V15

Table 3. Decision Making Units (DMUs)

No.	Provinsi (P)	DMUs	No.	Provinsi (P)	DMUs	No	Provinsi (P)	DMUs
1	Ac	Pr_V1	13	JT	Pr_V13	25	SU	Pr_V25
2	SU	Pr_V2	14	DIY	Pr_V14	26	ST	Pr_V26
3	SB	Pr_V3	15	JTi	Pr_V15	27	SS	Pr_V27
4	Ri	Pr_V4	16	Bn	Pr_V16	28	STe	Pr_V28
5	Jm	Pr_V5	17	Bl	Pr_V17	29	G	Pr_V29
6	SS	Pr_V6	18	NTB	Pr_V18	30	SB	Pr_V30
7	Bg	Pr_V7	19	NTT	Pr_V19	31	M	Pr_V31
8	Lp	Pr_V8	20	KB	Pr_V20	32	MU	Pr_V32
9	BB	Pr_V9	21	KT	Pr_V21	33	PB	Pr_V33
10	KR	Pr_V10	22	KS	Pr_V22	34	P	Pr_V34
11	DKI	Pr_V11	23	KTi	Pr_V23			
12	JB	Pr_V12	24	KU	Pr_V24			

Data Arrangement in Microsoft Excel Spreadsheets

A Microsoft Excel spreadsheet is used to arrange input and output data using linear programming techniques, namely the DEA input-oriented envelopment approach. There are fifteen output and thirteen input data points. Next, as shown in Tables 4 and 5, the efficiency value of each DMU is calculated using Microsoft Excel's solver function. In Microsoft Excel spreadsheets, the input, output, and DMU data settings are comprised of the DMU data and DMU under evaluation, input and output data, constraints, and efficiency score columns.

Analysis of Efficient and Inefficient DMUs

An efficient DMU has an efficiency score of one. DMUs that have an efficiency score of less than one are categorized as inefficient DMUs. There are three inefficient DMUs, namely Pr_V9, Pr_V21, and Pr_V28. The other DMUs fall into the efficient DMU category (31 DMUs). Efficient DMU has a percentage of 94% (31/34 x 100%). The percentage of inefficient DMUs is 6% (3/34 x 100%). Efficient and inefficient DMU categories are presented in Table 6.

Table 4. Data Arrangement in Microsoft Excel Spreadsheets

DMUs	X_V1	X_V2	→	X_V13	Y_V1	Y_V2	→	Y_15	λ	Eff.
Pr_V1	905	3,002		10	3,074	1,930		1,585	0	1
Pr_V2	4,604	12,986		38	11,748	5,999		5,194	0	1
Pr_V3	1,031	4,396		3	3,646	1,781		2,033	0	1
Pr_V4	1,430	5,389		14	6,108	2,935		1,860	0	1
Pr_V5	370	730		5	2,112	1,373		1,052	0	1
Pr_V6	2,286	11,019		5	5,594	3,213		6,442	0	1
Pr_V7	530	2,689		6	1,059	752		1,267	0	1
Pr_V8	1,088	5,436		12	5,177	3,032		1,114	0	1
Pr_V9	355	1,498		13	1,369	735		1,087	0	0.94
Pr_V10	757	3,381		28	3,479	1,388		1,825	0	1
Pr_V11	5,126	18,178		671	32,709	14,725		33,754	0	1
Pr_V12	9,079	34,018		236	53,318	20,926		25,730	0	1
Pr_V13	8,764	46,065		99	26,661	12,987		10,639	0	1
↓										
Pr_V33	268	677		4	583	355		1,366	0	1
Pr_V34	526	1,361		6	1,238	726		1,912	1	1

Table 5. Constraints, Reference Set, DMU under Evaluation, and Efficiency Score

Constraints	Reference Set		DMU under Evaluation	34	Efficiency
Inp_1 (B)	526	≤	526		1
Inp_2 (C)	1,361	≤	1361		
Inp_3 (D)	491	≤	491		
Inp_4 (E)	441	≤	441		
Inp_5 (F)	103	≤	103		
Inp_6 (G)	322	≤	322		
↓					
Inp_12 (M)	258	≤	258		
Inp_13 (N)	6	≤	6		
Outp_1 (P)	1238	≥	1238		
Outp_2 (Q)	726	≥	726		
Outp_3 (R)	12	≥	12		
Outp_4 (S)	334	≥	334		
Outp_5 (T)	66	≥	66		
Outp_6 (U)	87	≥	87		
↓					
Outp_14 (AC)	17	≥	17		
Outp_15 (AD)	1912	≥	1912		
$\sum\lambda$	1				

Table 6. Efficient-Inefficient DMUs and Efficiency Score (ES)

No.	DMUs	ES	No.	DMUs	ES	No.	DMUs	ES
1	Pr_V1	1	13	Pr_V13	1	25	Pr_V25	1
2	Pr_V2	1	14	Pr_V14	1	26	Pr_V26	1
3	Pr_V3	1	15	Pr_V15	1	27	Pr_V27	1
4	Pr_V4	1	16	Pr_V16	1	28	Pr_V28	0.95
5	Pr_V5	1	17	Pr_V17	1	29	Pr_V29	1
6	Pr_V6	1	18	Pr_V18	1	30	Pr_V30	1
7	Pr_V7	1	19	Pr_V19	1	31	Pr_V31	1
8	Pr_V8	1	20	Pr_V20	1	32	Pr_V32	1
9	Pr_V9	0.94	21	Pr_V21	0.88	33	Pr_V33	1
10	Pr_V10	1	22	Pr_V22	1	34	Pr_V34	1
11	Pr_V11	1	23	Pr_V23	1			
12	Pr_V12	1	24	Pr_V24	1			
	Number of Efficient DMUs				31			
	Number of Inefficient DMUs				3			
	Efficient DMU (%)				91			
	Inefficient DMU (%)				9			

Table 7. Provincial Effectiveness and Ineffectiveness

Classification	ES	Province (DMU)
Effective	ES=1	Ac (Pr_V1), SU (Pr_V2), SB (Pr_V3), Ri (Pr_V4), Jm (Pr_V5), SS (Pr_V6), Bg (Pr_V7), Lp (Pr_V8), KR (Pr_V10), DKI (Pr_V11), JB (Pr_V12), JT (Pr_V13), DIY (Pr_V14), JTi (Pr_V15), Bn (Pr_V16), Bl (Pr_V17), NTB (Pr_V18), NTT (Pr_V19), KB (Pr_V20), KS (Pr_V22), KTi (Pr_V23), KU (Pr_V24), SU (Pr_V25), ST (Pr_V26), SS (Pr_V27), G (Pr_V29), SB (Pr_V30), M (Pr_V31), MU (Pr_V32), PB (Pr_V33), and P (Pr_V34).
Ineffective	ES<1	STe (Pr_V28, ES=0.95), BB (Pr_V9, ES=0.94), and KT (Pr_V21, ES=0.88).

Analysis of Provincial Effectiveness and Ineffectiveness

Based on the classification, it can be seen which provinces are effective and which are not effective (Table 7).

Provinces with the effective category (ES = 1) include: Aceh (Ac), North Sumatra (SU), West Sumatra (SB), Riau (Ri), Jambi (Jm), South Sumatra (SS), Bengkulu (Bg), Lampung (Lp), Riau Islands (KR), DKI Jakarta (DKI), West Java (JB), Central Java (JT), D.I Yogyakarta (DIY), East Java (JTi), Banten (Bn), Bali (Bl), West Nusa Tenggara (NTB), East Nusa Tenggara (NTT), West Kalimantan (KB), Central Kalimantan (KT), South Kalimantan (KS), East Kalimantan (KTi), North Kalimantan (KU), North Sulawesi (SU), Central Sulawesi (ST), South Sulawesi (SS) , Gorontalo (G), West Sulawesi (SB), Maluku (M), North Maluku (MU), West Papua (PB), and Papua (P). Provinces in the ineffective category (ES < 1), namely Southeast Sulawesi (STe), Bangka Belitung (BB), and Central Kalimantan (KT).

Based on the efficiency score values, the DMUs can be classified as efficient or inefficient. An efficient DMU has an efficiency score of one, whereas an inefficient DMU has a value of less than one. The following considerations explain why DMUs have efficient or inefficient statuses: An efficient DMU always produces more outputs with equal input consumption, or it produces a given number of outputs with less input consumption. In contrast, an inefficient DMU requires more input to create the same amount of output [11]. According to the findings of this study, the provinces of Southeast Sulawesi (STe), Bangka Belitung (BB), and Central Kalimantan (KT), require more input to produce the same level of output.

Efforts to Increase Company Effectiveness

Performance measurement is very necessary for companies to evaluate their performance. To obtain maximum performance results, performance measurements must be carried out regularly. In this way, the progress of the company's targets to be achieved can be known about its performance. Performance evaluation, which is implemented periodically and routinely, will have an impact on achieving the company's efficient targets. Some of the underlying reasons are as follows:

1. Obstacles that hinder the company's development can be immediately identified and appropriate solutions sought.
2. Efforts to identify business weaknesses and find solutions to minimize losses from these weaknesses.
3. Company performance measurement is carried out to achieve optimal operational efficiency for the company. This efficiency includes technology, people, knowledge, and others.
4. If business units regularly measure company performance, the company has a more comprehensive and clear view of the effort and time required to complete all tasks. This can be used to evaluate and decide on better time management strategies.
5. Comprehensive performance appraisals also allow companies to assess the performance of their employees. Based on this information and utilizing the skills of their employees, companies can manage their workforce better and utilize existing human resources to achieve predetermined business goals [10].

The results of this research indicated that there are three provinces in the DMU ineffective category, namely: Southeast Sulawesi (STe), Bangka Belitung (BB), and Central Kalimantan (KT). The Indonesian government has made various efforts to improve PLN's performance in these three provinces. In this way, PLN can bring positive changes to people's daily lives and open up new opportunities to develop the local economy.

Improving PLN Performance in Southeast Sulawesi

PLN has completed various electricity projects to strengthen electricity in Southeast Sulawesi Province. It is hoped that stronger electricity will encourage industrial growth and increase the electrification ratio. A total of 130 megawatt (MW) generators were successfully operated to increase power supply. The Bau-Bau Gas Engine Power Plant (30 MW), Rongi Minihydro Power Plant (2×0.4 MW), and Kendari 3 Moramo IPP Steam Power Plant (2×50 MW) have all been operationally successful. Apart from power plants, PLN also connects the electricity system of Southern Sulawesi with Southeast Sulawesi via a 150-kilovolt (kV) transmission network and six substations. This 797-circuit-kilometer (ckm) transmission network is part of the Sulawesi Phase I electricity toll road, which connects the electricity systems in West Sulawesi, South Sulawesi, Central Sulawesi, and Southeast Sulawesi.

The connection of the Southern Sulawesi (Sulbagsel) electricity system with Southeast Sulawesi means that 400 MW of surplus power in Southern Sulawesi can be channeled to Southeast Sulawesi and provides potential savings of up to IDR 79 billion per month. In this way, Southeast Sulawesi's electricity will become stronger. This can encourage an increase in the electrification ratio and accelerate the emergence of industry.

PLN also continues to carry out construction to strengthen electricity in Southeast Sulawesi, including the 150 kV Kendari-Andolo-Kasipute transmission and the Kolaka Smelter Main Substation with a capacity of 30 Mega Volt Ampere (MVA). Through the village electricity program, PLN also succeeded in electrifying 94 villages spread across Southeast Sulawesi Province by building a medium voltage network of 310 ckm, a low voltage network of 258.8 ckm, and a distribution substation with a total capacity of 6,150 kVA [12]. PLN provides 24-hour, non-stop electricity access for 167 families spread across 16 villages in Southeast Sulawesi Province. The presence of this electricity infrastructure is a manifestation of PLN's commitment to providing equitable electricity to the community, including in the front, outer, and disadvantageous areas. Construction of various infrastructure, including: (i) Medium Voltage Network (MVN) along 62.22 circuit kilometers (ckm); (ii) Low Voltage Network (LVN) 60.58 ckm long; and (iii) 26 distribution substations with a total capacity of 1,450 kilo Volt Ampere (KVA) [13].

Improving PLN Performance in Bangka Belitung

PLN continually transforms how it provides services to customers. PLN is focused not just on expanding power supply, but also on customer satisfaction. End-to-end digital transformation initiative for customer service, facilitating access to power. PLN is transitioning from power supply to a focus on customer requirements and satisfaction. Household rates contributed the most to the increase in customer numbers, with 3,223,603, followed by business rates, which added 181,533 consumers. Currently, there are 72,311 social tariff consumers, 28,393 government tariff users, and 27,217 industrial tariff customers [14].

Comprehensive transformation that has been ongoing for the last 3 years. Starting with the transformation of business processes, organizations, and human resources to customer service. This achievement was achieved through the efforts of all PLN people who carried out end-to-end digital-based transformation. Starting from generation systems, transmission, distribution, procurement, financial systems, and planning systems to organizational restructuring and customer service, PLN has become more agile, unified, strong, and agile. This proves that PLN is not only able to plan transformation at the strategic level but is also able to execute it at the operational level [15].

Increase consistency and integrity to maximize synergy with stakeholders and PLN partners. In 2021, PLN received ISO 37001:2016 Anti-Bribery Management System (ABMS) accreditation. The involvement of PLN stakeholders is crucial to this success. SMAP implementation has been implemented and will be monitored to create a lean PLN Babel that upholds the values of integrity, good corporate governance (GCG), a code of business conduct, and ethics. All stakeholders must support PLN's consistent implementation of ABMS ISO 37001:2016 and the four No's, which include: (i) No Bribery or Extortion; (ii) No Kickback (no commission, thank you in the form of money or other forms); (iii) No Gifts (no gifts or gratifications that violate applicable rules and regulations); and (iv) No Luxurious Hospitality (no excessive reception or entertainment) [16].

Improving PLN Performance in Central Kalimantan

The development of electricity infrastructure in remote areas does not escape the synergy and collaboration of all parties, and awareness of the importance of equal distribution of electrical energy throughout the community motivates PLN to realize village electricity infrastructure. The development of electricity in three areas (disadvantaged, frontier, and outermost) is the government's mandate to PLN in terms of implementing the fifth principle of Pancasila, namely social justice for all Indonesian people with equal distribution of electricity infrastructure to remote areas, so that whatever the challenges, PLN continues to be committed to working to build electricity infrastructure for the whole society. Electricity can facilitate all forms of community activities, from urban areas to remote villages, so that it can improve the economy and community welfare. PLN's South Kalimantan and Central Kalimantan Main Distribution Unit (MDU) installed electricity connections so that it could illuminate 3,217 villages and sub-districts. The percentage of villages and sub-districts that have received electricity from PLN is 99.25 percent in South Kalimantan and Central Kalimantan, reaching 76.45 percent. PLN MDU South Kalimantan and Central Kalimantan targets completing the construction of electricity infrastructure in 70 villages and five hamlets (both in the South Kalimantan and Central Kalimantan regions) [17].

The Service Integration Program aims to enhance the Electronic Based Government System Index. The PLN Icon Plus Central Kalimantan Representative Regional Office has provided assistance for this program. PLN Icon Plus is a member of the PLN Group, which specializes in the telecommunications industry. In response to the industry's demand for telecommunications networks with continuous levels of availability and reliability, PLN Icon Plus is expanding its business by transferring excess capacity from PLN's fiber optic electrical telecommunications network in Java and Bali to public requirements. PLN Icon Plus works with a variety of businesses and institutions, particularly those whose operations require large and dependable telecommunications networks [18].

Synchronization and coordination, as well as increased synergy among all essential parties, will all contribute to the acceleration of regional power development in Central Kalimantan. Electricity conditions in Central Kalimantan are linked to the South Kalimantan-Central Kalimantan system. This interconnection has a supply capacity of 1,846 MW and a peak load of 1,391 MW. Thus, the electricity excess is 455 MW (25 percent). The PLN Central Kalimantan Distribution Main Unit is attempting to meet Central Kalimantan's energy supply demands as efficiently as possible. This is supported by the construction of four 150-kilovolt substations: Kuala Pembuang, Sukamara, Nanga Bulik, and Kuala Kurun. Each substation has a capacity of 30 MVA. The Central Kalimantan Provincial Government intends to develop village electricity for 200 villages that do not yet have PLN electricity through distributed solar power plants, as well as the New Electrical Installation Assistance Program for 5,500 Target Households for underprivileged communities as registered in the Ministry of Social Affairs' Integrated Social Welfare Data [19].

CONCLUSION

The research results indicate that there are three inefficient DMUs, namely Pr_V9, Pr_V21, and Pr_V28. The other DMUs fall into the efficient DMU category (31 DMUs). Efficient DMU has a percentage of 94%, and inefficient DMU has a percentage of 6%. Provinces in the ineffective category (SE < 1), namely Southeast Sulawesi (STe), Bangka Belitung (BB), and Central Kalimantan (KT). Performance evaluation, which is implemented periodically and routinely, will have an impact on achieving the company's efficient targets. Some of the underlying reasons include optimizing strategic steps, knowing the company's weaknesses, achieving optimal operational efficiency, better time management, and managing workforce skills.

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