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Application of The Analytic Hierarchy Process (AHP) in Strategic Factory Selection for Putra Madura Sejati Cigarette Company in Pamekasan

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***Abstract* - The tobacco industry in Indonesia is developing rapidly. Indonesia is the fifth-largest tobacco-producing country. Cigarettes are one of the sectors that contribute the most to excise and foreign exchange revenues for the country. With the rapid growth of the cigarette industry, producers must devise effective strategies to continue competing and developing in this market, one of which is finding a strategic factory location that ensures consumer satisfaction. The purpose of this study is to find the best location for the PR Putra Madura Sejati cigarette factory based on the criteria of accessibility, environment, workforce, market, and traffic. And the alternative locations that will be selected in this research are located in the Pamekasan district, namely on Blumbungan Street, Bangunran Street, Larangan Street, and Pademawu Street. The method used this time is the Analytical Hierarchy Process (AHP). Based on the results of the pairwise comparison between the criteria, this time it shows that the accessibility criterion has a value of 0.09, the environment has a value of 0.23, the workforce has a value of 0.47, the market has a value of 0.05, and traffic has a value of 0.16. then the results of the pairwise comparison between the accessibility criteria with all alternatives obtained the nyalaran road alternative has the highest value with 0.59, environmental criteria with the alternative namely nyalaran road highest with 0.53, workforce criteria with the alternative namely blumbungan road highest with 0.49, market criteria with the alternative namely pademawu road with 0.49, and traffic criteria with the alternative namely nyalaran road with 0.52. The final result of the pairwise comparison between all alternatives and all criteria shows that Jalan Nyalaran is the best location to be selected, with a value of 41.6. The author advises PR Putra Madura Sejati to continue implementing strategies by getting closer to the market and selecting skilled workers so that the quality of the cigarettes created will be better and can provide satisfaction to consumers.**

Index Terms: About; AHP, Customer Satisfaction, cigarette factory, location selection

I. INTRODUCTION

The cigarette industry is one of the fastest-growing industries in Indonesia and globally. Currently, the cigarette business is gaining popularity among entrepreneurs due to its high demand. Indonesia is the fifth-largest tobacco producer in the world, with total production in 2011 reaching 256 million cigarettes [Salsabila et al, 2022]. Along with the high demand, innovation among cigarette businesses is increasing. In addition to the clove cigarettes that are the hallmark of Indonesian cigarettes, filtered cigarettes are now being developed, even with various flavors and menthol, which are in high demand among young people. With the growing and booming cigarette industry, this business has become a pillar of the regional and national economy. The tobacco industry is one of the sectors that contributes the majority of state revenue through tobacco excise revenue and contributes significantly to foreign exchange earnings through cigarette and cigar exports [Prayoga dan Kusuma, 2020].

Cigarettes are one of the tobacco industries that have developed rapidly in Indonesia from the 19th century to the present day. There are several types of cigarettes consumed by the Indonesian people, ranging from hand-rolled kretek cigarettes, machine-rolled kretek cigarettes, and machine-rolled white cigarettes with a variety of flavors. Cigarettes have become a daily necessity and a necessity for those who smoke because they contain addictive substances that make users addicted to them. The chemical in cigarettes is nicotine, which is dangerous because it is addictive. Smokers who try to quit will find it difficult due to nicotine withdrawal symptoms. [Kodir dan Anggarawati, 2022]. With such rapid demand and proximity to the source of raw materials, namely tobacco, many businesses have

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begun to emerge in Pamekasan, East Java, operating in the cigarette industry. Tobacco cigarette factories in Indonesia are one of the many industries contributing to the government's taxation sector. The increase in excise revenue since 2009 has played a significant role in this revenue, *Anggaran Pendapatan dan Belanja Negara* (APBN) [Samuel, 2022]. PR Putra Madura Sejati is one of the cigarette companies that exists in Pamekasan Regency, producing hand-rolled kretek cigarettes. PR Putra Madura Sejati is passionate about preserving the tobacco industry and providing employment opportunities for the surrounding community, thereby helping to support the regional and national economy. PR Putra Madura Sejati is currently located in Cenlecen Village, Pakong District, Pamekasan Regency. Over time, with the premises not too large and demand continuing to increase significantly, PR Putra Madura Sejati wants to establish a second factory as a form of commitment to meet consumer needs with various criteria that will later become a reference in selecting a location such as accessibility, the environment around the factory, the availability of labor in the area, proximity to markets, and adequate traffic. Location is a company's decision to determine the place of business, carry out business activities or operational activities, and distribute goods or services that are part of its business activities to consumers. [Harani et al, 2022].

This study uses the Analytical Hierarchy Process (AHP) method as a method for selecting alternative solutions based on criteria, so that it becomes a decision-making method used to determine the location of the PR PMS factory. This method can make effective decisions on complex issues by simplifying and accelerating the decision-making process [Capryani et al, 2016]. Basically, the Analytical Hierarchy Process (AHP) is a method for solving a complex and unstructured problem into groups, arranging the groups into a hierarchy, entering numerical values as a substitute for human perception, making relative comparisons, and finally, with a synthesis, determining which element has the highest priority. The Analytical Hierarchy Process (AHP) is an appropriate method for solving the problem of selecting a business location because it is able to accommodate various criteria with different importance weights in a hierarchical framework [Aritonang dan Rizky, 2025]. AHP is an analysis method that has advantages and disadvantages. The advantages of the AHP method are its hierarchical structure, as a consequence of the selected criteria, down to the deepest sub-criteria. In addition, it takes into account validity up to the tolerance limit of inconsistency as the criteria and alternatives chosen by the decision maker, and takes into account the durability of the output of the decision-making sensitivity analysis [Permatasari, 2020].

Several previous studies related to location selection using the AHP method were conducted by [Capryani et al, 2016] at the office in Surakarta, at the restaurant location [Habibruhman dan HAmali, 2023], general business location [Sudasmoro dan Wendhasmoro, 2025]Home industry business locations in Pringsewu Regency [Susilowati, 2019]. This study used different criterion variables and alternative locations. The differences between this study and previous studies lie in the research object and data variables. This study sought to identify the best location for a cigarette factory based on accessibility, environment, workforce, market, and traffic. The authors are trying to determine the best location for the PR Putra Madura Sejati cigarette factory so that the company can increase its production capacity, improve its competitiveness, and be better known in the market to provide greater revenue.

I. RESEARCH METHODOLOGY

In this research methodology, we will discuss the stages of identifying problems and determining the objectives and methods that will be used to process the data that has been obtained in accordance with the objectives that have been set. First, the problem identification stage, the initial stage of this research, involves clearly defining the problem and the case study to be used. In this study, the problem raised is the location selection for the PR Putra Madura Sejati factory. Next, the objectives to be achieved from this research are determined, providing guidelines and reminders for researchers to focus on the predetermined objectives and avoid deviations from the objectives in this study. Furthermore, a literature review is used to provide researchers with further insight, sourced from previous research or journals, and to ensure that this research has never been conducted before. The respondents, as experts in this study, are the owners or directors of PR RMS who have

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conducted observations for these criteria and alternatives.

Data collection was carried out by gathering the necessary data, including primary data, which is data generated through observations and interviews with business owners regarding the business's strategy or business plan. Secondary data, which is existing data that does not require further observation by the researcher.

The data processing stage of the study discusses the factors or criteria that influence decision-making in determining the location of the PR Putra Madura Sejati factory. The researchers selected four alternative locations in Pamekasan Regency, East Java: Jalan Blumbungan, Jalan Nyalaran, Jalan Larangan, and Jalan Pademawu. The researchers focused on these four locations as alternatives in solving the problem of selecting the location of the PR Putra Madura Sejati factory.

Data processing was performed using the Analytical Hierarchy Process (AHP) approach. AHP also evaluates the consistency of decision-making by examining the consistency of the pairwise comparison matrix. This is essential to ensure that decisions are based on consistent and accountable comparisons. [1Sudarsono dan Wendhasmoro, 2025]. AHP is a method that aims to create a priority ranking for a decision and choose the best decision by considering existing criteria and by developing a numerical value as a ranking for each decision alternative [Habibruohman dan Hamali, 2023]. Based on the processing stages using the Analytical Hierarchy Process (AHP) method approach, namely:

a) Define the problem and determine the desired solution
b) Create a hierarchical structure that starts with the main objective
c) Create a pairwise comparison matrix that describes the relative contribution or influence of each element on the objectives or criteria at the same level as it
d) Define pairwise comparisons so that the number of assessments obtained is n X [(n-1) / 2], where n is the number of elements being compared
e) Calculate eigenvalues and test their consistency
f) Repeat steps 3,4 and 5 for all hierarchical levels
g) Calculate the eigenvectors of each pairwise comparison matrix
h) Checking the consistency of the hierarchy

II. RESULT AND DISCUSSION

These results and discussion contain data that the author has collected and processed to find the best decision in determining the appropriate location for the PR Putra Madura Sejati factory. The data used includes the criteria for selecting a business location and the alternatives provided.

A. Define the problem and determine the solution

At this stage, we will define the problem clearly so that the solution we choose is appropriate and appropriate to the problem. The following are the alternatives that will be tested based on the definition of each criterion.

a. Blumbungan
Blumbungan Road is easily accessible by public transportation. Located north of Pamekasan, it serves as the main road leading to the north coast of Java, particularly to tobacco-producing areas. This densely populated area is very close to markets. There is still land available, ready for use in cigarette factories. Traffic access is unimpeded, making it easy to conduct business.

b. Nyalaran
Nyalaran Road is easily accessible, has good road infrastructure, and is located north of Pamekasan City, providing access to tobacco-producing areas. This densely populated area still has plenty of vacant land ready for cigarette factories. This competitive strategy is highly effective, as Nyalaran is home to numerous tobacco warehouses and the emergence of local cigarette factories. Traffic access is adequate and unobstructed, ensuring smooth operations.

c. Larangan
This Larangan Road is easily accessible, being the main access road to Sumenep Regency. This area is densely populated, but there is still land available for building factories. Located east of Pamekasan City, this area is also home to a growing number of local cigarette factories.

d. Pademawu
The Pademawu area is still largely empty and not densely populated. Located east of Pamekasan City, it provides access to the Pamekasan coastal area. Accessibility is easy, and road infrastructure is adequate, although some roads are still in poor

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condition. There are no operating cigarette factories in the area.

B. Hierarchical Structure

After defining the objectives, criteria, and alternatives to be taken for the decision-making process of selecting the location of the PR Putra Madura Sejati factory, a hierarchical structure was created with the main objective at the top level being the selection of the cigarette factory location. The second level was comprised of five decision-making criteria: accessibility, environment, labor, market, and traffic. The third or lowest level consisted of alternatives, namely Blumbungan Street, Nyalaran Street, Larangan Street, and Pademawu Street.

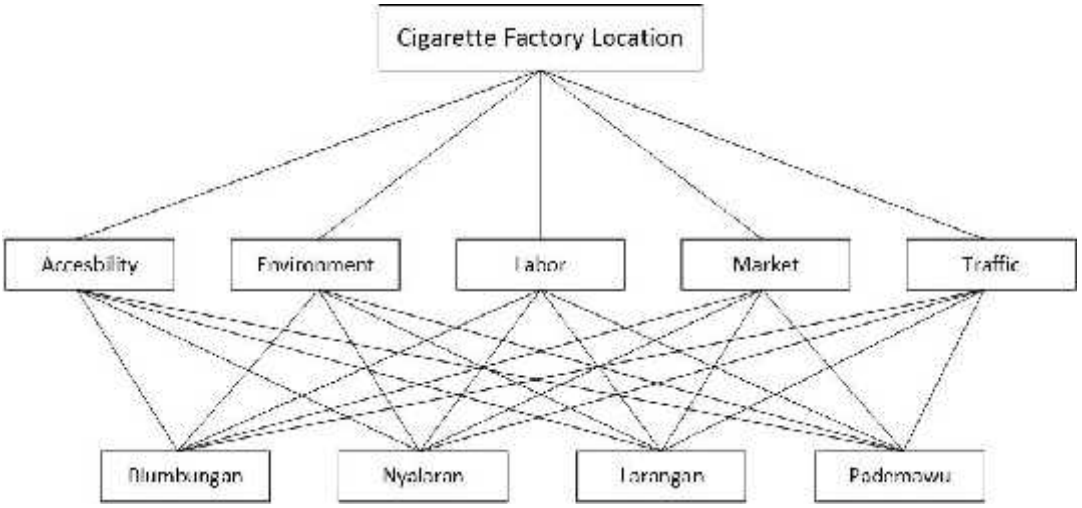

Figure 1. Hierarchical Structure

C. Calculation of the pairwise comparison matrix of alternatives and criteria

a. Pairwise Comparison Matrix of Criteria

From the results of the weighting and calculations that can be seen in Table 1 for each of the criteria for selecting the location to be chosen, the workforce criteria has the largest value, then the second is the environmental criteria, then the traffic, fourth is accessibility, and last is the market. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.

Table 1. Pairwise Comparison Matrix of Criteria

Criteria	Accesibility	Environment	Labor	Market	Traffic	CI	IR	CR
Accesibility	1.00	0.33	0.20	2	0.50	0.09	1.11	0.08
Environment	3	1.00	0.25	6	2			
Labor	5	4	1.00	5	5			
Market	0.5	0.17	0.20	1.00	0.33			
Traffic	2	0.5	0.20	3	1.00			
Total	11.50	6.00	1.85	17.00	8.83			

a. Alternative pairwise comparison matrix in accessibility criteria

The weighting and calculations carried out between accessibility and all alternative locations to be selected can be seen in Table 2, where Nyalaran has the highest value, then second is Blumbungan, third is Larangan, and last is Pademawu. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.09

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Table 2. Alternative pairwise comparison matrix with accessibility

Accesbility	Blumbungan	Nyalaran	Larangan	Pademawu	CI	IR	CR
Blumbungan	1.00	0.50	3	4	0.08	0.9	0.09
Nyalaran	2	1.00	4	5			
Larangan	0.33	0.25	1.00	4			
Pademawu	0.25	0.20	0.25	1.00			
Total	3.58	1.95	8.25	14.00			

Pairwise comparison matrix of alternatives in environmental criteria

The weighting and calculations carried out between the environment and all alternative locations to be selected can be seen in Table 3, where Nyalaran has the highest value, then second is Larangan, third is Blumbungan, and lastly is Pademawu. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.08.

Table 3. Alternative pairwise comparison matrix with environment

Environment	Blumbungan	Nyalaran	Larangan	Pademawu	CI	IR	CR
Blumbungan	1.00	0.20	0.50	3	0.07	0.90	0.08
Nyalaran	5	1.00	2	4			
Larangan	2	0.50	1.00	5			
Pademawu	0.33	0.25	0.20	1.00			
Total	8.33	1.95	3.70	13.00			

c. Alternative pairwise comparison matrix in the Labor criteria

The weighting and calculations carried out between the workforce and all alternative locations to be selected can be seen in Table 4, where Blumbungan has the highest value, then second is Nyalaran, third is Larangan, and lastly is Pademawu. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.0.

Table 4. Alternative pairwise comparison matrix with Labor

Labor	Blumbungan	Nyalaran	Larangan	Pademawu	CI	IR	CR
Blumbungan	1.00	3	5	6	0.07	0.90	0.08
Nyalaran	0.33	1.00	3	3			
Larangan	0.20	0.33	1.00	3			
Pademawu	0.17	0.33	0.33	1.00			
Total	1.70	4.67	9.33	13.00			

b. Pairwise comparison matrix of alternatives in market criteria

The weighting and calculations carried out between the market and all alternative locations to be selected can be seen in Table 5, where Pademawu has the highest value, then second is Larangan, third is Nyalaran, and lastly is Pademawu. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.08.

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Table 5. Alternative pairwise comparison matrix in market criteria

Market	Blumbungan	Nyalaran	Larangan	Pademawu	CI	IR	CR
Blumbungan	1.00	0.33	0.33	0.17	0.07	0.90	0.08
Nyalaran	3	1.00	0.33	0.20			
Larangan	3	3	1.00	0.33			
Pademawu	6	5	3	1.00			
Total	13.00	9.33	4.67	1.70			

c. Pairwise comparison matrix of alternatives in traffic criteria

The weighting and calculations carried out between traffic and all alternative locations to be selected can be seen in Table 6, where Nyalaran has the highest value, then second is Blumbungan, third is Larangan, and lastly is Pademawu. In this calculation, the data is considered consistent because it has a consistency ratio value of <0.1 or has a value of 0.08.

Table 6. Alternative pairwise comparison matrix with traffic

Traffic	Blumbungan	Nyalaran	Larangan	Pademawu	CI	IR	CR
Blumbungan	1.00	0.25	2	3	0.07	0.90	0.08
Nyalaran	4	1.00	4	5			
Larangan	0.50	0.25	1.00	3			
Pademawu	0.33	0.20	0.33	1.00			
Total	5.83	1.70	7.33	12.00			

e. Results of the pairwise comparison matrix of alternatives and criteria

Table 7. Pairwise comparison matrix of alternatives and criteria

Election	accesbility	environment	labor	Market	Traffic	
Criteria	0.09	0.23	0.47	0.05	0.16	
Blumbungan	0.21	0.13	0.49	0.07	0.26	23.2
Nyalaran	0.59	0.53	0.28	0.16	0.52	41.6
Larangan	0.14	0.27	0.15	0.29	0.16	20.2
Pademawu	0.07	0.07	0.08	0.49	0.07	15.6

Based on the table of results of the pairwise comparison matrix of alternatives and criteria in Table 7 above, the first choice is Jalan Sayalaran with a value of 41.6, the second is Jalan Blumbungan with a value of 23.2, the third is Jalan Larangan with a value of 20.2, and the fourth is Jalan Pademawu with a value of 15.6.

d. Hierarchical structure of AHP Calculation Result

From the calculation results above, it can be seen in Figure 2 that the values obtained by each criterion and alternative become the final value, which is used as a reference in making decisions in choosing a cigarette factory location.

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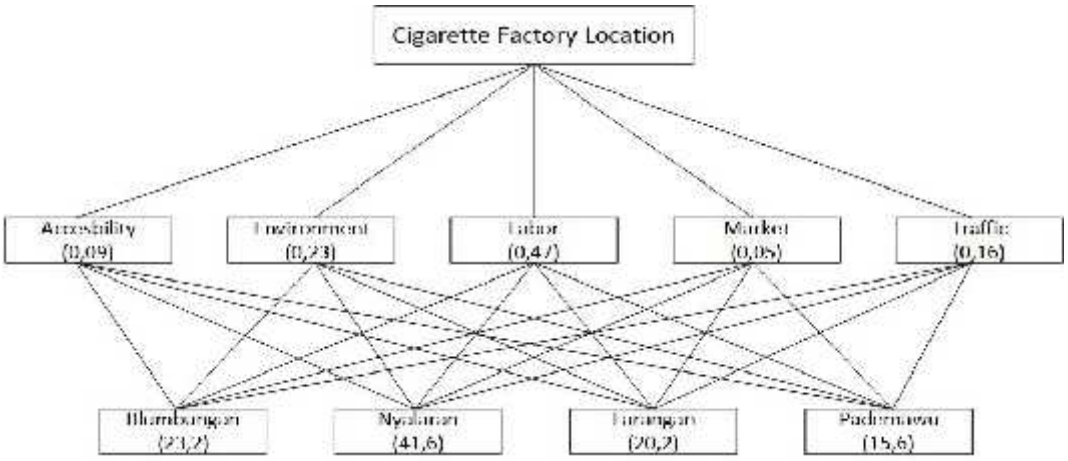

Figure 2. Hierarchical Structure with AHP Scores

C. CONCLUSION

Based on the results of the AHP calculation above, with a case study of selecting the location of the PR PMS factory with the criteria of accessibility, environment, workforce, market, and traffic, Nyalaran Street became the location chosen for the new factory location with a value of 41.6.

Based on the data analysis and calculations above, the author advises PR PMS to prioritize the selection of competent workers with good personal responsibility to help advance the company. Furthermore, PR PMS must examine the environmental conditions surrounding the new factory location, which will ultimately affect production waste and environmental pollution in surrounding settlements, to ensure the production process is not disrupted. Furthermore, the author recommends that previous research provide more comprehensive criteria variables and more objective weighting values to provide better results.

REFERENCES

[1] N. N. Salsabila, N. Indraswari, and B. Sujatmiko, "Gambaran Kebiasaan Merokok Di Indonesia Berdasarkan Indonesia Family Life Survey 5 (Ifls 5)," *J. Ekon. Kesehat. Indones.*, vol. 7, no. 1, p. 13, 2022, doi: 10.7454/eki.v7i1.5394.

[2] A. P. Prayoga and R. P. Kusuma, "Upaya Pemerintah Indonesia dalam Peningkatan Ekspor Produk Industri Hasil Tembakau ke Eropa Pada Periode 2016-2019," *Balcony*, vol. 4, no. 2, pp. 173–182, 2020.

[3] K. Kodir and T. Anggarawati, "Hubungan Ketergantungan Rokok Dengan Kadar Karbonmonoksida Udara Ekspirasi Pada Mahasiswa Akper Kesdam Iv/Diponegoro Semarang," *J. Pengabdi. Kpd. Masy. Sisthana*, vol. 3, no. 2, pp. 1–5, 2022, doi: 10.55606/pkmsisthana.v3i2.6.

[4] S. Samuel, "Peran Pemanfaatan Dana Bagi Hasil Cukai Hasil Tembakau Dalam Mencapai Tujuan Pengenaan Cukai," *J. BPPK Badan Pendidik. dan Pelatih. Keuang.*, vol. 15, no. 2, pp. 01–15, 2022, doi: 10.48108/jurnalbppk.v15i2.698.

[5] N. H. Harani, S. Nurhayati, and P. Kesuma, "Penentuan Lokasi Kantor Cabang Baru Perusahaan Logistik Menggunakan AHP dan SIG (Studi Kasus: Kota Balikpapan)," *Infotech J.*, pp. 56–66, 2022, [Online]. Available: https://doi.org/10.31949/infotech.v8I2.2855

[6] A. Capryani, A. W. Nugroho, V. H. L. Saputri, and Y. -, "Pemilihan Lokasi Kantor Menggunakan Metode Analytical Hierarchy Process (AHP) (Studi Kasus: PT. Monang Sianipar Abadi Surakarta)," *PERFORMA Media Ilm. Tek. Ind.*, vol. 15, no. 1, pp. 26–34, 2016, doi: 10.20961/performa.15.1.13744.

[7] S. A. Aritonang and F. Rizky, "Analisis Pemilihan Lokasi Usaha Strategis MenggunakanMetode Analytical

p-ISSN 2622-2027
e-ISSN 2622-2035

Hierarchy Process (Ahp)," *Nusant. J. Ilmu Pengetah. Sos.*, vol. 12, no. 3, pp. 1078–1083, 2025.

[8] C. K. Permatasari, "Penerapan Analitycal Hierarchy Process (Ahp) dalam Menentukan Lokasi Pabrik Tempe," *J. Appl. Sci.*, vol. 2, no. 2, pp. 024–033, 2020, doi: 10.36870/japps.v2i2.182.

[9] M. D. Habiburrahman and S. Hamali, "Analisis Pemilihan Lokasi Rumah Makan Padang Menggunakan Analytical Heirarchy Process," *J. Ekon. Sakti*, vol. 12, no. 2, pp. 246–255, 2023.

[10] B. Gunawan Sudarsono and R. Galih Whendasmoro, "Optimasi Pemilihan Lokasi Usaha Menggunakan Sistem Pendukung Keputusan Berbasis AHP," *Bull. Inf. Technol.*, vol. 6, no. 2, pp. 109–118, 2025, doi: 10.47065/bit.v5i2.2007.

[11] T. susilowati, "Metode Analitical Hierarchy Process (Ahp)," *J. Manaj. Sist. Inf. dan Teknol.*, vol. 09, No 01, 2019.