

## **Feed Selection Decision Support System The Best Cat uses the *Analytical Hierarchy Process Method***

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### **Abstract**

With the increasing development of technology and increasingly rapid competition in the business world, just opening a cat shop is not enough. To win the competition, technology and research are used to overcome the problem of consumers who are confused about choosing the type of food for their cats, because of the many types of cats and cat food available, circulating on the market currently. Cat Shop is a business that provides various types of pet needs, such as pet food, pet supplies and pet accessories. Cat Shop currently has a share of the pet market in big cities in Indonesia. This research will be built using a decision support system using the *Analytical Hierarchy Process* (AHP) method. The AHP method is a method that is widely used in cases of weighting criteria and determining the priority of each criterion. The aim of the research is to help cat owners make better decisions in choosing the best cat food. The results of the calculations show that the CR value is <0.1, so the consistency ratio of the calculations is acceptable. After implementing this research, the results were able to answer the need for information related to selecting the best cat food, and were able to answer and help in resolving the problem of selecting the best cat food purchase.

**Keywords:** Decision Support System, Analytical Hierarchy Process Method, Cat Food, Criteria, Weighting.

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### **1. Introduction**

Cat Shop is a business that provides various types of pet needs, such as pet food, pet supplies and pet accessories. Cat Shop sells various products to people who have pets specifically cats. Cat Shop currently also has a share of the pet market in big cities in Indonesia. It can be seen that there are many cat shops circulating in big cities and small towns to meet consumers' needs for their pets.

Based on data released by Euromonitor in 2021, the pet cat population in Indonesia increased from 2017 to 2021 by 129 percent. Therefore, the cat market category increased by 108 percent compared to 2017. This increase is accompanied by increased awareness of the cleanliness of pet cats. With the increase in the number of pet cats in Indonesia, this will also have an impact on the increase in service and product providers for pet cats.

This can be seen from the growing growth of Cat Shop businesses and clinics specializing in pets, especially cats. Pet products such as pet food are products that sell well to people who have pets. However, pet food sold for pets has many types and comes from many manufacturers, where each manufacturer claims that their product is the best product compared to other products, and this also creates confusion for consumers who come to shop at the Cat Shop.

With the increasing development of technology and increasingly rapid competition in the business world, just opening a cat shop is not enough. To win the competition, technology and research are used to overcome the problem of consumers who are confused about choosing the type of food for their cats, because of the many types of cats and cat food available, circulating on the market currently.

Decision Support Systems (DSS) are data management methods designed to support decision making by involving the use of databases [ 1]. DSS is designed to assist decision makers in solving problems and meeting application needs, but not to replace the decision-making process or make decisions on behalf of the user [ 2]. The act of choosing a strategy or action that the manager believes will provide the best solution to something is called decision making. The purpose of a decision is to achieve a target or certain action that must be carried out [ 3].

Decision support is an idea that characterizes the use of interactive computer systems that assist individuals in making decisions by utilizing data and models to solve problems that are complex and do not have a clear structure [ 4]. In principle, a Decision Support System (DSS) is created to provide support in the entire series of steps in decision making, including recognizing problems, selecting relevant data, determining the method to be used in the decision making process, and evaluating available alternative options [ 5].

Decision support systems do not aim to make decisions automatically, but provide interactive tools that allow decision makers to carry out various analyzes using the models that have been provided [6]

In dealing with this problem, the AHP method was used. The Analytical Hierarchy Process (AHP) method is a method that is often used to assign weight to criteria and determine the priority level of each criterion. The use of AHP is based on the eigenvector principle which is used to rank priority criteria based on the results of criteria comparisons carried out [7].

AHP is a decision support model developed by Thomas L. Saaty. AHP is a method used to arrange a sequence of alternatives with the aim of selecting the best one in the decision making process. In using AHP, situations sometimes arise where decisions need to be taken immediately, but the variation or complexity is very difficult to represent in the form of measurable numerical data [8].

Previous research on decision support systems regarding employee performance assessment using the AHP method has the aim of knowing the achievements that each employee can achieve. So it is hoped that it can help decision makers in obtaining information to determine employee performance achievements in a more objective manner [9].

Previous research has been widely used in various fields by applying the AHP method, such as decision support systems for selecting new employees[ 10], SPK for refunding savings funds[11], selecting free design vendors[12], scholarship recipients[13], selecting typical Sampit snacks[ 14], determining the best teacher[15] and many other studies.

## 2. Research methodology

To assist in preparing this research, it is necessary to have a framework with clear stages. This framework is the steps that will be taken in resolving the problem to be discussed. The research framework used can be seen in Figure 1:

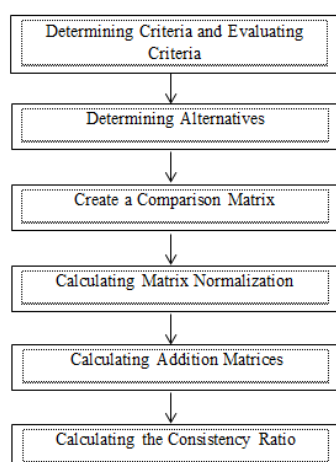


Figure 1. Research Framework

1. Define the problem and the desired solution and then form a hierarchy of existing problems.
2. Determine element priorities, by making pairwise comparisons according to criteria and using numbers to present the importance of each element.
3. Synthesis, consideration of pairwise comparisons is synthesized to obtain overall priorities. First the values from each column in the matrix are added up, then each value from the column is divided by the total of the column in question to get the normalized matrix, then the values from each row are added up and divided by the number of elements to get the average value.
4. Measuring consistency is important so that the consistency of the resulting decisions can be justified. The first step in measuring consistency is to multiply the value in the first column by the relative priority of the first element, and so on for the second column to the nth column. then add up each row and divide the sum by the relative priority element in question. Then add up the quotient by the number of elements present, this result is called  $\lambda$  max.
5. Calculate the consistency index (CI) with the formula:

$$CI = (\lambda_{maks} - n)/n$$

where n = number of elements

6. Calculate the consistency ratio (CR) with the formula:

$$CR = CI/IR$$

Where

CR = consistency ratio

I = consistency index

IR = random consistency index

7. Checking the consistency of the hierarchy, if the value is more than 10% or 0.1 then the judgment *must* be corrected. If it is below 0.1 then the calculation results can be considered correct. For more details, the IR value of the matrix size can be seen in Table 1.

Table 1 Random Consistency Index

No	Matrix Size	IR value
1	1, 2	0.00
2	3	0.58
3	4	0.90
4	5	1.12
5	6	1.24
6	7	1.32
7	8	1.41
8	9	1.45
9	10	1.49
10	11	1.51
11	12	1.48
12	13	1.56
13	14	1.57
14	15	1.59

## 3. Results and Discussion

### 3.1 Analytical Hierarchy Process (AHP) Method

The Analytical Hierarchy Process (AHP) calculation in the decision support system for determining the best food for

visitors at Jessy Cat Shop uses 4 criteria factors, namely Type, Price, Protein, Weight. The Analytical Hierarchy Process (AHP) method also calculates 4 intensities, namely very good, good, fair, poor and not good.

From the 4 criteria factors and 4 intensities for each of these criteria, the best cat food was selected for visitors at Jessy Cat Shop using the Analytical Hierarchy Process (AHP) model to obtain a total value for each food. The criteria, assessment criteria and food list in assessing the selection of the best food purchases for Jessy Cat Shop are as follows:

Table 2 List of Assessment Criteria

No.	Criteria
1.	Type
2.	Price
3.	Proteins
4.	Heavy

In Table 1 above there are 4 criteria, namely type, price, protein and weight criteria. Next there is an assessment of the criteria, where each criterion has a value, which can be seen in the following table:

Table 3 Assessment Criteria

No.	Criteria	Evaluation
1.	Type	Very good, good, fair, and poor
2.	Price	Very good, good, fair, and poor
3.	Proteins	Very good, good, fair, and poor
4.	Heavy	Very good, good, fair, and poor

The assessment criteria in this research are very good, good, fair and poor. Next, the table lists the names of cat food.

Table 4 Data on Alternative Cat Food

No.	Food name
1.	Whiskas
2.	Maxi
3.	Platinum
4.	Beauty
5.	Bold

This study used a list of 5 cat foods to be tested. As for the assessment of criteria and alternatives, they are assessed through pairwise comparisons using a predetermined comparison scale which is used to fill in the comparison matrix values. The assessment scale and pairwise comparisons can be seen in Table 5 below:

Table 5 Rating Scale and Pairwise Comparison

Intensity of Interest	Definition
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the others
7	One element is clearly more important than the other
9	One element is absolutely more important than the others
2,4,6,8	Values between two adjacent considerations
The opposite	If activity $i$ gets one numbers compared with activity $j$ , then $j$ has the inverse value of $i$ is compared to $i$ .

### 3.2 Determining Criteria Priority

The steps that must be taken in determining priority criteria are as follows:

Step 1: Create a pairwise comparison matrix between one criterion and another, as can be seen in Table 6 below:

Table 6 Rating Scale and Pairwise Comparison

Criteria	Type	Price	Proteins	Heavy
Type	1	3	5	5
Price	0.33	1	3	3
Proteins	0.2	0.33	1	2
Heavy	0.2	0.33	0.5	1
Amount	1.73	4.66	9.5	11

Step 2 : Perform normalization. The method is to divide each element by the number of each column as in Table 7 below.

Table 7 Rating Scale and Pairwise Comparison

Criteria	Type	Price	Proteins	Heavy	Amount	Priority
Type	0.57	0.64	0.52	0.45	2.20	0.55
Price	0.19	0.21	0.31	0.27	0.99	0.24
Proteins	0.11	0.07	0.10	0.18	0.47	0.11
Heavy	0.11	0.07	0.05	0.09	0.33	0.08

The total priority value is used to obtain the criteria weights as in Table 8 so that it becomes:

Table 8 Criteria Weights

Criteria	Weight
Type	0.55
Price	0.24
Proteins	0.11
Heavy	0.08

Step 4 : Create a sum matrix for each row. Each element in this table is calculated by multiplying the pairwise comparison matrix by the priority or average value. The row sum matrix can be seen in table 9 below :

Table 9 Row Addition Matrix

Criteria	Type	Price	Proteins	Heavy	Amount
Type	0.55016	1.65048	2.75080	2.75080	7.70255
Price	0.08293	0.24878	0.74633	0.74633	1.82437
Proteins	0.02369	0.03949	0.11847	0.23695	0.41861
Heavy	0.01652	0.02753	0.04129	0.08259	0.16793

The following is the calculation process to get the matrix value of the sum of each row by normalization:

Step 5 : Calculation of consistency ratio. Used to ensure that the consistency ratio (CR)  $\leq 0.1$  . If the CR value is  $> 0.1$  then the pairwise comparison matrix must be recalculated.

Table 10 Consistency Ratio Matrix

Criteria	The number of each row	Priority	Results
Type	7.70225	0.55016	8.25241
Price	1.82437	0.24878	2.07315
Proteins	0.41861	0.11847	0.53708
Heavy	0.16793	0.08529	0.25052
Amount			11.11315

The priority column is obtained from the priority column of the criterion value matrix table and the total column per row is obtained from the total column in the sum table for each row. Based on the values in Table 9d the following values can be calculated.

$$\lambda_{max} = \frac{jumlah}{n}$$

$$\lambda_{max} = \frac{7.70225 + 1.82437 + 0.41861 + 0.16793}{4} = 2.77829$$

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{2.77829 - 4}{4 - 1} = \frac{-1.22171}{4 - 1} = -0.40724$$

IR = 0.90 (karena menggunakan 4 kriteria)

$$CR = \frac{CI}{IR} = \frac{-0.40724}{0.90} = -0.5027623$$

Because CR  $< 0.1$ , the consistency ratio of the calculation is acceptable.

### 3.3 Determining Criteria Priority

The steps in determining the priority of all criteria are as follows:

#### 1. Make Pairwise Comparisons

Pairwise Comparison Table between different types of criteria or alternatives in a given context. This table shows a number of pairwise comparisons between criteria, where these numbers reflect the degree of preference or relationship between the criteria. Using a pairwise comparison table like this .. This table is used to measure and map relative preferences between various options.

Table 1 Pairwise Comparison of Types

Criteria	Whiskas	Maxi	Platinum	Beauty	Bold
Whiskas	1	2	1	3	0.5
Maxi	0.5	1	0.5	2	0.25
Platinum	1	2	1	3	0.5
Beauty	0.333	0.5	0.333	1	0.1666
Bold	2	4	2	5.999	1
Amount	4.833	9.5	4.833	14.999	2.4166

#### 2. Criteria Value Matrix

The table below describes the calculation results and comparison of values between various criteria or alternatives

used in the decision analysis process. The values in the table reflect the degree of preference or relative weight of one criterion over another.

Table 2 Criteria Value Matrix

Crit eria	Whisk as	Maxi	Platin um	Beau ty	Bold	Amo unt	Priorit y
Whiskas	0.2069	0.2105	0.2069	0.2	0.2069	1.0312	0.2062
Maxi	0.1034	0.1052	0.1034	0.1	0.1034	0.5489	0.1097
x	0.2069	0.2105	0.2069	0.2	0.2069	1.0312	0.2062
Beauty	0.0689	0.0526	0.0689	0.0	0.0689	0.3261	0.0652
Bold	0.4137	0.4210	0.4167	0.4	0.4137	2.0624	0.4124

This table is used to give priority and weight to criteria or alternatives in decision making.

#### 3. Type Consistency Ratio

The table below is a calculation of the consistency ratio for each type of criterion or alternative used in the evaluation process. The consistency ratio is one of the indicators used to evaluate whether the comparisons that have been made in the previous pairwise comparison matrix are consistent

Table 3 Type Consistency Ratio

Criteria	Amount	Priority	Results
Whiskas	1.0312	0.2062	1.2374
Maxi	0.5489	0.1097	0.6586
Platinum	1.0312	0.2062	1.2374
Beauty	0.3261	0.0652	0.3913
Bold	2.0624	0.4124	2.4748
Amount			5.9995

$$\lambda_{max} = \frac{5.9995}{5} = 1.1999$$

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{1.1999 - 5}{5 - 1} = \frac{-3.8001}{4} = -0.95$$

$$CR = \frac{CI}{IR} = \frac{-3.8001}{1.12} = -0.8482$$

Because CR  $< 0.1$ , the consistency ratio of the calculation is acceptable. To calculate other sub-criteria, calculations such as type can be carried out.

#### 4. Conclusion

Based on the results of the research that has been carried out, it can be concluded that this system has answered the need for information regarding the selection of the best cat food, has been able to answer and assist in resolving the problem of selecting the best purchase of cat food. After the existence of this decision support system, business promotion areas have spread within and outside the region and have included other cities within reach.

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