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Decision Support System for Selecting the Best Supplier of Dental Medicine Using the Analytical Hierarchy Process Method

Melin Destari[1)], David JM. Sembiring[2)], Raheliya Br. Ginting[3))], Meiliyani Br. Ginting[4)]
[1)2)3)]Institut Teknologi dan Bisnis Indonesia, Indonesia
[1)]melinvivo6@gmail.com, [2)]davidjmsembiring@gmail.com, [3)]raheliyabrginting@gmail.com,
[4)]meiliyani.ginting@gmail.com

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Abstract: A common problem is the subjective nature of the drug supplier selection process, requiring manual selection. This often presents several obstacles, such as when a supplier meets the desired price and payment terms, but there are issues with delivery speed or damaged goods in transit. Furthermore, there are also issues with claims for damaged goods that are not handled properly, quantities that do not match orders, and approaching expiration dates. A system is needed to facilitate more selective, careful, and precise drug procurement. The method used in the decision-making system for selecting the best dental drug suppliers is the Analytical Hierarchy Process (AHP). This system, which includes several criteria, significantly helps prioritize appropriate and efficient drug supply decisions.

Keywords: Decision Support System; Dental Medicine Supplier; Analytical Hierarchy Process

INTRODUCTION

The problem that often occurs in the practice of Drgg nina syafitri is in the supplier selection process which is still subjective where in choosing the Drgug Supplier must be selected manually and sometimes there are several obstacles that are often faced, namely when one supplier is in accordance with the price desired by the owner of the practice of Drgg nina syafitri, with a payment period that is appropriate but is constrained by the speed of delivery of goods or goods ordered are damaged in transit(Tejasukmana Putra et al., 2021). As well as the slowness of claims for damaged goods not being handled properly, the number of goods that do not match the order, and the expiration date is close. Therefore, there are so many suppliers offering Dental Drgugs, so the practice of Drg. Nina Syafitri must be more selective and careful in choosing the right supplier.

The problem in selecting suppliers requires a system for the supplier selection process so that the results selected are more accurate and precise. The system is made by applying the analytical hierarchy process (AHP) method(Nurrahman & Sarjono, 2022). Which is used to find the weight of each criterion and ranking of each alternative to get the results of selecting the best supplier, minimize inaccurate assessments, and speed up supplier selection(HenDrgi et al., 2023).

The method used in decision making for the selection of the best Dental Medicine Supplier is the Analytical Hierarchy Process (AHP). This method was chosen because the AHP method is a form of decision support model where the main equipment is a functional hierarchy with the main input of human perception, namely in this case a person who is an expert in the problem of Drgug Suppliers or a person who understands the problem of Drgug Suppliers(Shobun Kollied Anwar et al., 2021). so that later the system created can not only be used as a decision support system to determine the best Drgug Supplier in the practice of Drg. Nina Syafitri, but can also be used for a decision support system with different criteria and alternatives, and AHP is relatively easy to understand and use. The literature on supplier selection uses this method a lot. AHP is an ideal method for providing ranking or ordering of alternatives when several criteria and sub-criteria are present in decision-making(Pambudi et al., 2021). Based on the problems above, the researcher designed a decision support system to determine the Best Drgug Supplier in the practice of Drg. Nina Syafitri with the AHP method.

Previous research conducted by Khusna and Mariana (2021) entitled Design and Implementation of Drgug Supplier Selection Using the AHP Method, produced a desktop-based decision support system using the AHP and SAW methods in which the application contains several advantages of the supplier selection application. The

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system has a supplier master data, which can help employees search for supplier data and can report the results of the supplier selection decision maker easily to compare supplier performance results(Khusna & Mariana, 2021).

Further research was conducted by Pebrianti et al., (2020) entitled Supplier Selection at Pusaka Arta Pharmacy Using the Analytical Hierarchy Process (Ahp) and Simple Additive Weighting (Saw) Methods, which is the latest innovation from previous research, namely research conducted by Aldi Yudha Pradipta and Anita Diana. In the selection of Pusaka Arta Pharmacy suppliers, there are six criteria, because there is no weight for the assessment, the Analytical Hierarchy Process (AHP) method is used. While the assessment of various criteria uses the Simple Additive Weighting (SAW) method. The results of this study are website-based decision support system applications(Pebrianti et al., 2022). Supplier selection is one of the important things in purchasing activities for companies, where purchasing activities are activities that have important value for companies because purchasing components, raw materials and supplies represents a fairly large portion of the finished product(Ilham et al., 2018).

In making decisions to choose suppliers, decision makers need analysis tools that allow them to solve complex problems so that the decisions taken are of better quality. Supplier selection must be done carefully because choosing 2 (two) wrong suppliers will disrupt the company's production and operational processes(Yanto, 2021a). Supplier selection is a multi-criteria problem that includes quantitative and qualitative factors. Some of the criteria that influence the selection of suppliers are quantitative and qualitative(Siregar, 2022). Therefore, a method is needed that can include both in the measurement. One method that can be used for supplier selection is the AHP (Analytical Hierarchy Process) method. This method includes qualitative and quantitative measurements. AHP is a decision-making method developed for prioritizing several alternatives when several criteria must be considered, and allows decision makers to organize complex problems into a hierarchy or series of integrated levels(Sitompul et al., 2023).

Some influential and commonly used criteria in supplier selection include price, quality, delivery accuracy, quantity accuracy, and service. Sometimes, these criteria conflict with each other. For example, a supplier prefers to offer lower prices with below average quality, while another supplier offers goods with good quality with uncertain delivery. Based on the background description, the researcher will conduct research on the Decision Support System for Selecting the Best Dental Medicine Supplier Using the Analytical Hierarchy Process (AHP) Method (Case Study: Drgg nina syafitri). With the application of a decision support system in selecting suppliers, it is expected to help companies overcome these problems.

LITERATURE REVIEW

In society, people choose medicines based on mass media, advertisements, recommendations from neighbors, or other sources, and consulting with pharmacists. This often leads people to purchase medicines directly without consulting a pharmacist or understanding the drug's suitability for the patient's condition (Sari et al., 2023). Criteria for rational drug selection include appropriate indications, appropriate contraindications, dosage, type, and price. The number of drugs used to treat a single disease must be considered by the public to avoid making mistakes in selecting medications.

Supplier selection is a strategic process in supply chain management, which aims to determine the partner providing goods or services that best meets certain criteria such as quality, price, timeliness, and after-sales service (Blaster et al., 2023). In the healthcare industry, including the supply of dental drugs, selecting the right supplier is crucial to ensure product quality and distribution continuity (Muljadi et al., 2020). Supplier selection in the healthcare industry, particularly for products such as dental drugs, is a strategic process that directly impacts the quality of healthcare services. Supplier selection must consider various aspects, including product quality, price, timely delivery, and compliance with health regulations.

Based on the above issues, a Decision-Making System is needed. A Decision-Making System is a computer-based information system that supports the decision-making process by analyzing data and models to solve semi-structured or unstructured problems. A Decision-Making System is designed to help decision-makers consider complex alternatives and criteria. In the context of supplier selection, a Decision-Making System can provide recommendations based on predetermined weights and criteria (Panjaitan et al., 2023).

This Decision-Making System is designed using AHP, which offers several criteria that can assist in making drug selection decisions. The Analytical Hierarchy Process (AHP) is a multi-criteria decision-making method (Ilham et al., 2021). AHP works by breaking down complex problems into a hierarchy, starting from objectives, criteria, sub-criteria (if any), to alternatives. The AHP process consists of: determining the decision hierarchy, pairwise comparisons between elements, calculating priority weights, and assessing consistency (Yanto, 2021). The advantages of AHP include its ability to handle qualitative and quantitative aspects and generate priority values for each alternative based on predetermined criteria (Anwar et al., 2021)

.METHOD

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Decision making is faced with various factors that influence the selection of the best dental medicine supplier. Therefore, the author will create a system that can help the process of selecting the best dental medicine supplier, which system compares the criteria of each type of supplier available. The following is a flowchart image of the first matrix column.

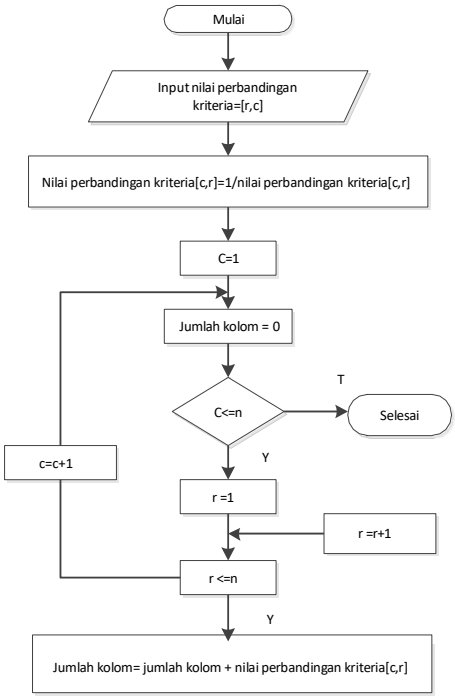

Figure 1. Flowchart of the First Matrix Column

The description in Figure 1 is the initial step in the program flow in the Matrix calculation, in the picture it has been explained that after entering we will enter the comparison value of each Criteria or against the alternative, after getting the comparison value then we will calculate the Pairwise Numerical Comparison, then after all the comparison values are obtained then we will total each criterion comparison value per column. The following is a flowchart image of the weight calculation.

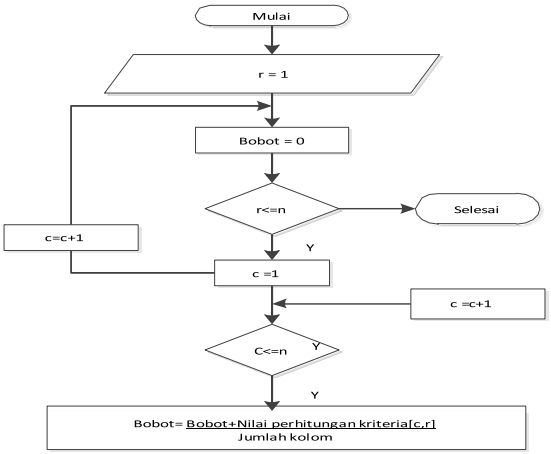

Figure 2. Flowchart of Weight Calculation

The image above explains that, after getting the comparison value per column, then we will take the weight value of each criterion or alternative, the value is obtained by averaging the criteria value or alternative value per row. The following is a flowchart of the total value of each supplier.

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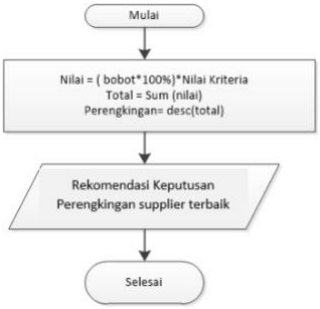

Figure 3. Flowchart of Total Value of each Supplier

The image above explains the total value obtained from each Supplier or Alternative. The following is a flowchart image of the AHP subsystem analysis.

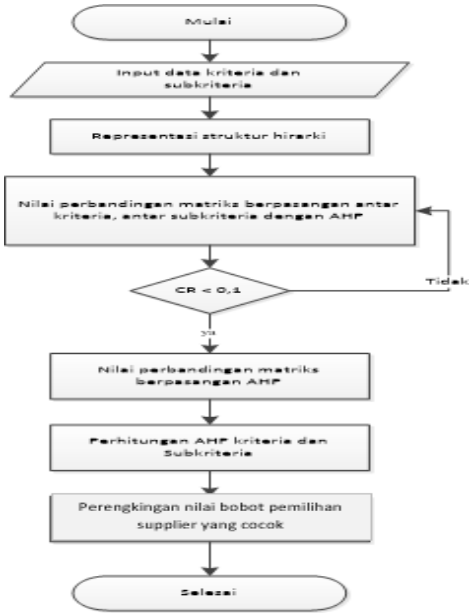

Figure 4. AHP Subsystem Analysis Flowchart

The image above explains the Subsystem Analysis carried out using the AHP Method, starting from inputting criteria and sub-criteria, compiling a hierarchical structure, performing comparison values using Matrix calculations to create paired comparison values, performing calculations and finally obtaining ranking values. Criteria for Selecting the Best Supplier The following are the criteria used as the basis for selecting the best supplier at the practice of Drg. Nina Syafitri's dentist. For the criteria to be used, there are 5 (five) criteria, namely the price of the Drgug to be purchased, the discount to be received from purchasing the Drgug, the speed of shipping the expedition used by the supplier, the completeness of the Drgug at the supplier and the Drgug packaging available at the supplier. The following is a table of criteria for selecting the best supplier.

Table 1. Criteria for Selecting the Best Supplier

C1	Quality
C2	Price
C3	Speed
C4	Completeness
C5	Packaging

The following is a picture of a hierarchical structure with AHP to determine the suitability of the best dental medicine supplier, namely:

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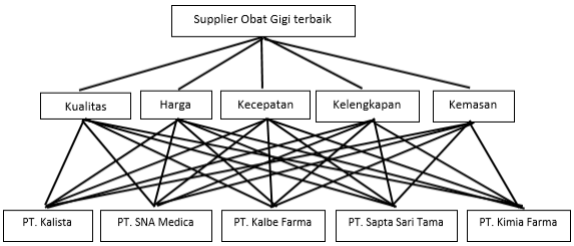

Figure 5. Hierarchical Structure with AHP to Determine the Feasibility of the Best Dental Medicine Supplier

There are 5 alternative Drgus suppliers used for case sample assessment, as listed in the table below.

Tabel 2. Nilai Alternatif Suplier

No	Supplier Code	Supplier Name	Information
1	SUP-01	PT. KALISTA	Quality:80 Price:65 Speed:80 Completeness:65 Packaging:80
2	SUP-02	PT. SNA MEDICA	Quality:70 Price:75 Speed:70 Completeness:80 Packaging:75
3	SUP-03	PT. KALBE FARMA	Quality:80 Price:75 Speed:65 Completeness:85 Packaging:75
4	SUP-04	PT. SAPTA SARI TAMA	Quality:70 Price:65 Speed:80 Completeness:85 Packaging:80
5	SUP-05	PT. KIMIA FARMA	Quality:85 Price:75 Speed:70 Completeness:80 Packaging:80

The following is a comparative description of the criteria:

1. Quality is slightly more important than price
2. Quality is as important as speed
3. Quality is as important as completeness
4. Quality is slightly more important than packaging
5. Price is as important as speed
6. Price is as important as completeness
7. Price is slightly more important than packaging
8. Speed is as important as completeness
9. Speed is slightly more important than packaging
10. Completeness is slightly more important than packaging

The following is a comparative image between the criteria.

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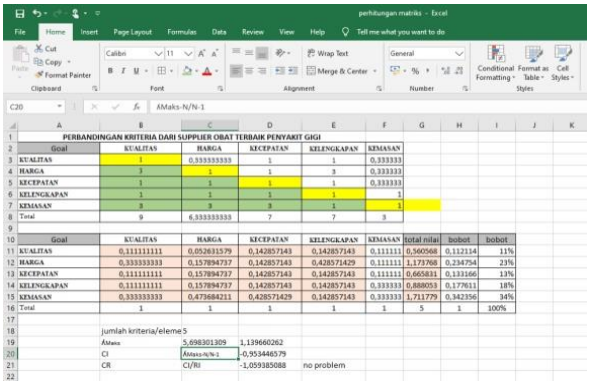

Figure 6. Comparison Between Criteria

The image of the comparison result display above is the result of the matrix comparison calculation on the criteria comparison using Microsoft Excel where the comparison must be tested because the final value cannot be more than 0.1, this needs to be done before entering the calculation of the results to Expert Choice to get the percentage results. The following is a comparison image of the Quality criteria.

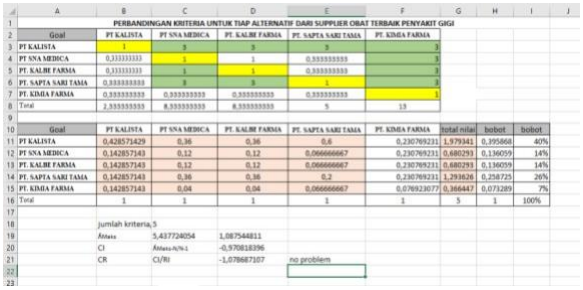

Figure 7. Comparison of Quality Criteria

Description of the Quality Comparison for each Alternative is in the Description Comparison below, namely:

1. PT. SNA Medica has slightly better quality medicines than PT Kalista
2. PT. Kalbe Farma has slightly better quality medicines than PT. Kalista
3. PT. Saritama has slightly better quality medicines than PT. Kalista
4. PT. Kimia Farma has higher quality medicines than PT. Kalista
5. PT. SNA Medica and PT. Kalbe Farma have the same quality medicines
6. PT. SNA Medica has slightly better quality medicines than PT. Sapta Sari Tama
7. PT. Kimia Farma has slightly better quality medicines than PT. SNA Medica
8. PT. Kalbe Farma has slightly better quality medicines than PT. Sapta Sari Tama
9. PT. Kimia Farma has slightly better quality medicines than PT. Kalbe Farma
10. PT. Kimia Farma has higher quality medicines than PT. Sapta Sari Tama.

The following is a comparative image of the price criteria.

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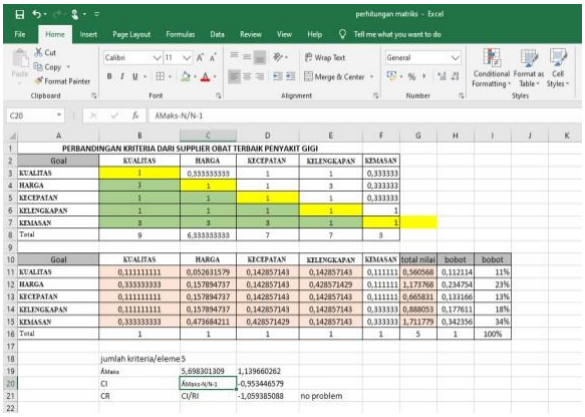

Figure 8. Comparison of Price Criteria

Price Comparison Information for each Alternative can be found in the Comparison Information below, namely:

1. PT. SNA Medica is slightly more expensive than PT Kalista
2. PT. Kalbe Farma is slightly more expensive than PT. Kalista
3. PT. Sapta Sari Tama has the same price as PT. Kalista
4. PT. Kimia Farma has more expensive than PT. Kalista
5. PT. SNA Medica and PT. Kalbe Farma have the same price
6. PT. SNA Medica is slightly more expensive than PT. Sapta Sari Tama
7. PT. Kimia Farma is slightly more expensive than PT. SNA Medica
8. PT. Kalbe Farma is slightly more expensive than PT. Sapta Sari Tama
9. PT. Kimia Farma is slightly more expensive than PT. Kalbe Farma
10. PT. Kimia Farma is slightly more expensive than PT. Sapta Sari Tama.

The following is a comparative image of the shipping criteria.

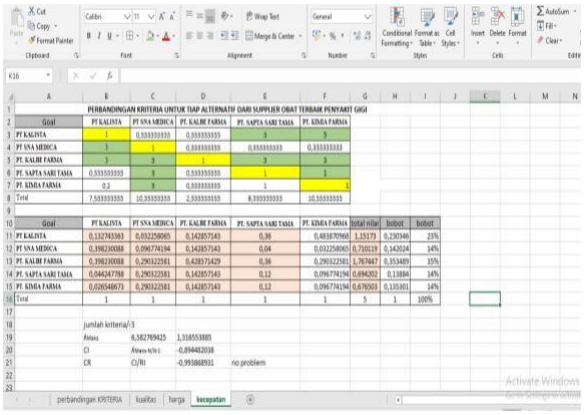

Figure 9. Comparison of Delivery Criteria

Description of the Comparison of Delivery Speeds for each Alternative can be found in the Comparison Description below, namely:

1. PT. Kalista is slightly faster in delivering medicines than PT SNA Medica
2. PT. Kalista is slightly faster in delivering medicines than PT. Kalbe Farma
3. PT. Saritama is slightly faster in delivering medicines than PT. Kalista
4. PT. Kimia Farma is faster in delivering medicines than PT. Kalista
5. PT. SNA Medica is slightly faster in delivering medicines than PT. Kalbe Farma
6. PT. SNA Medica is slightly faster in delivering medicines than PT. Sapta Sari Tama
7. PT. SNA Medica is slightly faster in delivering medicines than PT. Kimia Farma
8. PT. Sapta Sari Tama is slightly faster in delivering medicines than PT. Kalbe Farma

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9. PT. Kimia Farma is slightly faster in delivering medicines than PT. Kalbe Farma
10. PT. Kimia Farma and PT. Sapta Sari Tama have the same speed of delivering medicines.

The following is a comparative image of the completeness criteria.

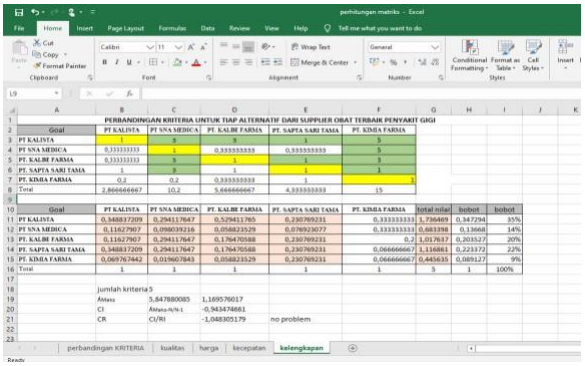

Figure 10. Comparison of Completeness Criteria

A description of the comparative completeness of each alternative can be found in the comparative description below, namely:

1. PT. SNA Medica has slightly more complete dental medicine than PT. Kalista
2. PT. Kalbe Farma has slightly more complete dental medicine than PT. Kalista
3. PT. Saritama has the same completeness of medicine as PT. Kalista
4. PT. Kimia Farma has more complete dental medicine than PT. Kalista
5. PT. SNA Medica has slightly more complete dental medicine than PT. Kalbe Farma
6. PT. SNA Medica has slightly more complete dental medicine than PT. Sapta Sari Tama
7. PT. Kimia Farma has more complete dental medicine than PT. SNA Medika
8. PT. Sapta Sari Tama has the same completeness of dental medicine as PT. Kalbe Farma
9. PT. Kimia Farma has slightly more complete dental medicine than PT.Kalbe Farma
10. PT. Kimia Farma and PT. Sapta Sari Tama have the same completeness of dental medicine.

The following is a comparative image of packaging criteria.

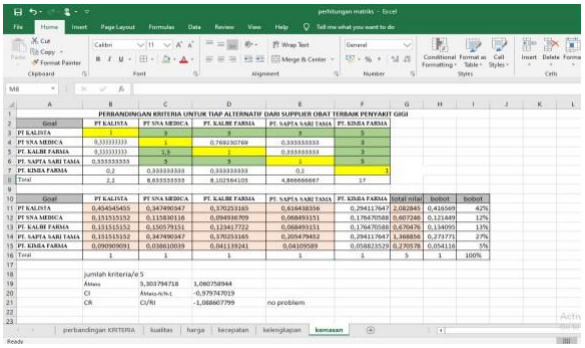

Figure 11. Comparison of Packaging Criteria

Description of the Packaging Comparison for each Alternative is in the Description Comparison below, namely:

1. PT. SNA Medica has slightly better dental medicine packaging than PT Kalista.
2. PT. Kalbe Farma has slightly better dental medicine packaging than PT. Kalista
3. PT. Sapta Sari Tama has slightly better dental medicine packaging than PT. Kalista
4. PT. Kimia Farma has better dental medicine packaging than PT. Kalista
5. PT. SNA Medica and PT. Kalbe Farma have almost the same dental medicine packaging
6. PT. SNA Medica has slightly better dental medicine packaging than PT. Sapta Sari Tama
7. PT. Kimia Farma has slightly better dental medicine packaging than PT. SNA Medica

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8. PT.Kalbe Farma has slightly better dental medicine packaging than PT. Sapta Sari Tama
9. PT. Kimia Farma has slightly better dental medicine packaging than PT.Kalbe Farma
10. PT. Kimia Farma has better dental medicine packaging than PT. Sapta Sari Tama.

RESULT

Based on the research that has been done, the researcher got the results of the problem where the researcher made the problem of selecting the best Drgug Supplier from each Supplier in the practice of Drg. Gigi Nina Syafitri where the results of all the criteria and alternatives are seen in the picture below. So the final result of solving the problem of the Quality criteria which is the advantage and the best type of Drgug which is the highest value of several other types of Drgugs, we can see from the picture below.

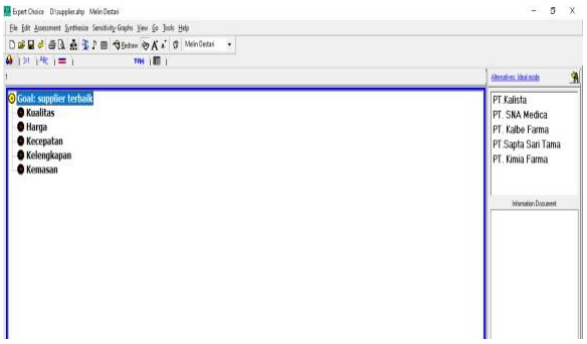

Figure 12. Expert Choice Display Where There Are Goals, Criteria and Alternatives

The system that has been designed is then implemented with the expert choice program, implementation is one of the steps where the system is ready to be built according to the results and a design, so to implement it using expert choice tools to help the decision-making process. The following is the interface of the Expert Choice Tools.

Then direct it to the goal node to weight the criteria and alternatives, first weight each criterion then weight each alternative by comparing each criterion.

Select Assessment, pairwise and menu, then select pairwise verbal comparison for each criterion as shown in the Figure below to return to the main screen every time click the model view icon.

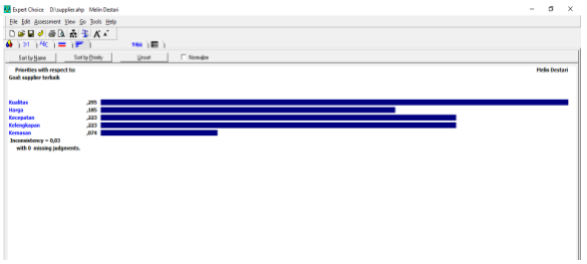

Figure 13. Comparison Criteria Graphic Display (Priorities Derived From Pairwise Compositions)

In the graphic display above, it can be seen that the highest value in the comparison of criteria is the Quality Criteria with a value of 295 and the same order in the Speed and Completeness criteria with a value of 223, the next order is the Price Criteria 185 and the lowest criterion value is the Packaging Criteria 74. The following is a picture of the pairwise numerical comparisons display for the Quality criteria.

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Figure 14. Pairwise Numerical Comparisons view for the Quality criterion

In the Quality comparison graph above, it can be seen that in terms of Quality, the highest value is found in PT. Kimia Farma with a value of 459, and the next good Quality after PT. Kimia Farma is PT. Kalbe Farma and PT. SNA Medica with a value of 193, and then the Quality criteria are at PT. Sapta Sari Tama and the lowest quality is at PT. Kalista 60. The following is a picture of the pairase numerical comparisons display for the Quality criteria.

Figure 15. Display of Comparison Criteria Price Graph Results for each Alternative

In the display of the results of the Price Criteria Comparison Chart above, it can be seen that the most expensive price is PT.Kimia Farma with a value of 436, then the next order is the Kalbe Farma criteria with a value of 220, the next order is the expensive price criteria at PT. SNA Medica with a value of 194, the next order is at PT. Sapta Sari Tama with a value of 83 and the cheapest price is at PT. Kalista with a value of 67. The following is a picture of the display of the results of the delivery speed criteria comparison chart for each alternative.

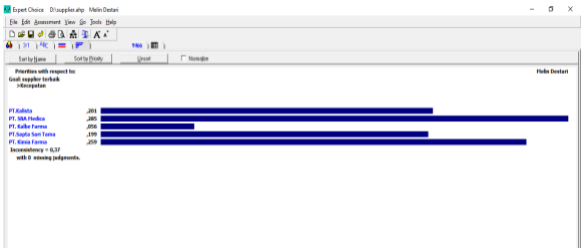

Figure 16. Comparison of Delivery Speed Criteria Results for each Alternative

In the display results of the Comparison of Delivery Speed Criteria, the fastest Drgug delivery is PT. SNA Medica with a value of 285, the second fastest Drgug delivery is PT. Kimia Farma with a value of 259, the next Speed Delivery is PT. Kalista with a value of 201, the next Delivery Speed by PT. Sapta Sari Tama with a value of 199 and the longest Drgug delivery is PT. Kalbe Farma with a value of 56. The following is a picture of the display results of the comparison graph of Drgug completeness criteria for each alternative.

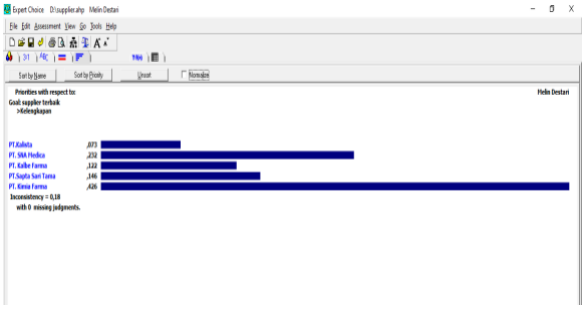

Figure 17. Display of Comparison Graphic Results of Drgug Completeness Criteria for each Alternative

In the display of the results of the comparison of the Drgug Completeness Criteria, it can be seen that the most maximum Drgug Completeness is at PT. Kimia Farma with a value of 426, the second order of Drgug completeness is at PT. SNA Medica with a value of 232, the third order in terms of Drgug completeness is at PT. Sapta Sari

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Tama with a value of 146, and the next order in terms of completeness of dental Drgugs is at PT. Kalbe Farma with a value of 122, and the order with the least completeness of dental Drgugs is at PT. Kalista with a value of 73. The following is a picture of the display of the results of the Drgug packaging criteria comparison graph for each alternative.

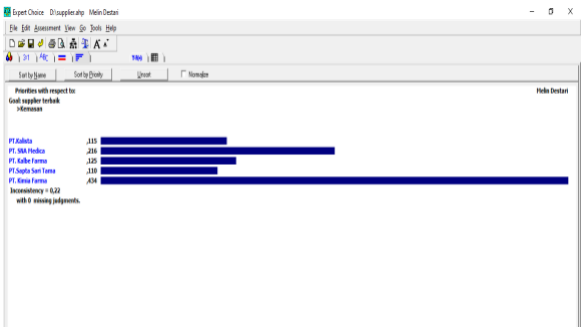

Figure 18. Display of Comparison Graphic Results of Drgug Packaging Criteria for each Alternative

In the display of the comparative graphic results on the Drgug Packaging Criteria, we can see that the Drgug packaging from PT. Kimia Farma is better with a value of 434, and in second place in good Drgug packaging is PT. SNA Medica with a value of 216, third in terms of good Drgug packaging is PT. Kalbe Farma with a value of 125, the next two in the packaging criteria are PT. Kalista with a value of 115 and the last order in Drgug packaging is PT. Sapta Sari Tama with a value of 110. The following is a picture of the results of the graphic display through a dynamic sensitivity graph.

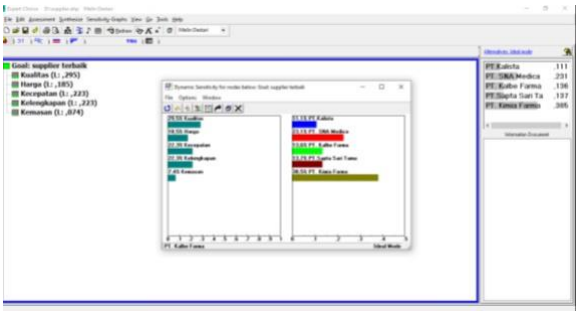

Figure 19. Results of the Graphic display via Dynamic Sensitivity Graph

After the comparison results and also the graph results of each Comparison of Criteria and Alternatives have been done, then we will immediately see the results, which Criteria are more Dominant among the Criteria that have been set and we will also see the results of the best Drgug Supplier from the Alternatives that have also been set. The following is a picture of the display of the open four graphs results.

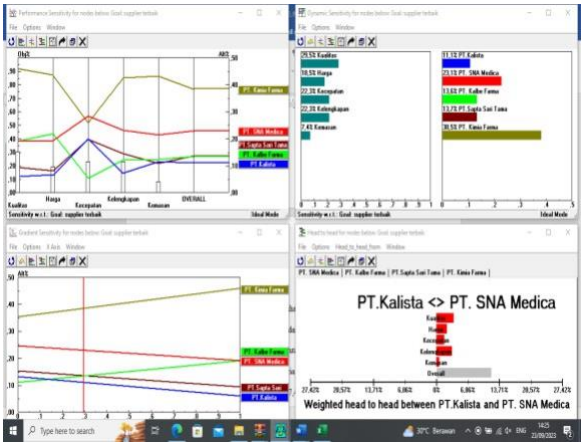

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Figure 20. Open For Graphs Results View

In the display above, it can be seen that the more dominant criteria are the Quality criteria with a value of 29.5% and the second order is the Speed and Completeness criteria with a value of 22.3%. The next order of criteria is the Price Criteria with a value of 18.5% and the last order of criteria which has the lowest value is the Packaging Criteria with a value of 7.4%. The results of the tests conducted, the selected alternative that has the highest value is PT. Kimia Farma with a value of 38.5%, the second best Drgug supplier is PT. SNA Medica with a value of 23.1%, the third best supplier is PT. Sapta Sari Tama with a value of 13.7%, the fourth best Drgug supplier is PT. Kalbe Farma with a value of 13.6%, and the lowest best Drgug supplier is PT. Kalista with a value of 11.1%.

CONCLUSION

Based on the analysis and discussion above, the author concludes that drug selection, which was initially done manually, can now be done through a designed system. This system, designed using the AHP method, is the right decision to facilitate the quick and accurate ordering of medical drugs according to the disease diagnosis without having to wait in long lines. It can also reduce errors and delays in drug collection. This can certainly improve service and patient satisfaction.

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