

Use of Analytical Network Process Algorithm in the decision-making process

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Use of Analytical Network Process Algorithm in the decision-making process

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Abstract. The aim of this research is to implement a decision support system where the resulting system is in the form of a recommendation for existing outcomes. Conducting research to select sunblock products. Sunblock is one of the lotions that must be used before leaving the house so that the skin can be protected from sunlight and UV rays, UV rays can have a harmful effect on the skin, therefore the skin needs sunlight protection, one of which is by using a sublock, many sunblock products on the market. The aim of this study is therefore to find the best sunblock products based on the consumer experience of sunblock users. The data obtained to complete the study were taken from the results of questionnaires distributed to sunblock users randomly located in the Simalungun district. This study uses the ANP (Analytic Network Process) decision support system, the researcher uses several criteria to complete this study, including: (H) Price, (Jk) Skin Type, (Ef) Side Effects, (Kp) Product Quality, (Ap) The rules of use, (Ktp) Product affordability and alternatives used are: (A1) Nivea, (A2) Vaseline, (A3) Wardah. The results of the study using the ANP method based on a questionnaire distributed to consumers using sunblock showed that the best recommendations for sunblock type recommended by consumers were Nivea (A1) = 7.2, Vaseline (A2) = 5.4 and Wardah (A3) = 5.07.

Keywords: Decision Support System, ANP, Sunblock, Consumers, Ranking

1. Introduction

Sunlight, on the one hand, requires living things as a source of energy, skin and bone health, for example in the formation of pro-vitamin D vitamin D that prevents polio or rickets, but on the other



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hand, sunlight contains ultraviolet rays that can cause various skin abnormalities, ranging from redness, black spots, premature aging, dryness, wrinkles to skin cancer. This research was carried out in the district of Simalungun by observing and giving random questionnaires to users of the sunblock. This is done to analyze consumer choices that become sunblock recommendations based on the alternatives and criteria identified in the study. A lot of techniques can be used to solve this problem. One of them is the implementation of the decision support system [1]–[3].

Decision support systems are part of an information system based on computers used in an agency or a business to support decision-making [4]–[6]. Decision making is essentially a way of choosing different alternatives and behavior, in order to achieve the best decision according to the parameters that have been used [7], when the process is carried out using a certain method. The Analytical Network Process (ANP) method [8] is one of the decision-making methods listed here. ANP's ability to calculate and summarize a number of variables in a hierarchy or network is its superiority over other methodologies [9]. There are no other synthesis methodologies such as the ANP [10]. ANP is a tool that can establish a system for solving decisions makers' problems without implying that higher and low levels would be independent [11]. In this study, the ANP method is used to manage and manage the selection of the best sunblock by sunblock consumers.

2. Methodology

In order to be able to choose the best sunblock, clear steps are needed which are also the methodology used in this study. These steps begin with the identification of sunblock users by observing and distributing questionnaires to sunblock users consisting of criteria and alternatives to sunblocks that are widely available on the market. On the basis of the model, the assessment of the value criteria generated by consumers is carried out by filling out the questionnaire data. The results of the assessment are processed using the ANP concept, which involves checking the consistency of the assessment, making an assessment matrix until a final weight value is obtained which can help to make the best decision on the sunblock. The flow of research carried out can be seen more clearly in Figure 1 below.

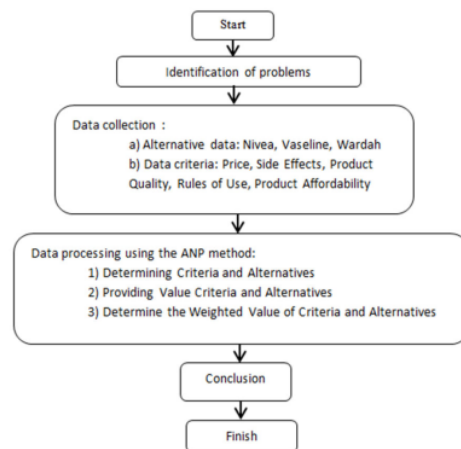


Figure 1. Research Flowchart

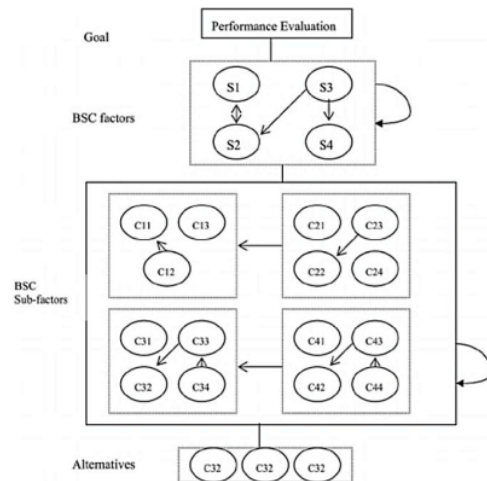


Figure 2. Model Analytic Network Process (ANP)

3. Results and Discussion

Data processing was carried out using the ANP method, which was hierarchically arranged with 6 criteria and 3 alternatives in the table showing the criteria and alternatives for consideration.

Table 1. Criteria

No	Criteria	Name
1	H	Price
2	Jk	Skin type
3	Es	Side effects
4	Kp	Product quality
5	Ap	Rules of use
6	Ktp	Product affordability

Table 2. Alternative

No	Criteria	Name
1	A1	Nivea
2	A2	Vaseline
3	A3	Wardah

After determining the appropriate criteria and alternatives for determining the best sunblock, the researchers completed the analysis of the results of the questionnaire in order to determine the maximum to the lowest weight, coupled with comparisons between the criteria.

Table 3. Pairwise Comparisons

Criteria	H	Jk	Es	Kp	Ap	Ktp
H	1	3	1/3	8	6	4
Jk	1/3	1	¼	2	1/3	1/3
Es	3	4	1	5	6	2
Kp	1/6	1/6	1/5	1	5	6
Ap	¼	3	1/6	1/5	1	5
Ktp	1/4	3	1/2	1/6	1/5	1

The matrix above is added up from each column to get the results in table 4.

Table 4. Evaluation of pairwise comparisons

Criteria	H	Jk	Es	Kp	Ap	Ktp
H	1.00	3.00	0.33	8.00	6.00	4.00
Jk	0.33	1.00	0.35	2.00	0.33	0.33
Es	3.00	4.00	1.00	5.00	6.00	2.00
Kp	0.17	0.17	0.2	1.00	5.00	6.00
Ap	0.25	3.00	0.17	0.2	1.00	5.00
Ktp	0.25	3.00	0.50	0.17	0.2	1.00
Jumlah	5	14.17	2,55	16.37	18,53	18.33

After the number of columns has been determined, the numbers in the 6x6 matrix are divided by the number of their respective columns to produce a 6x6 matrix for the sum of the columns. The results of the sum of the criteria can be found in Table 5.

Table 5. Results of the sum of the criteria

Criteria	H	Jk	Es	Kp	Ap	Ktp
H	5	4.72	7.73	2.05	3.08	4.59
Jk	15.16	14.17	7.28	8.19	56.16	55.55
Es	0.6	3.55	2.55	3.27	3.08	9.17
Kp	29.42	83.35	12.75	16.37	3.71	3.06
Ap	20	4.72	15	81.85	18.53	3.67
Ktp	20	4.72	5.1	96.29	92.65	18.33

The priority weight scale is obtained by calculating the row average from the 6x6 matrix, the calculation results can be seen in table 6.

Table 6. Pairwise comparison weighting scale

Criteria	H	Jk	Es	Kp	Ap	Ktp	Priority vector
H	1.00	3.00	0.33	8.00	6.00	4.00	14,93
Jk	0.33	1.00	0.35	2.00	0.33	0.33	3,19
Es	3.00	4.00	1.00	5.00	6.00	2.00	2,00
Kp	0.17	0.17	0.2	1.00	5.00	6.00	0,79
Ap	0.25	3.00	0.17	0.2	1.00	5.00	0,66
Ktp	0.25	3.00	0.50	0.17	0.2	1.00	0,54

Total	22.11
Principal eigen value	271.18
Consistency index	269.18
Consistency	

Table 7. Random Index Value of Criteria

Matrix size	Ri value
1,2	0,00
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,48
13	1,56
14	1,57
15	1,59

If for $n = 6$, then $R_i = 1.24$

$CR = CI / RI = 269.18 / 1.24 = 217.08$

Table 8. Weight of alternative global priority (ANP)

Criteria	Weight	Nivea	Vaseline	Wardah
Price	14,93	1,98	0,45	0,50
Skin Type	3,19	1,10	0,53	1,36
Side effects	2,00	0,82	0,93	1,05
Product quality	0,79	1,38	1,32	0,28
Usage Rules	0,66	0,84	0,80	1,34
Product affordability	0,54	1,08	1,37	0,54
Priority weight	22,11	7,2	5,4	5,07

Based on the results of the data processing in Table 8, each weighting of the criteria means that price is, among other criteria, the most important criterion. Meanwhile, the alternative assessment result with a higher priority weight is the Nivea alternative. Therefore, according to consumers, Nivea is chosen as the best sunblock, Nivea has a priority weight of 7.2, Vaseline has a priority weight of 5.4, Wardah has a priority weight of 5.07.

4. Conclusion

The decision-making model used is the Analytical Network Process (ANP). Based on the results of the data processing with the ANP model, the following results have been obtained: price with the highest criterion weight of 14.93 as the main priority. Following the skin type which has a weight criterion of 3.19, the side effects have a weight criterion of 2.00 and, finally, the quality of the product has a weight criterion of 0.79. By calculating the alternative ANP method, alternative nivea with a weight of 7.2 can be identified as the main priority, then vaseline with a weight of 5.4 and finally wardah with a weight of 5.07.

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