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Decision Analysis Using AHP and Kansei for Extracing Users's Emotional Factor of Information System

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ABSTRACT

In implementing an information system application based on particular users, one of the important consideration is to know users' feelings through its interface. Kansei is a method for translating emotional feelings into a set of application element designs. The implementation of Kansei in the development of information system is to help the design of user interface based on the emotional feelings. The Analytical Hierarchy Process (AHP) method is effective as a solution for our research case of information system selection based on what users feel when interacting the system via its user interface, and we also used multivariate factor analysis as the comparison method. This research aimed to explore the information system application based on Kansei. In this case, we focused on open-source ERP systems as our research objects. The result of this research were to support the analysis of ERP according to the point of view of users' emotional feeling using two methods. The results showed that there were different results between the two methods. However the Kansei word "Artistic" was an users' emotion that had a great influence.

Keywords : Kansei, Information System, System Application, ERP, User Interface, Emotion, AHP, Multivariate Analysis.

I. INTRODUCTION

Information system applications like ERP is a kind of software for supporting business processes efficiently and effectively. So many institutions need this kind of software to keep their performance of business using information technology properly. Recently, there are several recommended popular open-source ERPs that can be implemented [1]. In the case of determining the decision to select the appropriate ERP it is does not only prioritize on the specifications, but there are other important aspects in determining it, namely users' emotional feelings, since users are the persons who use it directly for a long time. Kansei Engineering

is a method to identify users' emotional feelings and translate them into software element design. [2]. The main key to the success of information systems is how so far we realize the quality of a system that is truly by what users feel. Therefore, it is very critical to analyze all related aspects of users' feelings that are expected to the appearance of software user interface [3].

The purpose of the research was to show how to build an information system application including ERP that uses elements of feelings and emotions in determining the decisions. This research used the method of Analytical Hierarchy Process (AHP) in determining decisions, since AHP is a decision-making method that has been widely applied in the industrial world and refers to the evaluation of several criteria, to evaluate a number of existing criteria. The AHP method can approach the assessment of qualitative and quantitative criteria [4].

The advantage of the final result of this research is a critical consideration for an toinstitution that plans to implement an open-source ERP system. It is important to explore users' emotional preferences before implementing the ERP system. In this case, we applied Kansei and AHP to identify and analyze users' emotions in detail, so that they can be used to determine the best suitable environment for implementating the ERP system.

II. LITERATURE REVIEW

A. Kansei Method

Kansei Engineering is an emotional engineering aspect in an interface design based on the disciplines of mathematics, statistics, psychology, and engineering, first launched by Mitsuo Nagamachi (a Professor at Hiroshima University in the 1970s). Kansei Engineering is a method for investigating and translating feelings, emotions, and impressions into product parameters [5]. Kansei Engineering is used to enable measurement of consumers' or users' emotional aspects of a product including software and relate the results to the product of design elements.

Kansei Engineering method in general consists of three systematical processes [3] as follows:

1) In the initial stages of Kansei Engineering, users will be investigated using psychological methods such as questionnaires, semantic differential scales, etc.
2) The collected data questionnaire in general will be analyzed using statistical multivariate analysis such as factor analysis. However, others analyses could be considered to be used.
3) The analyzed data will be interpreted into the design elements as the recommendation of the user interface based on users' emotional preferences.

Kansei Engineering method is an effective method to describe in detail the emotional factor related to the appearance of software. Kansei is also able to show the users' expectations of the information system through its user interface, since the user interface plays the main role as the bridge between users and the internal system [6].

B. AHP

Analytic Hierarchy Process (AHP) is a decision support model that describes a complex multi-factor or multi-criteria problem into a structure of hierarchy. A hierarchy is defined as a representation of a complex problem in a multi-level structure in which 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 the qualitative values into quantitative values to make a decision more objective. The 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 [7].

C. Related Works

Kansei Engineering research has been implemented in a variety of products including software development, especially information system software. There have been more Kansei research related to web-based information system. The research of Kansei mostly used a statistical multivariate method [8-13].

This research aimed to try to use AHP method to strengthen the evaluation results, and to find the relationship between the user interface of the information system and users' emotional feelings. The results of Kansei analysis using AHP could be performed to provide the better design recommendation when developing the user interface of an information system.

III. RESEARCH METHODOLOGY

This research was based on the general methodology in Kansei Engineering called KEPack I [5]. This methodology is the fundamental systematical process to be applied widely in Kansei-based user interface research. However, we used AHP and multivariate analysis.

The goal of this research mainly was to find the relationship between Kansei words and how they affect the user in selecting the open-source ERP system through its user interface.

The research methodology using Kansei Engineering in this research is mainly divided into five phases as illustrated in Figure 1. Semantic differential with 5 points scale was used in collecting data questionnaires.

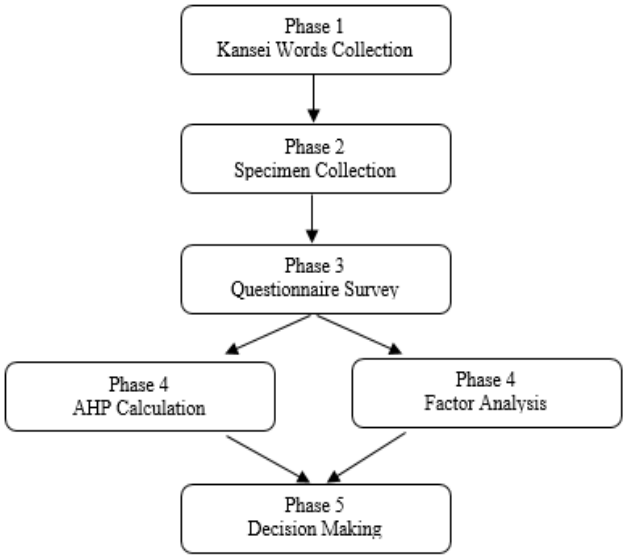

Figure 1: Research Methodology of Kansei

This research aimed to apply the AHP method in emotion analysis, and compare it with the conventional statistic method namely Factor Analysis. The two methods conducted in phase 4 of this research were to make decisions in more detail to observe the priority of users' emotional factors related to the process of user interface design of the information system.

IV. RESULT AND DISCUSSION

A. *Data Questionnaire*

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 ERP system, which is the result of a study involving 30 participants representing the customers of ERP. In this experiment we used 10 Kansei words, 5 alternatives of open-souce ERP systems, and 5 points semantic differential from 1 to 5.

TABLE I

THE AVERAGE OF DATA QUESTIONNAIRES

Kansei Words	S1	S2	S3	S4	S5
Simple	3.7	3.6	3.87	3.77	4
Artistic	4	3.77	3.77	3.8	3.83
Formal	3.37	2.6	2.5	2.4	2
Modern	3.8	3.57	3.37	3.8	3.43
Harmony	3.97	3.63	3.43	3.7	3.83
Calm	3.3	3.4	3.4	3.37	3.1
Impressive	3.93	3.6	3.57	3.63	3.67
Natural	4	3.2	2.8	2.8	3
Elegant	3.7	3.67	3.87	3.7	3
Classic	4	3.9	3.83	3.8	3.67

In Table I, we found that the average of Kansei Words varied. The largest value was 4 for the Kansei Word "Artistic" for specimen 1 (S1), while the smallest value was the Kansei Word "Formal" for specimen 5 (S5). The results of the questionnaires can be illustrated more clearly as shown in Figure 2.

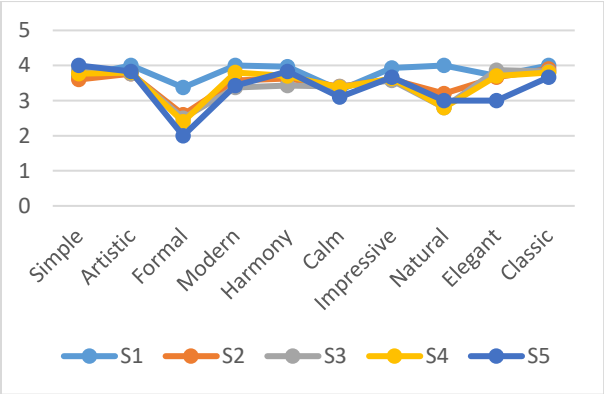

Figure 2: Data Questionnaires

B. *Pair Comparison*

The first process is the calculation of weight for each Kansei Words by comparing two Kansei Words. Pair comparison was based on their average obtained from questionnaires as shown in Table II, for example, the comparison between Kansei Word "Artistic" and Kansei Word "Simple" was 3.834/3.8788 = 1.012144.

TABLE III

THE AVERAGE OF DATA QUESTIONNAIRES

Kansei Words	Average
Simple/KW1	3.788
Artistic/KW2	3.834
Formal/KW3	2.574
Modern/KW4	3.594
Harmony/KW5	3.712
Calm/KW6	3.314
Impressive/KW7	3.68
Natural/KW8	3.16
Elegant/KW9	3.588
Classic/KW10	3.84

The results of all pair comparisons between two Kansei Words were found as shown in Figure 3.

	KW1	KW2	KW3	KW4	KW5	KW6	KW7	KW8	KW9	KW10
KW1	1	0,988002	1,471639	1,053979	1,020474	1,14303	1,029068	1,198355	1,055741	0,986202
KW2	1,012144	1	1,48951	1,066778	1,032866	1,15691	1,041565	1,212907	1,068562	0,998178
KW3	0,679514	0,671362	1	0,716194	0,693427	0,776705	0,699267	0,814299	0,717391	0,670138
KW4	0,948786	0,937402	1,39627	1	0,968211	1,08449	0,976365	1,136982	1,001672	0,935694
KW5	0,979937	0,968179	1,442113	1,032832	1	1,120097	1,008422	1,174312	1,03456	0,966415
KW6	0,874868	0,864371	1,28749	0,922092	0,89278	1	0,900299	1,048402	0,923634	0,862796
KW7	0,971753	0,960094	1,43007	1,024207	0,991649	1,110742	1	1,164505	1,02592	0,958344
KW8	0,834477	0,824465	1,22805	0,879521	0,851563	0,953832	0,858734	1	0,880992	0,822963
KW9	0,947202	0,935837	1,393939	0,998331	0,966595	1,08268	0,974735	1,135084	1	0,260349
KW10	1,013992	1,001826	1,49223	1,068726	1,034752	1,159022	1,043466	1,215122	3,841	1
Total	9,262672	9,151539	13,63131	9,76266	9,452317	10,58751	9,531921	11,09997	12,54947	8,461078

Figure 3: The Kansei Words' Pair Comparisons

C. *Normalization*

The second process was normalization. The normalization was conducted using the result in Fig. 3 by dividing each value of the column by its total, for example, normalization of KW1 ("Simple") was 1/9.262672=0.10796. The complete results of Normalization were shown in Figure 4.

KW1	0,10796	0,10796	0,10796	0,10796	0,10796	0,10796	0,10796	0,10796	0,084126	0,116557
KW2	0,109271	0,109271	0,109271	0,109271	0,109271	0,109271	0,109271	0,109271	0,085148	0,117973
KW3	0,073361	0,073361	0,073361	0,073361	0,073361	0,073361	0,073361	0,073361	0,057165	0,079202
KW4	0,102431	0,102431	0,102431	0,102431	0,102431	0,102431	0,102431	0,102431	0,079818	0,110588
KW5	0,105794	0,105794	0,105794	0,105794	0,105794	0,105794	0,105794	0,105794	0,082438	0,114219
KW6	0,094451	0,094451	0,094451	0,094451	0,094451	0,094451	0,094451	0,094451	0,073599	0,101972
KW7	0,104911	0,104911	0,104911	0,104911	0,104911	0,104911	0,104911	0,104911	0,08175	0,113265
KW8	0,09009	0,09009	0,09009	0,09009	0,09009	0,09009	0,09009	0,09009	0,070202	0,097265
KW9	0,10226	0,10226	0,10226	0,10226	0,10226	0,10226	0,10226	0,10226	0,079685	0,03077
KW10	0,109471	0,109471	0,109471	0,109471	0,109471	0,109471	0,109471	0,109471	0,306069	0,118188
Total	1	1	1	1	1	1	1	1	1	1

Figure 4: The Result of Normalization

The final result of AHP was the vector weight of each Kansei Word as shown in Table III. This results was found by calculatiing the average of Kansei Words.

TABLE IIIII
THE AVERAGE OF DATA QUESTIONNAIRES

Kansei Words	The Weight
Formal	0,072325
Natural	0,088819
Elegant	0,092854
Calm	0,093118
Modern	0,100985
Impressive	0,103430
Harmony	0,104301
Simple	0,106437
Artistic	0,107729
Classic	0,130002

According to the final result of AHP in Tabel III we found that the biggest weight of Kansei Word was "Classic", it means that the users' feeling of "Classic" is the most required based on users' emotion in this case. Other Kansei Words such as "Simple" and "Artistic" could be considered as alternative emotions.

D. *Factor Analysis*

As a comparison, we carried out other calculations using a multivariate Factor Analysis to find out which Kansei Word has the most influence, and the results were obtained as in Table IV. XLStat was used as a tool to calculate the Factor Analysis [14].

According to Table IV, there were three Kansei Words that have coefficient values more than 0.9 such as "Impressive", "Artistic", and "Natural". These three Kansei Words must be considered as users' emotional feelings when designing the user interface of the information system. However, the most influential Kansei Word was "Impressive".

Kansei Words	Coefficient
Calm	-0,29165
Simple	-0,25596
Elegant	-0,08911
Classic	0,573508
Formal	0,748326
Modern	0,78892
Harmony	0,889497
Natural	0,9464
Artistic	0,979978
Impressive	0,991704

E. *Decision Making*

According to the calculation using AHP we found the three biggest influences of Kansei Words were "Classic", "Artistic", and "Simple". Meanwhile, according to Factor Analysis we found the three biggest influences of Kansei Words were "Impressive", "Artistic", and "Natural". Therefore, according to both methods (AHP and Factor Analysis), there was one Kansei Word that had great influence in this case, namely "Artistic".

The Kansei Words "Simple", "Classic", "Natural" and "Impressive" had large differences between AHP and Factor Analysis. However, these Kansei Words could not be ignored, could be considered as alternatives emotions. It approved that AHP could be considered as an alternative method to analyze users' emotional preferences in research of Kansei.

The results of this research could prove that AHP could be used in Kansei analysis, and also could be

implemented to reduce the number of Kansei words using the AHP and Factor Analysis methods. So that the users' emotions analysis could be more focused.

V. CONCLUSION

The user interface in an information system has an important position in supporting the quality of software. Therefore, the development of information system must involve users to consider users' feelings or emotions in designing it's user interface. Kansei Engineering would help the developer to design the interface based on the user's emotional factor regarding the user interface of the information system.

The results showed that there were three alternative considerations in implementing an ERP system. The users' emotional feelings were considered as "Artistic" and as the alternative emotional preferences were "Classic" based on the AHP, and "Impressive" based on Factor Analysis.

For future research, it would be better to continue the reseach by implementing different methods to analyze users' emotional feelings with different perspectives to make the user interface of the information system more suitable for users.

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