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Decision Support System Determining Location of General Electricity Provider Station Using ANP and TopsisMethod in PT PLN Persero Jakarta Raya

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Abstract:

In selecting the location of a new general electricity supply station there are several criteria that can influence decision making, the choice of the right location can provide benefits in terms of meeting domestic energy needs and in terms of economy. To get an objective and transparent decision, a system is needed to help decision-makers determine the location of the SPLU, which criteria and alternative locations are suitable for the needs of the company. The system method developed to determine the best location established the SPLU from the many locations offered using the ANP and Topsis methods, which is one method of resolving decision-making problems based on the concept that the chosen alternative is the best. And it will be seen the influence of one criterion with other criteria, the criteria used are strategic location, population density, land status, easy to reach, distance between public electricity supply stations, parking lots, waiting rooms and surrounding security, which is divided into three criteria clusters. The results of this study indicate the best location is DuriKosambi with a value of 0.7334 and for the quality of this system to get a good response from the commercial division.

Keywords — **Criteria, alternative, TOPSIS, ANP, electricity, location, strategic.**

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I. INTRODUCTION

Tribunnews.com (2017, energy column) states that "The development of electric vehicles, both bicycles, motorbikes and electric cars, is increasingly being accepted in Indonesia when the support of the Government emerges. Long before that, PLN had seen this challenge and supported the development of this environmentally friendly technology by providing the necessary infrastructure, one of which was a General Electricity Provider Station (SPLU). At present PLN has provided at least 1200 SPLUs spread across a number of locations in Indonesia. SPLU developed by PLN since 2015, can be found in Jakarta, Bandung, Bangka Belitung, Riau and Riau Islands, MuaraBungo, Bengkulu, Lampung, Manado, Gorontalo, Palu, Kotamobagu, Yogyakarta, Bali, Makassar, and many more."

The General Electricity Provider Station in Jakarta since it was launched on 4 August 2016 until March 2018 has been installed in 369 locations. The existence of SPLU will continue to grow in line with the needs of consumers, including the need for energy charging for electric vehicles in public places. With a network reaching hundreds of units, spread throughout Indonesia, SPLU PLN is the pride of the Indonesian people in providing comfort and convenience for motorists in refueling using electricity. Therefore, to overcome the problem of distributing general electricity supply stations in the region, it is necessary to increase the number of SPLU to meet consumer needs for electricity resources (Cultural Festival, 2018).

The innovation of PLN as an electric vehicle charging infrastructure was initially used to serve the electricity needs of the public in public places, such as for Micro, Small and Medium Enterprises (UMKM) or street vendors (PKL). Along with the development of technology, SPLU can also be used to recharge electric vehicle energy. One example of the BejiLintar SPLU adopts a prepaid system. To use it, the public needs to fill up the stroom kWh meter by buying an electric token through the Online Payment Point Bank (PPOB), Emoney, ATM, minimarket, and others by mentioning the Customer ID or kWh Meter number listed on the SPLU to be used.

In selecting new SPLU locations there are several criteria that can influence decision making. These criteria include strategic location, easy to reach, the number of SPLU in the area of the road, the land status of the regional licensing fees, the surrounding security and others. In addition there are many roads that can be selected for new SPLU locations, so in this case PLN must be more careful and careful in making decisions. To help the decision making process can use 2 methods for Others Reference by Similarity to Ideal Solution (TOPSIS) and Analityc Network Process (ANP).

II. METHODOLOGY

A. *Analytic Network Processand Topsis Method*

The Analytic Network Process method was first published by Thomas L. Saaty. ANP is a renewal of the Analytic Hierarchy Process (AHP) method in which the renewal changes from a hierarchical pattern to a network of structures that determines the relationship of the required depedency ratio. The nature of this method is the dependence of components or criteria due to an alternative solution that will later be issued. The fundamental difference to other methods is the dependence between elements so that there is no need to set criteria at a certain level. If these components have fulfilled the requirements, there will be an alternative solution. Dependence on the component is translated into a matrix or also called Supermatriks.

Topsis is one of the multicriteria decision-making methods first introduced by Yoon and Hwang (1981). The Topsis method is based on the concept that the best selected alternative not only has the shortest distance from the positive ideal solution but also has the longest distance from the positive ideal solution but also has the longest distance from the ideal solution (Hwang, 1981) (Zeleny, 1982). This concept is widely used in several MADM models to solve decision problems practically (Hwang, 1981) (Yeh, 2000).

The ANP and Topsis methods are achieved by determining the priority of the location of the general electricity supply station. The criteria used are strategic location, easy to reach, land status, population density, distance, parking space, waiting room and surrounding security. It can be seen that there is a relationship between interdependence effects between criteria. The final result given by the system is the order of priority locations of the general electricity supply station from the alternative available location. The image below shows ANP modeling and created Topsis.

According to Swastha (2002), "Location is a place where a business or business activity is carried out". An important factor in the development of a business is the location of the location of the urban area, the way of achieving and the travel time of the location to the destination. A good location factor is relative to each different type of business.

According to Kotler (2008), "One of the keys to success is location, location begins with choosing a community". This decision depends heavily on the potential for economic growth and stability, competition, political climate and so on. Lamb et al (2001), stated that choosing a good place or location is an important decision the research steps must be carried out in sequence and the structure in accordance with the business processes that are in accordance with the existing conditions. Research steps planned by researchers in order to carry out research in accordance with the conceptual framework and problem solving mindset by adopting the RAD system development method are as shown below:

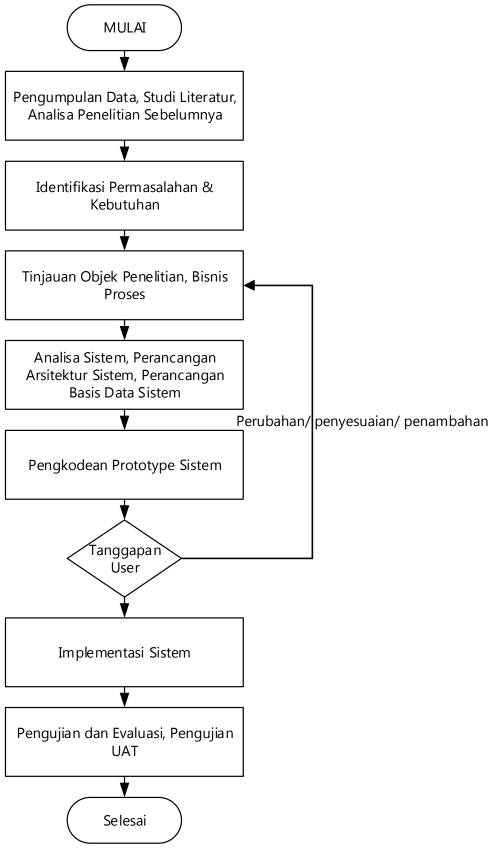

Fig 1. Stages of the SPLU Decision Support System Process

The decision-making process begins with determining the criteria needed in selecting a location. Next is to calculate the priority weight by considering the influence of interdependence, and then is to rank alternative locations of splu using the Topsis method so that priority locations can be obtained. The process steps are carried out as shown in the picture below.

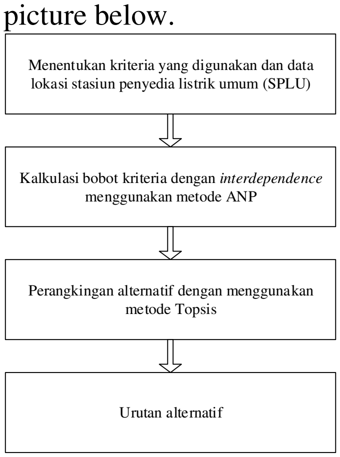

Fig 2. Stages of the SPLU Decision Support System Process

The method used in this study is a combination of ANP method and Topsis. ANP is a decision support system method that uses several variables with a multilevel analysis process. Analysis is done by giving priority values to each variable, then doing pairwise comparisons of the variables and alternatives available. Topsis is a method based on the concept that the best chosen alternative does not only have the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution. ANP is used for weighting each criterion and Topsis for ranking based on input from ANP.

III. RESULT AND DISCUSSION

Determining the criteria for the right SPLU location is expected to meet the company's expectations to attract consumers in order to get profits and vice versa if there is an error in the selection of locations will hamper business performance and automatically maximum profits will not be felt by the company. So, choosing a business location that is close to the target market and the availability of adequate infrastructure is a strategy that can also facilitate consumers to get the products / services they want.

The criteria used for alternative ranking of SPLU location selection is done through interviews / brainstorming with experts in the commercial field and through literature study. Then obtained several factors that influence the selection of SPLU locations, and consists of eight criteria, namely, strategic location, population density, land status, easy to reach, other distance, parking space, waiting room, and surrounding security.

Table I.
SPLU Location Determination Criteria

Cluster	KodeKriteria	Kriteria
Lahan	LS	LokasiStrategis
	KP	KepadatanPenduduk
	SL	Status Lahan
Jalan	MD	MudahDijangkau
	JS	Jarak SPLU Lain
Fasilitas	TP	TempatParkir
	RT	RuangTunggu

	KS	KeamananSekitar

The number of locations that the SPLU wants to build by the company, making the commercial part more selective in choosing alternative locations that will be used as locations for public electricity supply stations. From interviews conducted with the commercial section, here took a sample of ten alternative locations that could meet predetermined criteria.

Table II.
SPLU Location Alternatives

Alternatif	Lokasi	KodeAlternatif
AlternatifLokasiStasiunPenyediaListrikUmum	DuriKosambi	DK
	KebonJeruk	KJ
	Sunter Jaya	SJ
	PejagalanKalijodo	PK
	Jati Padang	JP
	RTH Kebagusan	RK
	PondokRanggon	PR
	CipinangMuara	CM
	BendunganHilir	BH
	Taman Menteng	TM

Network creation is based on determining the criteria and alternatives of predetermined location. This network will identify the interplay between the other criteria. The relationship between Inner Dependence and Outer Dependence, the relationship of mutual influences that occur between one criterion and the other criteria in one cluster is called the inner dependence relationship, while the relationship between one criterion and the other criteria in another cluster is called the outer dependence. For SPLU location selection decision support system, it only has inner dependence between criteria in each cluster. The following is the network for each criteria and alternative cluster.

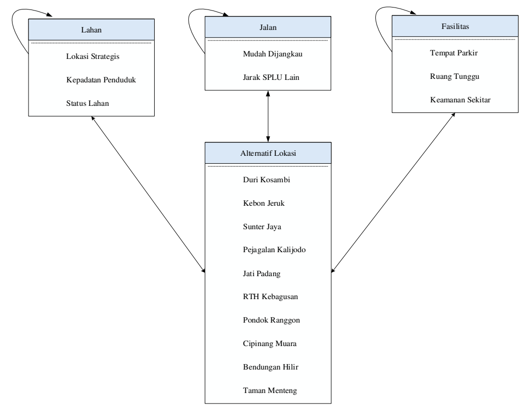

Fig 3. Network ANP Determination of SPLU Location

The picture above explains that in the decision support system the SPLU location determination only has an inner dependence relationship and the absence of an outer dependence relationship. The following is a hierarchy graph and a detailed decision support system for determining the location of a public electricity supply station.

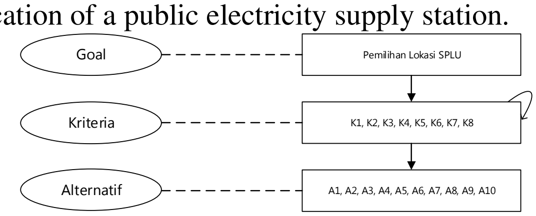

Fig 4. SPK hierarchy SPLU location with ANP

Table III.
Question Questionnaire from the Land Cluster

No	Kriteria	Skala									Kriteria
		9	7	5	3	1	3	5	7	9	
1	LS				√						KP

The use of right-hand scales 1, 3, 5, 7 and 9 means that the importance of population density (KP) is more important or more critical than the scale on the left, namely strategic land (LS). Table 3 explains that the respondent answered a scale of three (3), the land cluster affected the strategic land (LS) sub criteria with a moderate importance level when compared with the sub density population criteria (KP). If the opposite is the case when choosing number 3 on the right which means population density subcategory (KP) moderate the importance of the strategic land sub criteria (LS). Then the questionnaire was collected from 10 correspondents with answers from each.

Table IV.
Land Criteria Pairwise Comparison Matrix

No	Kriteria	K01	K02	K03	K04	K05	K06	K07	K08
1	K01	1	6	6	6	6	6	6	7
2	K02	0,2	1	0,17	0,17	0,17	0,17	0,17	0,17
3	K03	0,2	6	1	0,17	0,14	0,17	7	6
4	K04	0,2	6	6	1	0,14	6	7	7
5	K05	0,2	6	7	7	1	6	7	0,17
6	K06	0,2	6	6	0,17	0,17	1	0,14	0,14
7	K07	0,2	6	0,14	0,14	0,14	7	1	7
8	K08	0,1	6	0,17	0,14	6	7	0,14	1
	Jumlah	2,1	43	26,5	14,8	13,8	33,3	28,5	28,5

Information: K01 LahanStrategis (LS), K02 KepadatanPenduduk (KP), K03, Status Lahan (LS), K04 MudahDijangkau (MD), K05 Jarak SPLU (JS), K06 TempatParkir (TP), K07 RuangTunggu (RT), K08 KeamananSekitar (KS).

Table V.
Alternative Location Pairing Matrix

No	Alternatif	DK	KJ	SJ	PK	JP	RK	PR	CM	BH	TM
1	DK	1	6	6	0,17	6	0,13	4	0,2	6	0,14
2	KJ	0,17	1	4	6	0,17	6	6	7	0,2	6
3	SJ	0,17	0,25	1	6	0,17	6	0,14	0,14	0,17	0,13
4	PK	6	0,17	0,17	1	0,17	6	6	0,17	0,17	7
5	JP	0,17	6	6	6	1	0,17	0,17	0,17	6	6
6	RK	8	0,17	0,17	0,17	6	1	0,17	0,17	6	0,14
7	PR	0,25	0,17	7	0,17	6	6	1	0,17	0,17	0,14
8	CM	5	0,14	7	6	6	6	6	1	5	0,17
9	BH	0,17	5	6	6	0,17	0,17	6	0,2	1	0,13
10	TM	7	0,17	8	0,14	0,17	7	7	6	8	1
	Jumlah	27,92	19,06	45,33	31,64	25,83	38,46	36,48	15,21	32,7	20,85

Information: DK DuriKosambi, KB KebonJeruk, SJ Sunter Jaya, PK PejagalanKalijodo, JP Jati Padang, RK RTH Kebagusan, PR PondokRanggon, CM CipinangMuara, BH BendunganHilir, Taman Menteng.

The purpose of the consistency test is to determine the consistency of the answers that have been filled in by the respondents which will affect the stability of the results. By being declared consistent, the data can be used and processed to the next stage. The steps for calculating consistency test are as follows:

a. Times Vector Value.

The calculation of the value of times is the comparison matrix multiplication with the priority vector that has been done in the previous calculation.

b. Vector Value Share.

Calculation of vector values for is dividing vector values times with priority vectors. The total of the vectors for this will be used for maximum eigen calculation Maximum Eigen value.

c. The maximum eigen.

Calculation is done by summing the sigma vector for then divided by the size of the existing matrix (n) and this maximum eigenvalue will be used to calculate the consistency value of the index (CI). The following is the maximum eigenvalue formulation.

$$\lambda \text{ max} = \frac{(\sum vector\ for)}{n} \quad (4.3)$$

d. λ Consistency Index Value (CI).

The consistency index value (CI) is used to calculate the consistency ratio value which will determine whether the pairwise comparison matrix to be obtained from the results of the questionnaire has a consistent or not.

$$\text{CI} = \frac{(\lambda\, max\ - n)}{(n-1)} \quad (4.4)$$

e. Random Index Value (RI).

Index random value (RI) is obtained by looking at the index random table. The RI value will depend on the value of the matrix size. The random index value will be used to calculate the consistency ratio (CR), this CR value will determine the pairwise comparison matrix obtained from the results of the questionnaire has a consistent or not.

f. Consistency Ratio (CR).

Consistency ratio (CR) will be valid or consistent if the value of CR <0.1 or worth <10% and vice versa CR will be invalid or inconsistent if the value is greater ≥ 0.1 with the formulation of the consistency ratio (CR) as follows:

$$\text{CR} = \frac{CI}{CR} \quad (4.5)$$

Calculation of priority vectors to calculate the logical consistency of the questionnaire and get the weight of each criterion that will be used in the next calculation. Examples of priority vector calculations are as follows.

Table VI.
Priority Vector Criteria for Strategic Location

No.	Kriteria	K01	K02	K03	K04	K05	K06	K07	K08	Eigen
1	K01	0,47	0,14	0,23	0,41	0,44	0,18	0,21	0,25	0,29
2	K02	0,08	0,02	0,01	0,01	0,01	0,01	0,01	0,01	0,02
3	K03	0,08	0,14	0,04	0,01	0,01	0,01	0,25	0,21	0,09
4	K04	0,08	0,14	0,23	0,07	0,01	0,18	0,25	0,25	0,15
5	K05	0,08	0,14	0,26	0,47	0,07	0,18	0,25	0,01	0,18
6	K06	0,08	0,14	0,23	0,01	0,01	0,03	0,01	0,01	0,06
7	K07	0,08	0,14	0,01	0,01	0,01	0,21	0,04	0,25	0,09
8	K08	0,07	0,14	0,01	0,01	0,44	0,21	0,01	0,04	0,11

Table 6, the priority vector value obtained from the table 5 value of each cell value compared to the number of columns of each cell.

Table VII.
Priority Vector Alternative Strategic Locations

No.	Alternatif	DK	KJ	SJ	PK	JP	RK	PR	CM	BH	TM	Eigen
1	DK	0,04	0,32	0,13	0,01	0,23	0	0,11	0,01	0,18	0,01	0,1
2	KJ	0,01	0,05	0,09	0,19	0,01	0,16	0,16	0,46	0,01	0,29	0,14
3	SJ	0,01	0,01	0,02	0,19	0,01	0,16	0	0,01	0,01	0,01	0,04
4	PK	0,22	0,01	0	0,03	0,01	0,16	0,16	0,01	0,01	0,34	0,09
5	JP	0,01	0,32	0,13	0,19	0,04	0	0,01	0,01	0,18	0,29	0,12
6	RK	0,29	0,01	0	0,01	0,23	0,03	0,01	0,01	0,18	0,01	0,08
7	PR	0,01	0,01	0,15	0,01	0,23	0,16	0,03	0,01	0,01	0,01	0,06
8	CM	0,18	0,01	0,15	0,19	0,23	0,16	0,16	0,07	0,15	0,01	0,13
9	BH	0,01	0,26	0,13	0,19	0,01	0	0,16	0,01	0,03	0,01	0,08
10	TM	0,25	0,01	0,18	0,01	0,01	0,18	0,19	0,39	0,25	0,05	0,15

Table 7 priority vector values obtained from table 5 values for each cell value compared to the number of columns of each cell.

TableVIII.
Consistency Ratio of Land Criteria for Strategic Locations and Alternatives for Thorns

Hasil Cek Nilai Konsistensi		
(A)(W^t)	:	[4,6690] [0,1820] [1,6357] [2,7051] [3,0733] [0,8606] [1,5497] [1,8539]
t	:	15,6907
Index Konsistensi (CI)	:	1,0987
Rasio Konsistensi	:	0,7792
Hasil Konsistensi	:	Belum Konsisten

Shows the value of the consistency ratio of the strategic location land cluster, from the number of criteria in the interconnected cluster, the CI value of the consistency index is obtained by using the formula (4.4), the CR value of consistency ratio is obtained by using the formula (4.5) the CR value of consistency ratio is less than 0.1 then it is considered not consistent and the data cannot be used for the next process.

Table IX.
Consistency Ratio from the Land Criteria for Strategic Locations and the Alternative Thorns Area

Hasil Cek Nilai Konsistensi		
(A)(W^t)	:	[2,7168] [3,5770] [1,1977] [2,6877] [3,2371] [2,1990] [1,6407] [3,4917] [2,0677] [3,6746]
t	:	26,8018
Index Konsistensi (CI)	:	1,8669
Rasio Konsistensi	:	1,2529
Hasil Konsistensi	:	Belum Konsisten

Unweighted supematriks is the value of the priority vector that does not take into account the comparison of clusters, criteria or alternatives that are above means that affect, while the criteria or alternatives that are below it means it is affected. If the inter-criteria or alternative meeting does not have a value then it is filled with zero (0), which means there is no relationship between the criteria or the alternative.

Table X.
Unweighted Supermatriks

Supermatriks Tidak Terbobot																			
No	Cluster dan Node	Alternatif										Kriteria							
		DK	KJ	SJ	PK	JP	RK	PR	CM	BH	TM	LS	KP	SL	MD	JS	TP	RT	KS
	Alternatif																		
1	DK	0	0	0	0	0	0	0	0	0	0	0,1	0,06	0,21	0,25	0,25	0,02	0,25	0,25
2	KJ	0	0	0	0	0	0	0	0	0	0	0,14	0,06	0,12	0,2	0,14	0,04	0,16	0,18
3	SJ	0	0	0	0	0	0	0	0	0	0	0,04	0,09	0,15	0,14	0,17	0,27	0,15	0,14
4	PK	0	0	0	0	0	0	0	0	0	0	0,09	0,26	0,11	0,12	0,12	0,17	0,11	0,12
5	JP	0	0	0	0	0	0	0	0	0	0	0,12	0,21	0,1	0,1	0,1	0,12	0,1	0,09
6	RK	0	0	0	0	0	0	0	0	0	0	0,08	0,12	0,1	0,05	0,08	0,12	0,08	0,07
7	PR	0	0	0	0	0	0	0	0	0	0	0,06	0,04	0,08	0,06	0,06	0,09	0,06	0,06
8	CM	0	0	0	0	0	0	0	0	0	0	0,13	0,03	0,05	0,04	0,04	0,08	0,04	0,04
9	BH	0	0	0	0	0	0	0	0	0	0	0,08	0,05	0,03	0,03	0,03	0,06	0,04	0,03
10	TM	0	0	0	0	0	0	0	0	0	0	0,15	0,07	0,04	0,02	0,02	0,05	0,02	0,02
	Kriteria																		
1	LS	0,29	0,33	0,3	0,35	0,32	0,33	0,24	0,29	0,32	0,34	0	0	0	0	0	0	0	0
2	KP	0,02	0,22	0,19	0,2	0,02	0,21	0,12	0,21	0,19	0,21	0	0	0	0	0	0	0	0
3	SL	0,09	0,14	0,13	0,16	0,21	0,1	0,09	0,15	0,14	0,15	0	0	0	0	0	0	0	0
4	MD	0,15	0,11	0,12	0,11	0,14	0,03	0,02	0,12	0,12	0,09	0	0	0	0	0	0	0	0
5	JS	0,18	0,08	0,1	0,07	0,13	0,04	0,11	0,09	0,09	0,09	0	0	0	0	0	0	0	0
6	TP	0,06	0,06	0,1	0,06	0,07	0,05	0,1	0,06	0,07	0,06	0	0	0	0	0	0	0	0
7	RT	0,09	0,04	0,04	0,03	0,06	0,14	0,16	0,05	0,04	0,04	0	0	0	0	0	0	0	0
8	KS	0,11	0,02	0,02	0,02	0,04	0,09	0,16	0,02	0,03	0,02	0	0	0	0	0	0	0	0

Table 10 is a super-weighted or unweighted super matrix matrix. There is a weight value in each column numbering one and also amounting to more than one, this is due to the relationship or influence of one criterion with other criteria, whether on the criteria with the cluster itself or with different clusters.

Weighted Supermatric, the pairwise comparison between clusters determines whether or not there is a weighted supermetric matrix. Without a pairwise comparison between clusters, the value of unweighted super matrix with weighted super matrix will be the same. Weighted super matrix is the result of unweighted supermatrix times with the comparison of pairs of clusters that influence each other.

Table XI.
Weighted Supermatriks

Supermatriks Tidak Terbobot																			
No	Cluster & Node	Alternatif										Kriteria							
		DK	KJ	SJ	PK	JP	RK	PR	CM	BH	TM	LS	KP	SL	MD	JS	TP	RT	KS
Alternatif																			
1	DK	0	0	0	0	0	0	0	0	0	0	0,1	0,06	0,21	0,25	0,25	0,02	0,25	0,25
2	KJ	0	0	0	0	0	0	0	0	0	0	0,14	0,06	0,12	0,2	0,14	0,04	0,16	0,18
3	SJ	0	0	0	0	0	0	0	0	0	0	0,04	0,09	0,15	0,14	0,17	0,27	0,15	0,14
4	PK	0	0	0	0	0	0	0	0	0	0	0,09	0,26	0,11	0,12	0,12	0,17	0,11	0,12
5	JP	0	0	0	0	0	0	0	0	0	0	0,12	0,21	0,1	0,1	0,1	0,12	0,1	0,09
6	RK	0	0	0	0	0	0	0	0	0	0	0,08	0,12	0,1	0,05	0,08	0,12	0,08	0,07
7	PR	0	0	0	0	0	0	0	0	0	0	0,06	0,04	0,08	0,06	0,06	0,09	0,06	0,06
8	CM	0	0	0	0	0	0	0	0	0	0	0,13	0,03	0,05	0,04	0,04	0,08	0,04	0,04
9	BH	0	0	0	0	0	0	0	0	0	0	0,08	0,05	0,03	0,03	0,03	0,06	0,04	0,03
10	TM	0	0	0	0	0	0	0	0	0	0	0,15	0,07	0,04	0,02	0,02	0,05	0,02	0,02
Kriteria																			
1	LS	0,29	0,33	0,3	0,35	0,32	0,33	0,24	0,29	0,32	0,34	0	0	0	0	0	0	0	0
2	KP	0,02	0,22	0,19	0,2	0,02	0,21	0,12	0,21	0,19	0,21	0	0	0	0	0	0	0	0
3	SL	0,09	0,14	0,13	0,16	0,21	0,1	0,09	0,15	0,14	0,15	0	0	0	0	0	0	0	0
4	MD	0,15	0,11	0,12	0,11	0,14	0,03	0,02	0,12	0,12	0,09	0	0	0	0	0	0	0	0
5	JS	0,18	0,08	0,1	0,07	0,13	0,04	0,11	0,09	0,09	0,09	0	0	0	0	0	0	0	0
6	TP	0,06	0,06	0,1	0,06	0,07	0,05	0,1	0,06	0,07	0,06	0	0	0	0	0	0	0	0
7	RT	0,09	0,04	0,04	0,03	0,06	0,14	0,16	0,05	0,04	0,04	0	0	0	0	0	0	0	0
8	KS	0,11	0,02	0,02	0,02	0,04	0,09	0,16	0,02	0,03	0,02	0	0	0	0	0	0	0	0

Table 11 is a table of the weighted supermetric matrix above which is obtained from the super-matrix unweighted table that has been influenced by local weighting between clusters.

Limiting supermatriks is the result of super matrix iteration, so that it gets the same value in each row. By getting the results of the super-limiting limiting, we will get the weights of each alternative and the weight of each of the criteria in the ANP model. Where later the weights of each of these criteria will be used in the topsis method to find alternative locations that will be recommended.

Table XII.
Limiting Supermatriks

Hasil Sintesize (Nilai Normal Tertinggi merupakan Alternatif Terbaik)			
No	Alternatif	Nilai Asal (RAW)	Nilai Normal
1	Duri Kosambi	0,077484	0,15512871
2	Pejagalan Kalijodo	0,067221	0,13458143
3	Kebon Jeruk	0,06425	0,12863326
4	Jati Padang	0,060226	0,12057692
5	Sunter Jaya	0,058481	0,1170833
6	RTH Kebagusan	0,042775	0,08563872
7	Taman Menteng	0,036502	0,07307971
8	Cipinang Muara	0,035414	0,07090145
9	Pondok Ranggon	0,030928	0,06192015
10	Bendungan Hilir	0,026201	0,05245634

Table 12 shows the matrix super limiting values for alternative values and cluster values for each criterionRegional alternatives that will be used as SPLU locations are determined by the company. The alternative areas that will be used as SPLU locations are the Jakarta city in the Jakarta area.

Table XIII.
Alternative identification

Alternatif	Lokasi	KodeAlternatif
AlternatifLokasiStasiunPenyediaListrikUmum	DuriKosambi	DK
	KebonJeruk	KJ
	Sunter Jaya	SJ
	PejagalanKalijodo	PK
	Jati Padang	JP
	RTH Kebagusan	RK
	PondokRanggon	PR
	CipinangMuara	CM
	BendunganHilir	PT
	Taman Menteng	TM

TableXIV.
Area of Alternative Regional Cities

Kelurahan/Kabupaten/Kota		Luas Wilayah
1	DuriKosambi	5,03
2	KebonJeruk	3.69
3	Sunter Jaya	4,68
4	PejagalanKalijodo	3,23
5	Jati Padang	1,56
6	RTH Kebagusan	2,26
7	PondokRanggon	3,66
8	CipinangMuara	2,9
9	BendunganHilir	158,16
10	Taman Menteng	2,44
Luas Wilayah Kota DKI Jakarta		183,92

Table XV.
Alternative City Density

Kelurahan/Kabupaten/Kota		KepadatanPenduduk per km^2
1	DuriKosambi	15.702
2	KebonJeruk	15500.20
3	Sunter Jaya	11.887
4	PejagalanKalijodo	27306,76
5	Jati Padang	5.161
6	RTH Kebagusan	38.006
7	PondokRanggon	7243,69
8	CipinangMuara	22314,68
9	BendunganHilir	20.025
10	Taman Menteng	12478,27
KepadatanPenduduk DKI		160.124

TableXVI.
Criteria Value Data

No.	Kode	Alternatif	Nilai Kriteria							
			Lokasi Strategis	Kepadatan Penduduk	Status Lahan	Mudah Dijangkau	Jarak SPLU	Tempat Parkir	Ruang Tunggu	Keamanan Sekitar
1	DK	Duri Kosambi	5	3	5	6	6	6	5	5
2	KJ	Kebon Jeruk	5	5	6	6	6	5	3	5
3	SJ	Sunter Jaya	5	6	5	3	6	5	6	3
4	PK	Pejagalan Kalijodo	6	6	3	5	5	3	6	3
5	JP	Jati Padang	5	6	3	6	5	5	5	3
6	RK	RTH Kebagusan	6	3	5	5	6	3	6	6
7	PR	Pondok Ranggon	5	5	6	3	6	5	5	5
8	CM	Cipinang Muara	6	5	5	5	3	3	6	6
9	BH	Bendungan Hilir	5	5	6	3	6	3	5	5
10	TM	Taman Menteng	6	3	5	3	6	3	6	5

Normalization decision matrix, carried out by lifting each cell value from each column, then adding up each column, then adding the square root to get the normalized decision table. Normalization data is done using the formula:

$$N = \frac{Data}{Akar\ hasil\ pangkat\ per\ kriteria} \quad (4.6)$$

Table XVII.
Data Normalized

No	Kode	Alternatif	Nilai Kriteria							
			Lokasi Strategis	Kepadatan Penduduk	Status Lahan	Mudah Dijangkau	Jarak SPLU	Tempat Parkir	Ruang Tunggu	Keamanan Sekitar
1	DK	Duri Kosambi	0,2916	0,1957	0,3156	0,4054	0,3402	0,446	0,2941	0,3341
2	KJ	Kebon Jeruk	0,2916	0,3262	0,3787	0,4054	0,3402	0,3716	0,1765	0,3341
3	SJ	Sunter Jaya	0,2916	0,3914	0,3156	0,2027	0,3402	0,3716	0,3529	0,2004
4	PK	Pejagalan Kalijodo	0,3499	0,3914	0,1894	0,3379	0,2835	0,223	0,3529	0,2004
5	JP	Jati Padang	0,2916	0,3914	0,1894	0,4054	0,2835	0,3716	0,2941	0,2004
6	RK	RTH Kebagusan	0,3499	0,1957	0,3156	0,3379	0,3402	0,223	0,3529	0,4009
7	PR	Pondok Ranggon	0,2916	0,3262	0,3787	0,2027	0,3402	0,3716	0,2941	0,3341
8	CM	Cipinang Muara	0,3499	0,3262	0,3156	0,3379	0,1701	0,223	0,3529	0,4009
9	BH	Bendungan Hilir	0,2916	0,3262	0,3787	0,2027	0,3402	0,223	0,2941	0,3341
10	TM	Taman Menteng	0,3499	0,1957	0,3156	0,2027	0,3402	0,223	0,3529	0,3341

Normalized data, obtained from table 16, then normalized process to lift each cell and then add up, after summing the roots of the results are summed.

TableXVIII.
Weighted Normalization Weights

No	Kode	Alternatif	**Nilai Kriteria**							
			Lokasi Strategis	Kepadatan Penduduk	Status Lahan	Mudah Dijangkau	Jarak SPLU	Tempat Parkir	Ruang Tunggu	Keamanan Sekitar
1	DK	Duri Kosambi	1,458	0,5871	1,578	2,4327	2,0414	2,6759	1,4706	1,6704
2	KJ	Kebon Jeruk	1,458	0,9785	1,8936	2,4327	2,0414	2,2299	0,8824	1,6704
3	SJ	Sunter Jaya	1,458	1,1742	1,578	1,2163	2,0414	2,2299	1,7647	1,0022
4	PK	Pejagalan Kalijodo	1,7496	1,1742	0,9468	2,0272	1,7011	1,3379	1,7647	1,0022
5	JP	Jati Padang	1,458	1,1742	0,9468	2,4327	1,7011	2,2299	1,4706	1,0022
6	RK	RTH Kebagusan	1,7496	0,5871	1,578	2,0272	2,0414	1,3379	1,7647	2,0045
7	PR	Pondok Ranggon	1,458	0,9785	1,8936	1,2163	2,0414	2,2299	1,4706	1,6704
8	CM	Cipinang Muara	1,7496	0,9785	1,578	2,0272	1,0207	1,3379	1,7647	2,0045
9	BH	Bendungan Hilir	1,458	0,9785	1,8936	1,2163	2,0414	1,3379	1,4706	1,6704
10	TM	Taman Menteng	1,7496	0,5871	1,578	1,2163	2,0414	1,3379	1,7647	1,6704

Normalization is weighted, by multiplying normalization data by weighting criteria. Weighted normalization = Normalization data x Criteria weight.

Table XIX.
Ideal Solution Value Data

SOLUSI IDEAL	Nilai Solusi Ideal Kriteria							
	Lokasi Strategis	Kepadatan Penduduk	Status Lahan	Mudah Dijangkau	Jarak SPLU	Tempat Parkir	Ruang Tunggu	Keamanan Sekitar
SOLUSI IDEAL POSITIF	1,7496	1,1742	1,8936	2,4327	2,0414	2,6759	1,7647	2,0045
SOLUSI IDEAL NEGATIF	1,458	0,5871	0,9468	1,2163	1,0207	1,3379	0,8824	1,0022

Determining Ideal Solution, with Formulation is:

Dx+

$$\sqrt{(AxC1 - Y1 +)^2 + (AxC1 - Y2 +)^2 + \ldots + AxCn - Yn)^2}$$

Dx+

$$\sqrt{(AxC1 - Y1 +)^2 + (AxC1 - Y2 -)^2 + \ldots + AxCn - Yn)^2}$$

TableXX.
Positive and Negative Ideal Solution Value Data

No	Kode	Alternatif	Jarak Solusi Ideal Positif (d+)	Jarak Solusi Ideal Negatif (d-)	Nilai Preferensi (V)
1	DK	Duri Kosambi	0.8529	23.457	0.7334
2	KJ	Kebon Jeruk	11.011	21.938	0.6658
3	SJ	Sunter Jaya	16.934	18.328	0.5198
4	PK	Pejagalan Kalijodo	19.928	1.526	0.4337
5	JP	Jati Padang	1.545	18.517	0.5451
6	RK	RTH Kebagusan	15.488	19.914	0.5625
7	PR	Pondok Ranggon	14.141	19.182	0.5756
8	CM	Cipinang Muara	17.703	17.542	0.4977
9	BH	Bendungan Hilir	1.895	16.982	0.4726
10	TM	Taman Menteng	19.559	16.584	0.4588

Determine preference values for each alternative, using formulations:

$$Vx = \frac{Dx-}{(Dx-)+(Dx+)} \quad (4.12)$$

The following is a program screen that is created using PHP and the MySql database for decision support systems for the selection of public electricity supply stations.

The login menu display is used so that we get access to run menus in the main menu. This is done so that people cannot access this system application. So that the confidentiality menu form is maintained properly. Equipped with the first level of user level, the user can access all menus in the system.

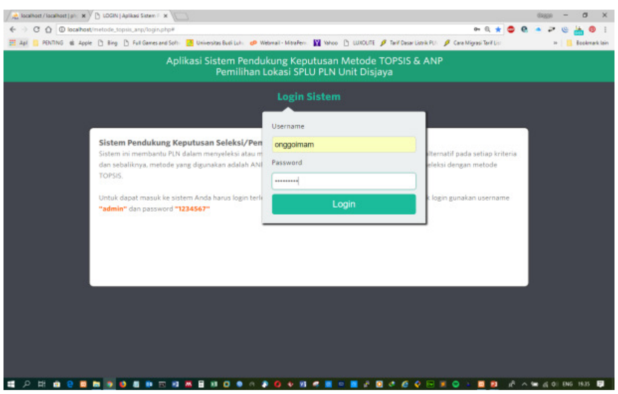

Fig 5. Login Screen

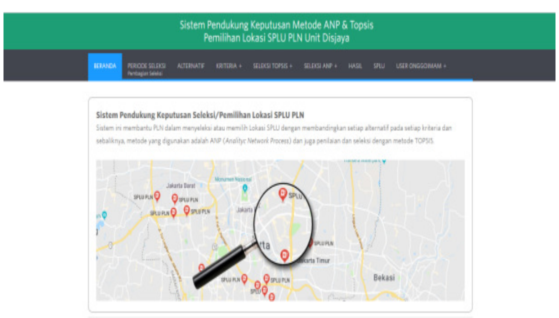

Fig 6. Home Screen

Fig 7. Criteria Menu

Fig 8. List criteria group

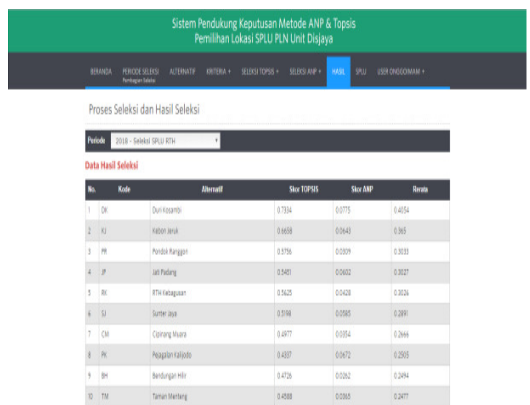

Fig 9. Process Menu Screen and Selection Results

No.	Kode	Alternatif	Skor Akhir	Ranking
1	DK	Duri Kosambi	0.7334	1
2	KJ	Kebon Jeruk	0.6658	2
3	PR	Pondok Ranggon	0.5756	3
4	RK	RTH Kebagusan	0.5625	4
5	JP	Jati Padang	0.5451	5
6	SJ	Sunter Jaya	0.5198	6
7	CM	Cipinang Muara	0.4977	7
8	BH	Bendungan Hilir	0.4726	8
9	TM	Taman Menteng	0.4588	9
10	PK	Pejagalan Kalijodo	0.4337	10

Fig 10.Display of Topsis Value Chart Selection Screen

IV. CONCLUSIONS

Based on the results of the study, it can be concluded that. Decision support system for the selection of general electricity supply station locations with the ANP Topsis case study method at PT. PLN Persero. Can be used as a basis for management decisions in the process of selecting the location of a public electricity supply station. Where the biggest value is the first rank, obtained by DuriKosambi (DK) of 0.7334. The second position is recommended to KebonJeruk (KJ) of 0.6658. The third position is PondokRangon (PR) of 0.5756. The fourth position is KEbagusan RTH (RK) of 0.5625. The fifth position of Jati Padang (JP) is 0.5451. The sixth position of Sunter Jaya (SJ) was 0.5198. The seventh position of CipinangMuara (CM) is 0.4977. The eighth position of the Lower Dam (BH) was 0.4726. The ninth position of Taman Menteng (TM) is 0.4588. The tenth position of Kalijodo Slaughterhouse (PK) was 0.4337.

1. Decisions taken can be accounted for by the support of calculations carried out by the Topsis ANP method as a model in decision support systems.
2. The criteria that have been analyzed by the author are appropriate and able to assist in making decisions in evaluating alternative locations and making a choice of the location of general electricity supply stations as expected by decision makers, and have been tested by testing the UAT (User Acceptance Test).

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