Implementation of the Simple Additive Weighting Method as a Decision Support in the Selection of the Right Drug Supplier

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Abstract- Supplier is a business relationship that plays a crucial role in securing the logistics of medicines needed by pharmacies. A large number of suppliers makes it difficult to determine a good supplier. For this reason, an overview of supplier selection is needed according to the criteria expected by the pharmacy using the Simple Additive Weighting method. This study aims to find out the best drug suppliers for the types of drugs Paracetamol 500 mg tablets and Ambroxol 30 mg tablets. The data processed is in the form of data on quality, delivery, price, trust, and responsiveness. In the Simple Additive Weighting (SAW) method, the assessment of each criterion is obtained from the assessment of the assistant pharmacist, then proceed with the matrix normalization process based on the equation adjusted for the type of criteria (benefit criteria or cost criteria) so that a normalized matrix is obtained. and proceed with the ranking process. The research results obtained are priority suppliers of Paracetamol 500 mg tablets, namely PT. Penta Valent and the priority supplier for Ambroxol 30 mg tablets are PT. Tri Sapta Jaya.

1. Introduction

A supplier is a chain that is very important for the sustainability of a company (Abbas et al., 2020). A pharmacy is a company engaged in the pharmaceutical sector in the form of various types of medicines sourced from several suppliers. Suppliers in a pharmaceutical company are urgently needed, and the availability of goods in the form of medicines must be fulfilled so that all pharmacy activities can run well and smoothly, get suppliers to offer competitive costs with other suppliers,

and provide convenience in ordering (Berman, 2010). Therefore, pharmacies are required to be selective in selecting suppliers in supplying goods (Jaberidoost et al., 2015).

The selection of suppliers is one of the decision-making activities carried out to meet the needs of raw materials needed by a company. One of the keys to success in doing business is the ability to choose the right supplier (Ku et al., 2010). Ideally, a company only has one supplier that provides all the goods needed according to the criteria set by the company. But in reality, a company cannot depend on just one supplier. The selection of suppliers that are not right can disrupt the operational activities of the pharmacy. Therefore, it is necessary to have an appropriate supplier performance appraisal system with the aim of getting an overview of supplier performance and being able to find out suppliers who make the best contribution (Asamoah et al., 2012).

The method used in the process of selecting the best drug supplier at Ridho Farma Pharmacy is using the Simple Additive Weighing (SAW) method. The SAW method is the Selection of suppliers usually considers the quality of the product, service, and timely delivery are important, although several other factors must be considered (Sugianto & Gunawan, 2020). The main factors considered by a company when selecting suppliers are price, quality, service, location, supplier inventory policies, and flexibility (Senthil Kumar & Malathi, 2018). Thirteen criteria are considered very important in evaluating suppliers, namely: quality, delivery, price, trust, responsiveness, flexibility, finances, and management. and organization, technical capability, facility and capacity, performance history, warranty, and environmental performance (Chou & Chang, 2008).

Based on the results of interviews with the Assistant Pharmacist at Ridho Farma Pharmacy, which is located on Jl. Tan Malaka Simpang Kuranji Guguak VIII Koto, Kecamatan Guguak, Kabupaten Lima Puluh Kota on Wednesday, March 1, 2023. The selection of drug suppliers is one of the problems faced by Ridho Farma Pharmacy, where the selection of drug suppliers is still based on price criteria only, namely choosing a supplier that provides the lowest possible price for its products. In selecting drug suppliers, there is still an assessment of the criteria needed besides price, the pharmacy also hopes to be able to select drug suppliers based on other criteria.

Currently, Ridho Farma Pharmacy has 16 drug suppliers for all types of drugs. However, several types of drugs have more than one supplier. Among these drugs are Paracetamol 500 mg tablets with a total of 8 suppliers and Ambroxol 30 mg tablets with a total of 4 suppliers. Because of the problems mentioned above, pharmacies need to select suppliers by assessing the criteria needed by the pharmacy. So that the pharmacy can find out which supplier can fulfill the wishes of the pharmacy in overcoming this problem. If the pharmacy is successful in selecting the right supplier, then the pharmacy can also find out the extent to which the supplier's performance is in meeting the needs required by the pharmacy. Therefore, pharmacies are required to be able to select and prioritize the best drug suppliers to support the needs of the pharmacy itself.

The method used in the process of selecting the best drug supplier at Ridho Farma Pharmacy is using the Simple Additive Weighing (SAW) method. The SAW method is the most well-known and widely used method in dealing with Multiple Attribute Decision Making (MADM) situations (Zanakis et al., 1998). MADM itself is a method used to find optimal alternatives from several alternatives with certain criteria. This SAW method requires the decision-maker to determine the weight of each attribute (Technology et al., 2013). The total score for the alternative is obtained by adding up all the multiplication results between the rating and the weight of each attribute (Mukodimah et al., 2018). The rating for each of these attributes must be dimension-free in the sense that it has passed the previous matrix normalization process (Sahir et al., 2017).

The SAW method helps in assessing so that it is not only measured by opinions and feelings. The selection of criteria is determined by the pharmacy according to the level of need (Simanungkalit et al., 2023), and the assessment of each criterion is obtained from the assessment of the Ridho Farma Pharmacy Assistant Pharmacist. This research will help pharmacy owners compare the performance of each supplier that works with the pharmacy.

The advantage of the Simple Additive Weighting (SAW) method is that it can determine the weight value of each attribute (Pratiwi et al., 2014), followed by a ranking process that will select the best alternative from several alternatives and the assessment will be more precise because it is based on predetermined criteria values and preference weights (Afshari et al., 2010). The application of the Simple Additive Weighting method in the supplier selection process is carried out to be able to evaluate each existing supplier and compare each supplier according to the criteria required by the Ridho Farma pharmacy.

2. Methods

This type of research is applied research. The results of this study can be implemented in improving the problems encountered. The type of data in this study is primary data regarding suppliers who collaborate, supplier selection criteria, and supplier performance assessments that have collaborated with Ridho Farma Pharmacy. The variables used in this study are supplier selection criteria with sub-variables including quality, delivery, price, trust, and responsiveness. The analytical method used in this study is :

a. Determining the candidate has become a choice in determining the drug suppliers' best.
b. Determine criteria by the manufacturer decided to be referred to taking decision. Weight for every criterion is determined by the maker's decision.
c. Determine weight preference or level of interest for every criterion.
d. Defines a match rating for every candidate on each criterion obtained from the resulting interview with Assistant Pharmacist.
e. Make a match rating table for every candidate on each criterion.
f. Make matrix decisions based on established criteria from the match rating table for every candidate on each criterion.
g. Do normalization matrix based on adjusted equation with type criterion (criterion profit or criteria cost) so obtained matrix normalized.
   - It says criteria profit if mark owned attributes from every criterion give profit for taker decision.
   - It says criteria cost if mark owned attributes every criterion raises the cost for taker decision.
h. Result of performance rating value normalized form matrix normalized.
i. The final result obtained from the ranking process is with sum from the multiplication matrix normalized with vector weight so that obtained mark selected the largest as the candidate's best solution.

3. Results and Discussion

The data used is Ridho Farma Pharmacy supplier data obtained from interviews with the Assistant Pharmacist of Ridho Farma Pharmacy. In this study, there were eight candidates for the type of drug Paracetamol 500 mg tablets and four candidates for the type of drug Ambroxol 30 mg tablets. Supplier companies for the type of drug Paracetamol 500 mg tablets are shown in Table 1.

Table 1. Paracetamol Alternative Table

A1	PT. Bina San Prima
A2	PT. Penta Valent
A3	PT. Anugerah Parmindo Lestari
A4	PT. Kimia Farma
A5	PT. Tri Sapta Jaya
A6	PT. Perintis Bukit Farma
A7	PT. Anugerah Argon Medica
A8	PT. Antar Mitra Sembada

Supplier companies for the type of drug Ambroxol 30 mg tablets are shown in Table 2.

Table 2. Ambroxol Alternative Table

B1	PT. Tri Sapta Jaya
B2	PT. Perintis Bukit Farma
B3	PT. Anugerah Parmindo Lestari
B4	PT. Kimia Farma

(a) Criteria and Weighting Analysis

In the process of selecting drug suppliers, the criteria are determined by the Assistant Pharmacist at

Ridho Farma Pharmacy. It requires weighting of each criterion that has been previously determined by the decision maker provided that the total value of the weight given is 100%. The Pharmacist Assistant determines 5 (five) criteria to be used in Table 3.

Table 3. Weight of each criterion

	Criteria Name	Weight
C1	Kualitas (*quality*)	40%
C2	Pengiriman (*delivery*)	25%
C3	Harga (*price*)	25%
C4	Kepercayaan (*trust*)	5%
C5	Daya tanggap (*responsiveness*)	5%
	Total	100%

(b) Match Rating

The value of each criterion is entered into the appropriate match rating table and adjusted to the value of the criteria table with an alternative rating scale in Table 4.

Table 4. Alternative Rating Scale

Rate	Scoring Scale
1	Sangat buruk
2	Buruk
3	Cukup
4	Baik
5	Sangat baik

Based on the alternative rating scale in Table 4, the results of the suitability rating given by the decision maker are as follows :

(a) Paracetamol 500 mg tablet
The value of each company supplying the type of drug Paracetamol 500 mg tablets against each of the criteria given is in Table 5.

Table 5. Criteria Paracetamol Compatibility

Alternative	Criteria				
	C1	C2	C3	C4	C5
A1	5	3	4	5	3
A2	5	5	5	3	3
A3	4	5	5	5	5
A4	3	5	3	3	2
A5	5	4	5	5	5
A6	2	4	5	2	2
A7	4	4	3	3	5
A8	2	5	5	3	5

(b) Ambroxol 30 mg tablet
The value of each company supplying the type of drug Ambroxol 30 mg tablets against each of the criteria given is in Table 6.

Table 6. Criteria Ambroxol Compatibility

Alternative	Criteria				
	C1	C2	C3	C4	C5
B1	5	4	5	5	5
B2	2	4	5	2	2
B3	4	5	5	5	5
B4	3	5	5	3	2

(c) Decision Matrix

The decision matrix based on the criteria is formed from the suitability rating table of each alternative on each criterion.

1. Paracetamol 500 mg tablet

Based on Table 5, a decision matrix can be formed with the following data :

$$x = \begin{bmatrix} 5 & 3 & 4 & 5 & 3 \\ 5 & 5 & 5 & 3 & 3 \\ 4 & 5 & 5 & 5 & 5 \\ 3 & 5 & 3 & 3 & 2 \\ 5 & 4 & 5 & 5 & 5 \\ 2 & 4 & 5 & 2 & 2 \\ 4 & 4 & 3 & 3 & 5 \\ 2 & 5 & 5 & 3 & 5 \end{bmatrix}$$

2. Ambroxol 30 mg tablet

Based on Table 6, a decision matrix can be formed with the following data :

$$y = \begin{bmatrix} 5 & 4 & 5 & 5 & 5 \\ 2 & 4 & 5 & 2 & 2 \\ 4 & 5 & 5 & 5 & 5 \\ 3 & 5 & 5 & 3 & 2 \end{bmatrix}$$

(d) Matrix Normalization

Matrix normalization is done by adding up each score on a criterion relative to all other criteria and then making it a divisor for each score on that criterion. Before the process of normalizing the matrix, determine in advance the criteria that fall into the category of benefits or cost.

Table 7. Criteria Category

	Criterion	Category
C1	Kualitas (*quality*)	*benefit*
C2	Pengiriman (*delivery*)	*benefit*
C3	Harga (*price*)	*cost*
C4	Kepercayaan (*trust*)	*benefit*
C5	Daya tanggap (*responsiveness*)	*benefit*

Matrix normalization using the formula:

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{Max\ X_{ij}} & \text{if j is a benefit criterion} \\ \dfrac{Min\ X_{ij}}{X_{ij}} & \text{if j is a cost criterion} \end{cases}$$

The results of the normalization of the decision matrix adjusted for the category criteria in Table 7 are as follows:

1. Paracetamol 500 mg tablet

The normalization results obtained from the formula are :

$$R_1 = \begin{bmatrix} 1.00 & 0.60 & 0.75 & 1.00 & 0.60 \\ 1.00 & 1.00 & 0.60 & 0.60 & 0.60 \\ 0.80 & 1.00 & 0.60 & 1.00 & 1.00 \\ 0.60 & 1.00 & 1.00 & 0.60 & 0.40 \\ 1.00 & 0.80 & 0.60 & 1.00 & 1.00 \\ 0.40 & 0.80 & 0.60 & 0.40 & 0.40 \\ 0.80 & 0.80 & 1.00 & 0.60 & 1.00 \\ 0.40 & 1.00 & 0.60 & 0.60 & 1.00 \end{bmatrix}$$

2. Ambroxol 30 mg tablet

The normalization results obtained from the formula are :

$$R_2 = \begin{bmatrix} 1.00 & 0.80 & 1.00 & 1.00 & 1.00 \\ 0.40 & 0.80 & 0.80 & 0.40 & 0.40 \\ 0.80 & 1.00 & 0.80 & 1.00 & 1.00 \\ 0.60 & 1.00 & 0.80 & 0.60 & 0.40 \end{bmatrix}$$

(e) Ranking

The final stage for obtaining the ranking process is the sum of the normalized matrix multiplication with the weight value of each criterion so that the largest value is selected as the best alternative as the solution.

$$V_i = \sum_{j=1}^{n} W_j r_{ij}$$

Criteria weight = [0.4 ; 0.25 ; 0.25 ; 0.05 ; 0.05]

1. Paracetamol 500 mg tablet

V1 = (1)(0.4)+(0.6)(0.25)+(0.75)(0.25)+(1)(0.05)+(0.6)(0.05)
   = 0.4 + 0.15 + 0.1875 + 0.05 + 0.03
   = 0.8175
V2 = (1)(0.4)+(1)(0.25)+(0.6)(0.25)+(0.6)(0.05)+(0.6)(0.05)
   = 0.4 + 0.25 + 0.15 + 0.03 + 0.03
   = 0.86
V3 = (0.8)(0.4)+(1)(0.25)+(0.6)(0.25)+(1)(0.05)+(1)(0.05)
   = 0.32 + 0.25 + 0.15 + 0.05 + 0.05
   = 0.82
V4 = (0.6)(0.4)+(1)(0.25)+(1)(0.25)+(0.6)(0.05)+(0.4)(0.05)
   = 0.24 + 0.25 + 0.25 + 0.03 + 0.02
   = 0.79
V5 = (1)(0.4)+(0.8)(0.25)+(0.6)(0.25)+(1)(0.05)+(1)(0.05)
   = 0.4 + 0.2 + 0.15 + 0.05 + 0.05
   = 0.85
V6 = (0.4)(0.4)+(0.8)(0.25)+(0.6)(0.25)+(0.4)(0.05)+(0.4)(0.05)
   = 0.16 + 0.2 + 0.15 + 0.02 + 0.02
   = 0.55
V7 = (0.8)(0.4)+(0.8)(0.25)+(1)(0.25)+(0.6)(0.05)+(1)(0.05)
   = 0.32 + 0.2 + 0.25 + 0.03 + 0.05
   = 0.85
V8 = (0.4)(0.4)+(1)(0.25)+(0.6)(0.25)+(0.6)(0.05)+(1)(0.05)
   = 0.16 + 0.25 + 0.15 + 0.03 + 0.05
   = 0.64

All grades V1 – V8 are multiplied by the normalized matrix combined in Table 8.

Table 8. Results of Paracetamol Supplier Values

No	Alternative	C1	C2	C3	C4	C5	Result
1	A1	0.4	0.15	0.1875	0.05	0.03	0.8175
2	A2	0.4	0.25	0.15	0.03	0.03	0.86
3	A3	0.32	0.25	0.15	0.05	0.05	0.82
4	A4	0.24	0.25	0.25	0.03	0.02	0.79
5	A5	0.4	0.2	0.15	0.05	0.05	0.85
6	A6	0.16	0.2	0.15	0.02	0.02	0.55
7	A7	0.32	0.2	0.25	0.03	0.05	0.85
8	A8	0.16	0.25	0.15	0.03	0.05	0.64

2. Ambroxol 30 mg tablet

V1 = (1)(0.4)+(0.8)(0.25)+(1)(0.25)+(1)(0.05)+(1)(0.05)
    = 0.4 + 0.2 + 0.25 + 0.05 + 0.05
    = 0.95
V2 = (0.4)(0.4)+(0.8)(0.25)+(0.8)(0.25)+(0.4)(0.05)+(0.4)(0.05)
    = 0.16 + 0.2 + 0.2 + 0.02 + 0.02
    = 0.6
V3 = (0.8)(0.4)+(1)(0.25)+(0.8)(0.25)+(1)(0.05)+(1)(0.05)
    = 0.32 + 0.25 + 0.2 + 0.05 + 0.05
    = 0.87
V4 = (0.6)(0.4)+(1)(0.25)+(0.8)(0.25)+(0.6)(0.05)+(0.4)(0.05)
    = 0.24 + 0.25 + 0.2 + 0.03 + 0.02
    = 0.74

All grades V1 – V4 are multiplied by the normalized matrix combined in Table 9.

Table 9. Results of Ambroxol Supplier Values

No	Alternative	C1	C2	C3	C4	C5	Result
1	B1	0.4	0.2	0.25	0.05	0.05	0.95
2	B2	0.16	0.2	0.2	0.02	0.02	0.6
3	B3	0.32	0.25	0.2	0.05	0.05	0.87
4	B4	0.24	0.25	0.2	0.03	0.02	0.74

(f) Results of the Decision on Ranking of Drug Suppliers at Ridho Farma Pharmacy

The grouping results above have not obtained actual results for all samples of drug suppliers, so it is necessary to sort the values from the highest result to the lowest result. The alternative that is at the very top will be the best alternative supplier for Ridho Farma Pharmacy because the results of the research and its performance show that the supplier has minimal problems when compared to other alternative suppliers.

1. Paracetamol 500 mg tablet
The ranking results from 8 drug suppliers can be seen in Table 10.

Table 10. Ranking Results (P) of Paracetamol Supplier

No	Alternative	C1	C2	C3	C4	C5	Result	P
1	A1	0.4	0.25	0.15	0.03	0.03	0.86	1
2	A2	0.4	0.2	0.15	0.05	0.05	0.85	2
3	A3	0.32	0.2	0.25	0.03	0.05	0.85	3
4	A4	0.32	0.25	0.15	0.05	0.05	0.82	4
5	A5	0.4	0.15	0.1875	0.05	0.03	0.8175	5
6	A6	0.24	0.25	0.25	0.03	0.02	0.79	6
7	A7	0.16	0.25	0.15	0.03	0.05	0.64	7
8	A8	0.16	0.2	0.15	0.02	0.02	0.55	8

The sequence of drug supplier companies for the type of drug Paracetamol 500 mg tablets from the highest yield to the lowest yield can be seen in Table 11.

Table 11. Best Suppliers of Paracetamol

Supplier	Sequence
PT. Penta Valent	1
PT. Tri Sapta Jaya	2
PT. Anugerah Argon Medica	3
PT. Anugerah Parmindo Lestari	4
PT. Bina San Prima	5

PT. Kimia Farma	6
PT. Antar Mitra Sembada	7
PT. Perintis Bukit Farma	8

Based on Table 10, a ranking decision was obtained from 8 suppliers of Paracetamol 500 mg tablets, where the first rank was A2, namely PT. Penta Valent with the results obtained at 0.86.

2.   Ambroxol 30 mg tablet

The ranking results of the 4 drug suppliers can be seen in Table 12.

Table 12. Ranking Results (P) of Ambroxol Supplier

No	Alternative	Criteria					Result	P
		C1	C2	C3	C4	C5		
1	B1	0.4	0.2	0.25	0.05	0.05	0.95	1
2	B2	0.32	0.25	0.2	0.05	0.05	0.87	2
3	B3	0.24	0.25	0.2	0.03	0.02	0.74	3
4	B4	0.16	0.2	0.2	0.02	0.02	0.6	4

The sequence of drug supplier companies for the type of drug Paracetamol 500 mg tablets from the highest yield to the lowest yield can be seen in Table 13.

Table 13. Best Suppliers of Ambroxol

Supplier	Sequence
PT. Tri Sapta Jaya	1
PT. Anugerah Parmindo Lestari	2
PT. Kimia Farma	3
PT. Perintis Bukit Farma	4

Based on Table 12. a ranking decision was obtained from 4 suppliers of Ambroxol 30 mg, where the first rank was B1, namely PT. Tri Sapta Jaya with the results obtained at 0.95.

4. Conclusion

The priority of alternative drug suppliers for Ridho Farma Pharmacy based on calculations using the Simple Additive Weighting method for the type of drug Paracetamol 500 mg tablets is the drug supply company PT. Penta Valent with a value obtained of 0.86. And for the type of drug Ambroxol 30 mg tablets, the company supplying the drug is PT. Tri Sapta Jaya with a value of 0.95. The calculation results show that PT. Penta Valent and PT. Each of Tri Sapta Jaya is the best alternative supplier for Ridho Farma Pharmacy because the research results and performance show that the supplier has minimal problems when compared to other alternative suppliers.

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