IMPLEMENTATION OF THE AHP METHOD IN DECISION SUPPORT SYSTEMS FOR GRANTING DISPOSAL PERMITS HOUSEHOLD LIQUID WASTE IN MAKASSAR CITY

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ABSTRACT

The permit for the disposal of restaurant liquid waste is carried out by the Makassar City Environment Agency. The process of granting permits is carried out by determining eligibility standards with a prediction system without using standardized assessment criteria so that the final determination of granting permits is not accurate and precise. Staff at the Makassar City Environmental Agency are still handwriting the permit issuance which of course takes a long time. The purpose of the study was to develop a permit assessment system with standard computer-based criteria with the concept of a decision support system. The assessment process for determining the feasibility uses the AHP method to calculate the value of each criterion. Decision making presents a hierarchical relationship between factors, attributes, characteristics or alternatives in the decision-making environment. The parameters for evaluating the feasibility of restaurant quality standards are PH 6-9 Mg/L, BOD 100 Mg/L, SS 100 Mg/L, oils and fats 10 mg/L. The application of the AHP method to the decision support system for granting a waste disposal permit results in a qualifying or non-passing category. The final decision of the system greatly facilitates the leadership of the Environmental Agency to determine the granting of permits.

Keywords: AHP, Decision Support System, Restaurant Liquid Waste.

1. INTRODUCTION

The state of the environment will cause problems continuously if the world community does not immediately think about safety and environmental balance and make efforts. Regional development spurs environmental pollution such as water pollution, soil pollution, and air pollution. Rivers are places where waste products from various human activities accumulate before being discharged into lakes and oceans. This condition causes all dissolved pollutants to enter the river in the form of liquid waste. The amount of pollutant that enters the river affects the quality of the water. one day it will be polluted.

Sources of sewage pollution into rivers come from the discharge of hospital wastewater, restaurant wastewater, hotels and other public institutions. To minimize this problem, supervision and licensing are needed from the party in charge. So that the community does not dispose of liquid waste indiscriminately, it is necessary to regulate the issuance of permits. The

Environmental Agency for the Makassar City area is one of the agencies tasked with overseeing the environmental management of hospitals, restaurants, hotels and industrial companies.

The problem encountered by researchers in the licensing system by the Makassar City Environmental Agency is the absence of a supporting software that can assist staff at the Makassar City Environmental Agency in granting permits. Where in the current system, staff at the Makassar City Environmental Agency are still handwriting permits which of course require quite a long time, and there is no standard in the form of assessment criteria used to grant liquid waste management permits for hospitals, Restaurants, Hotels, and Industry. In determining whether or not it is appropriate for a company or agency to issue a permit for liquid waste disposal, a Decision Support System will be developed in the form of a web-based application. A decision support system (DSS) is part of an information system. DSS usually use one or more data stores (databases) that provide information to support decision making (M. I. Ismail, 2022).

The decision support system will process the information to produce an initial decision whether the waste is in accordance with environmental quality standards or not, so that earlier handling measures can be taken to avoid more severe environmental pollution. (Ashari et al., 2021). The development of a decision support system in this study uses the AHP method for calculating machine processes in the system. AHP is a practical approach to solving complex decision problems which includes comparison of alternatives. AHP also allows decision making to present a hierarchical relationship between factors, attributes, characteristics or alternatives in the decision making environment (Pebakirang et al., 2017). With special characteristics, its hierarchy, unstructured complex problems are solved in groups (Maryanigsih et al., 2021).

Referring to the existing problems, the focus of this research discussion is to develop a system for granting permits for computer-based wastewater management by applying the AHP method. The purpose of developing this system is to facilitate the environmental management agency in granting permits, starting from determining whether the existing liquid waste meets quality standards or not to granting permits for liquid waste management so that it can accelerate the issuance of permits.

2. THEORY

2.1 Decision Support System

A decision support system (DSS) is a system that can provide problem solving and communicating with problems skills (Karim, 2018). The term semi-structured decision support system refers to situations of semi-structured and unstructured situations in which no one really knows clarify how decisions should be made (Jumarlis, 2021).

2.2 *Analytic Hierarchy Process* (AHP)

The AHP method is a method of calculating the value of consistency in determining the priority level of criteria and alternatives. The concept of AHP is to change qualitative values into quantitative values (Jadiaman Parhusip, 2019). This method also combines the power of feelings and logic concerned with various issues, then synthesizes various considerations into

results that match intuitive estimates as presented in the considerations that have been made. (Saputra & Nugraha, 2020).

2.3 Liquid Waste

Liquid waste is the residue from industrial activities that are not used. Disposal of liquid waste can reduce the risk of pollution that has an impact on the environment. Liquid waste is liquid waste from households, commercial, offices, industries, or other public places which generally endangers human health and life and can disrupt the sustainability of the environment which contains substances or chemicals. (Sumada et al., 2021). Liquid waste consists of concentrations and certain amounts of organic and inorganic chemicals, which can have a negative impact on the environment, especially human health, so that the waste must be treated. (Martini et al., 2020).

2.4 *Website*

Website is a collection of pages that contain specific information that can be accessed anytime, anywhere via the Internet. The web is used as an information medium, where everyone can convey and receive information. Simply by opening the website address, one can find out the various kinds of information available on the web page (A. Z. N. Ismail, 2022).

3 METHOD

3.1 Research Stages

This research was carried out based on the important stages carried out with orientation towards indicators of success in making a decision support system for granting restaurant liquid waste disposal permits so that they can be used to solve existing problems. To achieve these indicators, the stages of this research were as follows:
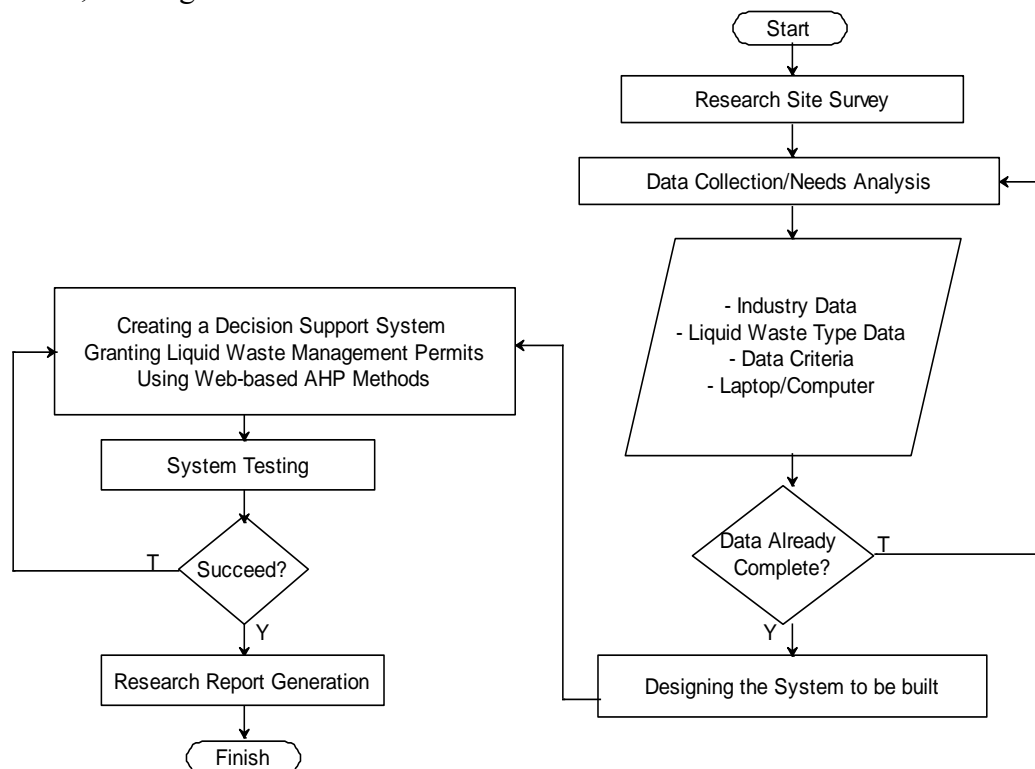

Figure 1. Research Stages Flowchart

3.2 Data Collection Methods

a. Observation

Conducted direct observations in the field, namely at the Office of the Environmental Agency in the city of Makassar. As for what was observed in the liquid waste management licensing section.

b. Interview

Data collection at the office of the Environmental Agency in the city of Makassar was conducted by interviewing the head of the liquid waste management licensing section. The interview process was conducted to obtain information related to the procedure for granting permits for liquid waste management in the city of Makassar.

c. Literature Study

Collecting data by studying books, articles, journals, news, etc. which were considered relevant and can support the research process (Darmalaksana, 2020).

3.3 System Design Model

In designing the application, the design was described using the Use Case model. The design made was an overview of the decision support system for granting permits for liquid waste management. The following was the system design created.
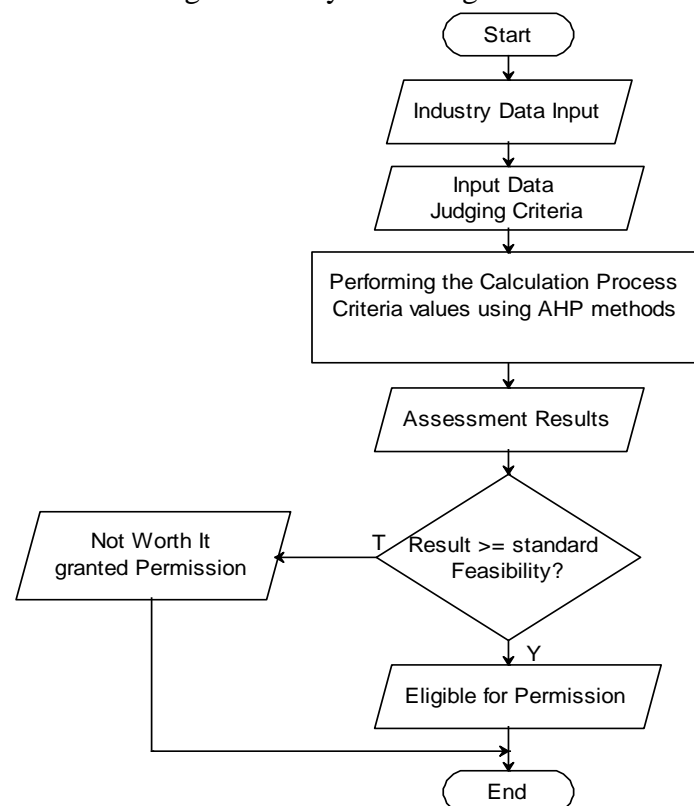

Figure 2. Document Flowchart

The picture above explains the process of calculating company quality standards in the proposed system as follows:

a) Select the applicant menu on the application.
b) Furthermore, if the applicant's data exists, the system will display the applicant's data that has been inputted by the staff

c) Meanwhile, if the applicant's data does not exist, the system will not display the applicant's data

d) Furthermore, the staff in charge of selecting the applicant's name to calculate the quality standard.

e) After selecting the applicant's name, the system will check the quality standard calculation data based on the selected applicant's name.

f) If the applicant's calculation data is still less than three months and has been declared passed in that month, the system will display a form to calculate the quality standard value.

g) Meanwhile, if the selected applicant's data has carried out the calculation process for three months, the system will display detailed quality standard comparisons based on the name of the selected applicant.

h) Furthermore, to fill in the company (restaurant) quality standard calculation form in the form of PH, BOD, TSS, Fatty Oil, it is adjusted based on the value issued by the laboratory.

i) Furthermore, if all fields in the form have been completed, the system will check the values entered in the form.

j) If the value entered is in accordance with the provisions of the restaurant quality standard, the system will store the applicant's calculation data with the status "meet quality standards ", whereas if the value entered in the form does not comply with the restaurant quality standard provisions, the system will store the standard calculation data the quality of the applicant with the status of "does not meet quality standards".

3.4 Analysis Method

a. Data analysis

The method used in data analysis was a qualitative method in the form of analyzing theoretical data and information.

b. Analisis Sistem

System analysis method used is flowchart, namely a standard for designing and documenting the flow of software systems in a structured manner (Nurdianto, 2021).

c. Test Analysis

The testing method used is Black Box Testing which is a test based on checking the procedural controls and functional applications (Setiyani, 2019).

4   RESULT AND DISCUSSION

4.1 Industrial Waste Quality Standards

The calculation of quality standards was carried out for three months. The following was the quality standard (comparison value) that was used to perform the calculation.

Table 1. Industrial Quality Standards

No	Parameter	Quality standards	Unit
1	PH	6-9	Mg/L
2	BOD	100	Mg/L
3	TSS	100	Mg/L
4	Oil and Fat	10	Mg/L

The results of the calculation of the quality standard from each agency or company would be used as a benchmark by the officer for granting a permit for liquid waste disposal if it meets ($\leq=$) each parameter in the quality standard for three months per month.

4.2   Database Implementation

The following was the result of implementing a decision support system application database for granting restaurant waste management permits in Makassar.
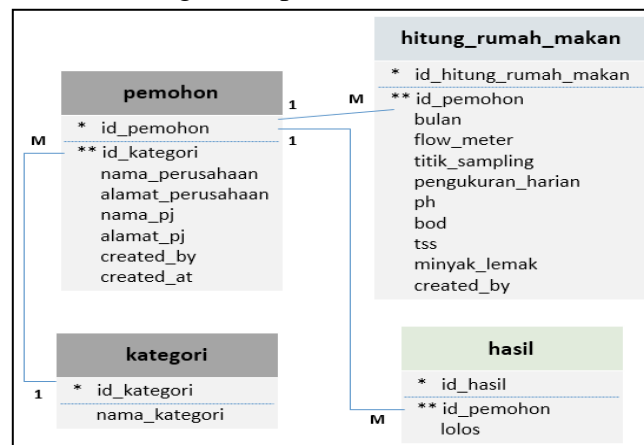

Figure 3. Database Relations Implementation

The picture above was an application database relation consisting of four tables, namely the applicant table, category table, calculating table, results table.

4.3 Application Implementation

Implementation of the application was grouped into 5 parts namely, implementing the login page, main page, officer page, applicant page, and the final results page. The following is the result of the implementation of each section:
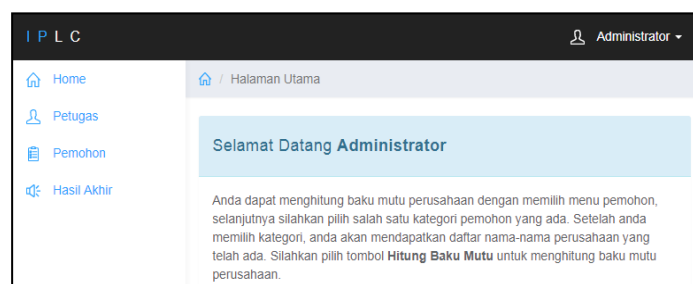
a)   Main Page

Figure 4. Main Page Aplication

The picture above was the main page of the application that would be displayed by the system after the staff had successfully logged in.
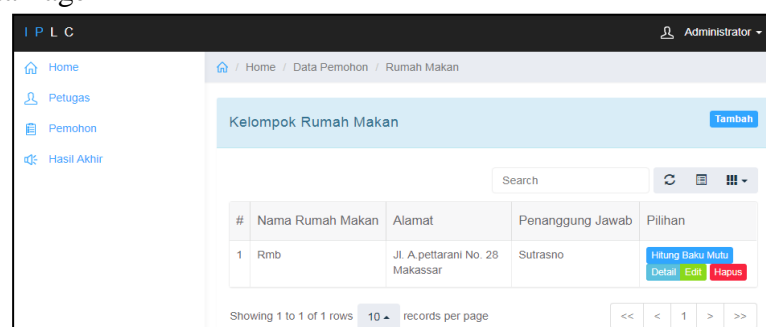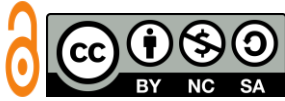
b)   Applicant Data Page

Figure 5. Applicant Data Page

The picture above was a page that would display restaurant data that had been stored in the system.

c) Quality Standard Calculation Page

Figure 6. Quality Standard Calculation Page

The picture above was the page used to calculate the quality standard for restaurants. The calculate button on this page was used to process the calculation of the quality standard for restaurants and the cancel button to cancel the calculation of the quality standard.

d) Calculation Detail Page

Figure 7. Calculation Detail Page

The picture above was a page that is used to see the detailed calculation of restaurant quality standards.

e) Calculation Result Page

Figure 8. Calculation Result Page

The picture above was a page that is used to see the results of calculating the quality standards for restaurants that pass and are entitled to be granted a permit for disposing of liquid waste.
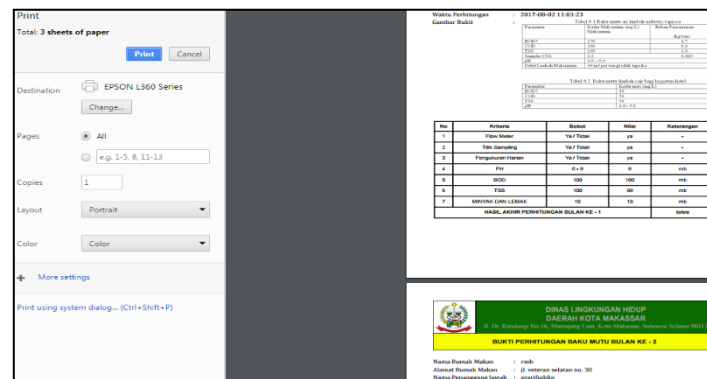
7

f)   Print Report Page

Figure 9. Print Report Page

The picture above was a printed page for proof of the overall quality standard calculation.

4.4 System Testing

Testing the system used utilized the blackbox method or testing based on the functionality of the system that the author has made. Testing looks at the functions of the system that had been made whether it was as desired or not. The following were the results of system testing.

Table 2. Testing of the Applicant's Data

NO	Test Scenario	Expected Results	Test Results	Information
1	Choose the add data menu on the applicant page by completing the form and selecting the save button to save the applicant's data	The system will store data according to the data entered	According to expectations	Valid
2	Edit the applicant's data by selecting the edit button on one of the applicant's data to be edited by changing the data and selecting the save button to save changes to the applicant's data	The system will save data changes	According to expectations	Valid
3	Select the edit button on one of the applicant's data and change the applicant's data then select the save button	The system will display the data editing page and save the changes to the data entered	According to expectations	Valid
4	Select the delete button on one of the applicant's data	The system will display a confirmation to delete the data	According to expectations	Valid
5	Select the details button in one of the existing restaurant applicant data	The system will display detailed data according to the selected restaurant applicant's data	According to expectations	Valid

Table 3. Quality Standard Calculation Data Testing

NO	Test Scenario	Expected Results	Test Results	Information
1	Select the menu quality standart data to calculate the data quality standard on the applicant's page by completing the form and selecting the calculate button to process the calculation of the quality standard	The system will store data according to the data entered	According to expectations	Valid
2	Calculate the quality standard for the next month with the status of the calculation not passing in the previous month	The system will display detailed quality standard calculation data grouped by month of calculation and displays a button to recalculate the quality standard in the month of calculation with a status of not passing	According to expectations	Valid
3	Calculate the quality standard for the next month with the status of passing the calculation in the previous month	The system will display the quality standard value input form for the following month	According to expectations	Valid
4	Complete all inputs on the restaurant quality standard calculation input form and select the calculate button to calculate the quality standard or select the cancel button to cancel the quality standard calculation	The system will save the restaurant quality standard data that is input if the calculate button and redirects to the restaurant applicant data page if the cancel button is selected	According to expectations	Valid

After doing Black Box testing, the next step was to do beta testing. Beta testing is a test that is carried out objectively where it is directly tested for spaciousness, namely those concerned with making a questionnaire regarding user satisfaction (users) and to find out to what extent this application is functioning properly and whether it is easy to understand in its application a question by selecting one of the options available. available. This questionnaire consisted of 5 questions using a Likert scale from 1 to 5. From the results of the study it can be concluded that the results of the presentation of answers from respondents for testing the system were as follows:

a. Very Good   = 5
b. Good   = 4
c. Good Enough   = 3
d. Not Good   = 2
e. Very Not Good   = 1

Table 4. Beta Testing Table

Indicator	Respondents										Total
	1	2	3	4	5	6	7	8	9	10	
Is the design of this program attractive?	5	4	4	5	5	3	3	3	4	4	40
Is this program easy to understand?	3	4	4	4	4	5	4	3	4	4	39
Is the layout and text good?	5	3	3	4	4	4	4	4	3	4	38
Is this program able to present the information needed by the user?	5	5	5	5	5	4	4	4	5	4	46
Does this program help provide decision-making solutions?	5	4	4	4	5	3	3	3	5	3	39

From the table above it can be concluded that:

Lowest Value $= 1 \times 50 = 50$

The Highest Value $= 5 \times 50 = 250$

$$\text{NJI} = \frac{\text{The Highest Value} - \text{Lowest Value}}{\text{Number of Question Criteria}} c \qquad (1)$$

$$\text{NJI} = \frac{250 - 50}{5}$$

$$= 40$$

$50{,}0 - 90{,}0$	$= $ Very Not Good
$90{,}1 - 130{,}0$	$= $ Not Good
$130{,}1 - 170{,}0$	$= $ Good Enough
$170{,}1 - 210{,}0$	$= $ Good
$210{,}1 - 250{,}0$	$= $ Very Good

So it can be concluded that:

Table 5. Beta Testing Conclusion Table

Indicator	Total
Is the design of this program attractive?	40
Is this program easy to understand?	39
Is the layout and text good?	38
Is this program able to present the information needed by the user?	46
Does this program help provide decision-making solutions?	39
Total	202
Results	Good

5 CONCLUSIONS AND SUGGESTIONS

Conclusions

Based on the results of the research that has been done, it can be concluded that the decision support application for granting liquid waste disposal permits can help staff at the Makassar City Regional Environmental Agency in terms of calculating restaurant quality standards to obtain information on restaurants that can and cannot granted a liquid waste disposal permit.

Suggestions

For the development of decision support applications for granting restaurant liquid waste management permits, a feature can be added to display restaurant quality standard calculation data in graphical form. In addition, future researchers can use other methods for the calculation process as a comparison with the method used in this study.

6   ACKNOWLEDGMENTS

REFERENCES

Ashari, M., Jannah, S. H., Fadli, S., & Saikin. (2021). Sistem Pendukung Keputusan Penerimaan Murid Baru Menggunakan Metode Ahp Dan Saw. *Pixel :Jurnal Ilmiah Komputer Grafis*, *14*(2), 287–299. https://doi.org/10.51903/pixel.v14i2.592

Darmalaksana, W. (2020). Metode Penelitian Kualitatif Studi Pustaka dan Studi Lapangan. *Pre-Print Digital Library UIN Sunan Gunung Djati Bandung*, 1–6.

Ismail, A. Z. N. (2022). Pemanfaatan Aplikasi Marketplace Berbasis Web Guna Meningkatkan Daya Saing Dan Pemasaran BUMDES Rompegading. *Inspiration : Jurnal Teknologi Informasi Dan Komunikasi*, *12*(1), 47–56. https://jurnal.akba.ac.id/index.php/inspiration/article/view/2650

Ismail, M. I. (2022). Sistem Pendukung Keputusan Penerimaan Siswa Baru SMAN 7 Watansoppeng Menggunakan Metode Simple additive weighting. *Jurnal Ilmiah Sistem Informasi Dan Teknik Informatika "JISTI,"* *5*(1), 29–36. https://doi.org/10.32736/sisfokom.v10i2.940

Jadiaman Parhusip. (2019). Penerapan Metode Analytical Hierarchy Process (AHP) Pada Desain Sistem Pendukung Keputusan Pemilihan Calon Penerima Bantuan Pangan Non Tunai (BPNT) Di Kota Palangka Raya. *Jurnal Teknologi Informasi Jurnal Keilmuan Dan Aplikasi Bidang Teknik Informatika*, *13*(2), 18–29. https://doi.org/10.47111/jti.v13i2.251

Jumarlis, M. (2021). Sistem Pengambilan Keputusan Pemilihan Bibit Ikan Air Tawar untuk Dibudidayakan Menggunakan Metode AHP Berbasis Web. *Inspiration: Jurnal Teknologi Informasi Dan Komunikasi*, *11*(1), 7. https://doi.org/10.35585/inspir.v11i1.2605

Karim, J. (2018). SISTEM PENDUKUNG KEPUTUSAN PENENTUAN PRIORITAS PEMBANGUNAN MENGGUNAKAN METODE PROMETHEE PADA DESA AYULA KECAMATAN RANDANGAN KABUPATEN POHUWATO PROVINSI GORONTALO. *ILKOM Jurnal Ilmiah*, *10*(April), 86–91.

Martini, S., Yuliwati, E., & Kharismadewi, D. (2020). Pembuatan Teknologi Pengolahan Limbah Cair Industri. *Jurnal Distilasi*, *5*(2), 26. https://doi.org/10.32502/jd.v5i2.3030

Maryanigsih, M., Fredricka, J., & Sari, N. (2021). Sistem Pendukung Keputusan Penentuan Paud Terbaik Dengan Menggunakan Metode AHP. *Inspiration: Jurnal Teknologi Informasi Dan Komunikasi*, *11*(2), 159. https://doi.org/10.35585/inspir.v11i2.2665

Nurdianto, P. K. (2021). Analisis Sistem Informasi Akuntansi Penggajian dan Pengupahan dalam Upaya Mendukung Pengendalian Intern (Studi Kasus Pada CV. Thamrin Square Semarang). *Cakrawala Informasi*, *1*(1), 1–14.

Pebakirang, S., Sutrisno, A., & Neyland, J. (2017). Penerapan Metode Ahp (Analytical Hierarchy Process) Untuk Pemilihan Supplier Suku Cadang Di. *Jurnal Online Poros Teknik Mesin*, *6*(1), 32–44. https://ejournal.unsrat.ac.id/index.php/poros/article/download/14860/14426

Saputra, M. I. H., & Nugraha, N. (2020). Sistem Pendukung Keputusan Dengan Metode Analytical Hierarchy Process (Ahp) (Studi Kasus: Penentuan Internet Service Provider Di Lingkungan Jaringan Rumah). *Jurnal Ilmiah Teknologi Dan Rekayasa*, *25*(3), 199–212. https://doi.org/10.35760/tr.2020.v25i3.3422

Setiyani, L. (2019). Pengujian Sistem Informasi Inventory Pada Perusahaan Distributor Farmasi Menggunakan Metode Black Box Testing. *Techno Xplore : Jurnal Ilmu Komputer Dan Teknologi Informasi*, *4*(1), 1–9.

https://doi.org/10.36805/technoxplore.v4i1.539

Sumada, K., Chaerani, N. C., Priambodo, M. D., & Saputro, E. A. (2021). Pengolahan Limbah Cair Industri Pakan Ternak dengan Kombinasi Proses Aerasi dan Biologi Aerob. *Jurnal Teknologi Lingkungan*, *22*(2), 249–256. https://doi.org/10.29122/jtl.v22i2.3967