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Kansei Analysis using Analytical Hierarchy Process

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***Abstract*—In determining a choice that is not based on specifications, it is important to know the aspects of feelings in a product. Kansei is a technology that translates feelings into product design. The application of Kansei in the development of decision support systems can help facilitate decision making based on feelings. Decision support system development certainly involves a decision support system method. One method that is often applied in decision support systems is the Analytical Hierarchy Process (AHP), as many decision support systems have been applied in the industrial world referring to the evaluation of a number of criteria to evaluate a number of existing criteria used the AHP method which able to approach the assessment of qualitative and quantitative criteria. AHP method is the right solution for the case of product selection based on feelings that have the same specifications. This research aims to choose IT Helpdesk based on feelings. For now, there are several recommended options for a helpdesk that can serve properly. The result of this research is to produce the best alternative recommendations with the criteria that influence. The results obtained from this research are to produce the selection of helpdesk with the highest weight, which the C-Desk alternative with a value of 0.2119 and influenced by Classical criteria with a value of 0.0242 as the main factor.**

Keywords—Decision Support System, Kansei, AHP, Helpdesk

I. INTRODUCTION

Helpdesk is a tool to solve the problems that are designed and adjusted to provide technical services that are concentrated on specific products or services. [1] Currently, there are several recommended options for a helpdesk that can serve properly.

In determining the decision to choose the helpdesk not only prioritizes decision making objectively or based on specifications, but there are other important aspects in determining it, namely feeling. Kansei Engineering (KE) is a technology that translates feelings into product design. Kansei Engineering (KE) is a method for translating feelings, emotions, and impressions into product parameters. [2] The main key to the success of a KE product is feeling, so to realize a quality product that is truly in accordance with feelings is very important to know all aspects of feelings that are expected to appear in a product [3-5].

Based on previous research, the purpose of the research is to show how to build a decision support system that uses elements of feelings and emotions in determining the decisions. The method used in determining decisions is Analytical Hierarchy Process (AHP), as a decision support system that has been widely applied in the industrial world basically refers to the evaluation of a number of criteria, to evaluate a number of existing criteria used the AHP method that is able to approach the assessment of qualitative and quantitative criteria [6-10].

II. METHODS

A. Kansei Engineering

Kansei Engineering is an emotional engineering aspect in interface design based on the disciplines of mathematics, statistics, psychology, and engineering, created by Professor Mitsuo Nagamachi of Hiroshima University in the 1970s. Kansei Engineering (KE) is a method for translating feelings, emotions, and impressions into product parameters [2]. Kansei Engineering is used to enable measurement of consumers' emotional aspects of a product and relate the results to product design elements. Here are the principles of Kansei Engineering:

Fig 1. Kansei Engineering Process Diagram

Kansei Engineering Method Diagram The stages of Kansei Engineering, as shown in Fig.1 is explained as follows:

1. In the initial stages of Kansei Engineering, customers will be investigated using psychological or psychophysiological methods.
2. Data collected will be analyzed using multivariate analysis or psychological equipment.
3. The analyzed data will be interpreted into product design through Kansei Engineering techniques.

It is evident from the existing literature that the method described in Kansei Engineering is that most details are in the form of narratives and the most complete details of Kansei Engineering are available in Japanese. Several attempts have been made by academic researchers to explain the Kansei Engineering methods in the literature in English. To increase the literature of the Kansei Engineering methodology so that this field of study is spread throughout the world so that the principles of the process flow in implementing Kansei Engineering, as shown in Fig. 2.

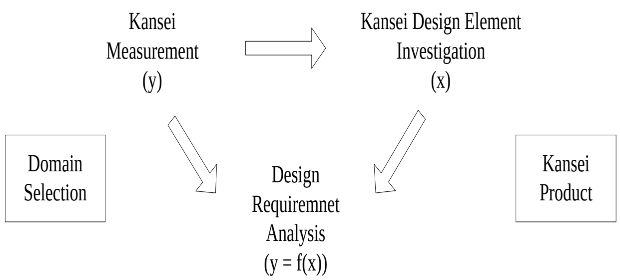

Fig 2. Principles of implementing Kansei Engineering

In the figure outlining the principles of Kansei Engineering Implementation that may occur in all development cycles for various types of products. This procedure includes several stages, namely domain selection, measurement, investigation design element analysis, and analysis, in order to develop product Kansei [5].

B. Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) is a decision support model developed by Thomas L. Saaty. This decision support model will describe a complex multi-factor or multi-criteria problem into a hierarchy. A hierarchy is defined as a representation of a complex problem in a multi-level structure. The first level is the goal, followed by the level of factors, criteria, sub-criteria, and so on down to the last level of alternatives. The concept of the AHP method is to change qualitative values into quantitative values. So the decisions made become more objective. AHP method is enough to rely on intuition as its main input, but the intuition must come from a decision that is well informed and understands the decision problem being faced [6].

To solve the problem using the AHP method, there are several principles that underlie the AHP method, namely: decomposition, comparative judgment, synthesis of priority and logical consistency.

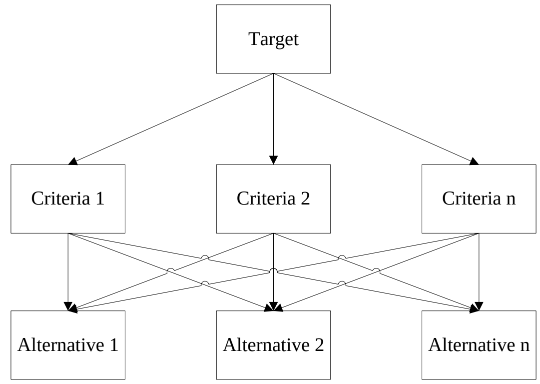

Fig 3. AHP Hierarchy Structure

In making decisions, the thing to consider is that the decisions taken are not always 100% consistent, due to changes in the situation and conditions on the ground. Thomas L. Saaty proved that the consistency index of the ordered matrix can be obtained by finding the value of the consistency index (CI). But before calculating CI, you must first find the value of the eigenvector (λ) using Equation 2.1 and then calculate the CI value using equation 2.2.

$$\lambda = \left(\sum a_{11-n1} \times x_1\right) + \cdots + \left(\sum a_{11-n1} \times x_n\right) \tag{2.1}$$

$$CI = \frac{(\lambda - n)}{(n-1)} \tag{2.2}$$

With:

CI = *Consistency Index*

λ = *The largest normalized value of the matrix n order*

n = *Order matrix*

If CI has a value of 0 (zero), then the matrix will be emphasized, otherwise, it will determine the value of CI above 0 will discuss the inconsistency limits. The inconsistency limit determined by Saaty is agreed by using a consistency ratio (Consistency Ratio or CR), which is what connects the consistency index with the Random Index value (RI) can be seen in Table 1.

TABLE I. RANDOM INDEX VALUE (RI)

N	1	2	3	4	5	6	7	8	9	10
RI	0,00	0,00	0,58	0,90	1,12	1,24	1,32	1,41	1,45	1,49

Where CR is formulated as follows:

$$CR = CI / RI \quad (2.3)$$

With:

CR = *Ratio Consistency*

RI = *Random Index*

If the comparison matrix with a value of $CR \leq 0.1$ (10%) then the inconsistency of the decision maker can be accepted, and if not need to be reassessed.

III. RESULTS AND DISCUSSION

In this research, the method using Kansei Engineering and Analytical Hierarchy Process method. The goal is to provide analysis results from Kansei Engineering using Analytical Hierarchy Process decision support system methods that are able to provide decisions to users without ignoring aspects of the user's feelings towards a product. The Kansei Engineering method was chosen because it was proven to be able to describe in detail the feelings and expectations of consumers towards the product [3-4].

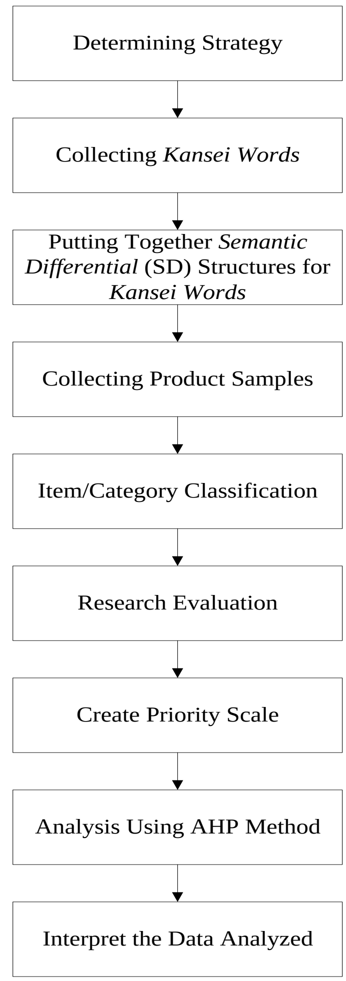

Fig 3. 1. Proposed Stages

The flow of research explains the stages of research in analyzing Kansei using the AHP method in Fig 3.1. The stages of this research are described as follows:

A. Determining the Dataset

In determining the dataset, this study will use the KEPack approach. The stages used are the stages of Determinating Strategy to Research Evaluation. As for this research, these stages will be represented by a dataset from research that has used the stage of determining the strategy to research evaluation. The stages of determining the dataset are the result of an evaluation of the related dataset research experimental data.

The data source of this research will use the dataset as a source of testing data. The data used is a dataset to select the IT Helpdesk, which is the result of a study involving 30 participants representing customers from PT. INTI consists of 20 Kansei words and 5 alternatives.

TABLE II. DATASET IT HELPDEESK

Kansei Word	C-Desk	Fresh desk	Ng Desk	Spice works	Zen Desk
Natural	4	3,2	2,8	2,8	3
Modern	3,8	3,57	3,37	3,8	3,43
Simple	3,7	3,6	3,87	3,77	4
Impresive	3,93	3,6	3,57	3,63	3,67
Classic	4	3,9	3,83	3,8	3,67
Calm	3,3	3,4	3,4	3,37	3,1
Artistic	4	3,77	3,77	3,8	3,83
Harmony	3,97	3,63	3,43	3,7	3,83
Elegant	3,7	3,67	3,87	3,7	3
Formal	3,37	2,6	2,5	2,4	2

B. Calculate the Weight of the word Kansei

The process of calculating weights is done by calculating the average of each word in the dataset. Then based on the average obtained compared with each word Kansei there. Next is to calculate the difference and normalize the different results. The process of calculating the difference will produce a number from 0 to 5. In AHP, the priority scale consists of numbers 1 to 9. However, because in this research, the Kansei approach is used, the priority scale that will be used is 1 to 2. Numbers 1 to 2 are conversion numbers Kansei from 0 to 1.

TABLE III. PRIORITY SCALE

	Priority Scale	
Kansei	0	1
AHP	1	2

Because the resulting difference is in the form of a decimal number, it is, therefore, necessary to normalize. Normalization at this stage aims to round up decimal numbers so that the numbers 0 to 5 are generated so that the numbers obtained can be used to build a priority scale based on the conversion table above.

C. Calculate Alternative Weights

This stage is the stage of calculating the difference between each alternative based on each Kansei word. The method used is the same as the stages of calculating the weights in Kansei words. The difference in this stage is, each alternative will be compared with each other based on every existing Kansei word. For example, there are 3 alternatives and 10 Kansei words. Then it is necessary to calculate the difference of 3 alternatives 10 times in accordance with each word Kansei.

D. Building Matrix of the Kansei Word

Based on the results of the average difference of Kansei words that were obtained before, then there is comparing each word case. A larger difference will indicate that one of the two being compared has more priority than the other. Furthermore, the difference is used to construct alternative matrices. For example, E1 is 5 and E2 is 1; based on the difference, the difference between E1 and E2 is 4, where 5 is greater than 1. So E1 is more important than E2. Then the comparison matrix between E1 and E2 is 5 because 5 is a scale of 4 in Kansei. For E2 with E1, the value obtained is 1/5.

TABLE IV. NORMALIZATION OF KANSEI

Criteria Preferences	**Natural**	**Modern**	**Simple**	**Impresive**	**Classic**	**Calm**	**Artistic**	**Harmony**	**Elegant**	**Formal**
Natural	1	1	0,5	0,5	0,5	1	0,5	0,5	1	1
Modern	1	1	1	1	1	1	1	1	1	2
Simple	2	1	1	1	1	1	1	1	1	2
Impresive	2	1	1	1	1	1	1	1	1	2
Classic	2	1	1	1	1	1	2	1	1	2
Calm	1	1	1	1	1	1	1	1	1	2
Artistic	2	1	1	1	0,5	1	1	1	1	2
Harmony	2	1	1	1	1	1	1	1	1	2
Elegant	1	1	1	1	1	1	1	1	1	2
Formal	1	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	1
Total	**15**	**9,5**	**9**	**9**	**8,5**	**9,5**	**10**	**9**	**9,5**	**18**

E. Building an Alternative Matrix

In this stage, the process carried out is similar to the stages of building a matrix of the Kansei word. At this stage, the difference is to make comparisons of each alternative based on all the words used.

F. Perform Calculations Using AHP

Next is to build selection criteria, by weighting using AHP then ranking the best alternatives to the results of AHP weighting. From the calculations in table 3. 4, after that divide each value in the column comparison Kansei Word with the sum of the corresponding columns. In the Kansei Word matrix, there are 10 criteria, so the value of n in 1/n here follows the number of criteria, which is 10.

TABLE V. PRIORITY VECTOR KANSEI WORD

Criteria	Priority Vector
Natural	0,071350
Modern	0,104455
Simple	0,111121
Impresive	0,111121
Classic	0,121121
Calm	0,104455
Artistic	0,105239
Harmony	0,111121
Elegant	0,104455
Formal	0,055561
Total	**1**

After getting the results of the Kansei Word priority vector, the next step is to calculate the value of the eigenvector (λ) which will be used in calculating the consistency index (CI) by adding up the multiplication results between the cells in the number row in table 3. 4 with the priority vector in the table 3. 5. And the result of λ = 10,12951.

The next step is to calculate the consistency index or CI. From the calculation of CI, the resulting value of CI = 0.01439.

Because of the value of CI ≠ 0, the tolerance limit of inconsistency or consistency ratio must be calculated where the random index (RI) values are taken from the Random Consistency Index table. From the calculation of CR, it produces a CR value of 0.009658 and is considered consistent because the CR value is smaller than 10% or 0.1.

IV. CONCLUSION

The final result of weighting using AHP and AHP decision results can be seen in Figure 4 and Figure 5. The first position is occupied by an alternative C-Desk with a final weight of 0.2119 and is influenced by Classical as a major factor with a value of 0.0242. The second position is occupied by NgDesk with a final weight of 0.2026 and is influenced by Harmony criteria as the main factor with a value of 0.0257. The third position is occupied by Freshdesk with a final weight of 0.01989 and is influenced by Classical as the main factor with a value of 0.0242. The fourth position is occupied by Spiceworks with a final weight of 0.01989 and is influenced by Classical as the main factor with a value of 0.0242. The last position is the fifth occupied by ZenDesk with a final weight of 0.1892 and is influenced by Classical as the main factor with a value of 0.0242.

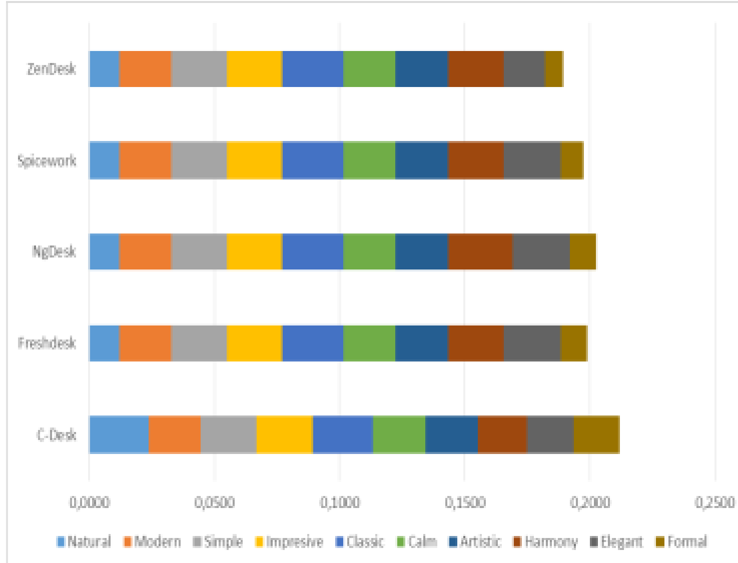

Fig. 4. Final Result of AHP Weighting

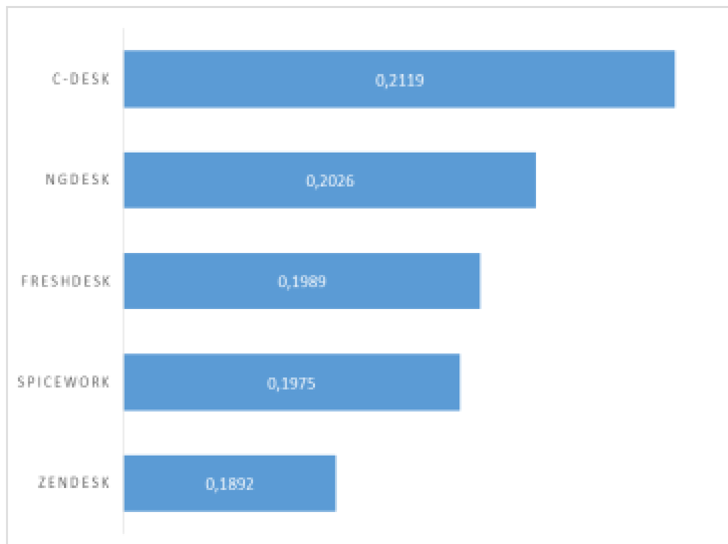

Fig. 5. Results of AHP Decisions

From the test results show Kansei engineering analysis using AHP is a solution to build a decision support system based on feelings or emotions for the case of the selection of a product that has the same specifications. In terms of AHP, calculations can be proven with a consistency ratio of less than 0.10, which in this test has the final result of CR is 0.009658. The value of 0.009658 is smaller than 0.10, so that the AHP method in this study can be used to solve the problem of product selection that has the same specifications.

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