

# A Study on Consumer Preference for Laptop Products using Conjoint Analysis and Cluster Analysis

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**Abstract**— Laptops own attributes which are commonly offered and widely known by consumers. The present study is aimed to determine the level of each attribute which becomes consumer consideration in buying laptop products, grouping the consumers based on characteristics similarity with attributes. The method employed was Conjoint Analysis. Cluster Analysis was used to group the respondents. From the data collection, there are five things considered important: RAM Memory, Processor, Brand, Hard Disk Capacity, Operating System; and attribute level of these three brands: I, C, and A. The results of study are: the consumers consider the BRAND attribute is the most important with the importance value of (32.79%) with the level Brand C, and then followed by RAM factor (21.06%) with a capacity of 8 GB RAM, HDD (17.67%) with a hard disk capacity of 1 TB, OS (16.93%) and Operating System Windows level, Processor (11.53%) with Intel level. The consumer grouping, which uses K-Means Cluster analysis by entering utility value as the variable being grouped, obtains two clusters where cluster one is the employee group, and cluster two is the general group (Students/ Employees).

**Keywords:** Consumer Preference, Conjoint Analysis, Cluster Analysis

## I. INTRODUCTION

Laptops own attributes which are commonly offered and widely known by consumers. The current laptop system is related to fast processor, large storage capacity, and large RAM or memory. Manufacturers need to develop products that do not only meet the consumers' requirement, but also affordable prices. Basically, when the product (goods or services) is being offered to the consumer, what really being done is an effort to deliver the value. Therefore, it is necessary for the manufacturers to know the product's attributes which is appropriate with the consumers' needs. There are several concepts in analyzing the consumer preference; one of which is conjoint analysis.

Several studies on consumer preference have been conducted using conjoint analysis and cluster analysis. References [19] uses conjoint analysis to determine the behavior and characteristics of students as users of library services, degree of importance and expectation towards library services, and the main factors of service quality at UIN Yogyakarta. References [1] employed conjoint analysis aimed to determine consumer preferences or utility optimization of product's attributes for commodities or superior vegetables (potatoes, red onions, and red chilies). References [13]

performed research to find out consumer preferences in using social messenger in Bandung - using explorative and descriptive methods as well as data analysis using conjoint analysis. The attributes used in the assessment of social messenger preference are product quality, feature, additional feature and design. References [4] conducted a study aimed to determine consumer preference in choosing cell phone, using conjoint analysis method, logistic regression model, and experiment design on choice-based conjoint. The attributes used were the period of warranty, price, screen size, RAM memory size, and camera sharpness. Based on the results, three attributes that influence the respondents in choosing cell phone product are price, screen size, and camera sharpness, offered by each cell phone product. References [16] used conjoint analysis to determine the characteristics of instant coffee as a basis for instant coffee preference analysis, and investigate variations between regional differences and market segments. References [2] employed conjoint analysis to identify good research practices in the healthcare world. References [20] adopted conjoint analysis to determine consumer preference in tourism services, giving an evaluation of alternatives from different attributes. References [10] made use of conjoint analysis to evaluate preferences in the upper middle class to design residential property attributes at high cost, decision-making from different attributes. References [3] implements cluster analysis to find out student segmentation based on Emotionally Intelligent Leadership (EIL) behavior. References [5] carried out a cluster analysis based on correlation analysis to reduce the complexity of the quantitative indicator for the research performance measurement. References [21] demonstrates that the K-Means cluster analysis method is able to provide a classification of modern service industry in China via index data analysis. Based on the background above, this article will discuss the study on laptop product preference using conjoint analysis and cluster analysis to group objects based on characteristic similarity among the objects.

## II. CONSUMER PREFERENCES

Consumer preference is a consumer's attitude on the choice of a products' brand, formed through the evaluation upon various brands in various options available. [11].

Assumptions related to consumer preferences: [12]

- a. When consumers encounter a choice between certain number of commodities, they can decide which one is more preferable. In other words, if given with various combinations of commodities capable of giving satisfaction, then consumer can determine which combination is more preferable, or those that produce similar level of satisfaction. This assumption is known as completeness.
- b. The consumers are consistent in making choices between many different combinations of commodities. Therefore, if the first consumer shows a preference towards Product 1 rather in comparison with Product 2; and Product 2 in comparison with Product 3; then to make it consistent, the consumer should show preference towards Product 1, rather than Product 2. This assumption is said transitive or consistency.
- c. Larger amount is more preferable than fewer. Nobody will ever be satisfied with the desired commodity. This assumption is known as non-satisfaction.

These three assumptions can be translated into indifference curve. It is a curve that indicates a constant level of satisfaction, or as a set of points indicating a combination of two commodities (or set of commodities), where the consumer perceives no difference.

### III. CONJOINT ANALYSIS

In the opinion of [9], conjoint analysis is a multivariate technique used to understand how the respondent constructs preferences over products or services.

This analysis can also be used for: [7]

- a. Designing price
- b. Predicting the sales level or product usage (market share)
- c. Testing new product concept
- d. Preference segmentation
- e. Designing promotional strategy

In the process, conjoint analysis will provide a quantitative measure on the utility and relative importance of an attribute compared to other attributes. It is done through psychological considerations or consumer preference. [8]

According to [15], there are several steps that should be conducted in conjoint analysis:

1. Determining the attribute factor and then the level (the parts of the factor) and an object, namely the attribute or level attribute to be used in designing stimuli (a combination of attribute levels).
2. Design the stimuli, which is a combination of factors and levels. The preparation of a stimuli combination can be done by factorial design or fractional factorial. Factorial design is used when all combinations of stimuli formed are presented to the respondents. Meanwhile, the fractional factorials are used when only a number of levels are proposed. For too much amount of stimuli, it can be reduced using provision of minimal stimuli: [15]

$$\text{Stimuli Minimum} = \text{Number of levels} - \text{Number of factors} + 1 \quad (1)$$

3. Collecting respondents' opinions on any stimuli available. The opinion of each respondent is called utility, which is

expressed by numbers, and becomes the basis of the Conjoint calculation.

4. Carrying out the Conjoint process. From the respondents' opinion on so many stimuli, the Conjoint process is conducted to predict the product form desired by the respondents. The output generated from the conjoint analysis process is utility value that indicates the tendency of consumers' preference over stimuli combination, and the importance value that indicates the most important or the most influencing attributes in a product.
5. Determining the predictive accuracy of conjoint result above: to measure the level of prediction accuracy from the analysis results, where the conjoint results do not differ significantly from the actual respondent's opinion which is reflected by the high correlation and significance between estimations and actual results. Meanwhile, the Conjoint outcome with a number of holdout samples was tested to determine whether the prediction conducted has a high accuracy.
6. Outcome interpretation. To facilitate the interpretation of Conjoint analysis outcome, the utility function should be plotted beforehand. From the result of utility function plot, consumer preference can easily be known, both to level attributes and important attributes. The interpretation of preference is done in aggregate, or subscribers' groups. Aggregate interpretation indicates overall consumer preference, whilst group interpretation shows consumer preference in varying market segments.

### IV. CLUSTER ANALYSIS

Characteristics of a good cluster: [15]

- a. High homogeneity between members within cluster
- b. High heterogeneity (difference) between one cluster and another (between-cluster)

References [15] argues that the basic process of cluster analysis includes:

- a. Measuring similarity between objects. In accordance with the basic principle of clusters, which is grouping objects that have similarities, thus the first process is to measure how far the similarities between objects is. There are three methods used:
  - 1) Measuring the correlation between a pair of objects on several variables.
  - 2) Measuring the distance between two objects.
  - 3) Measuring associations between objects
- b. Before going any further, consider whether the data (variable) existed have a million units, while a person's age only has a unit of tens; thus this striking difference will make the distance calculations and other invalid. Therefore, the entire data must be subjected to standardization process - by changing the Z-score.
- c. Creating a cluster. In the creation of clusters, there are two doable methods:
  - 1) Hierarchical Method  
This method is started by grouping two or more objects that have the closest similarity. Then, the process is forwarded to other objects that own a second closeness, and so on until the cluster forms a second closeness, and so on until the cluster forms a type of 'tree' - where there is a clear hierarchy

(level) between objects which finally will only form one cluster. Dendograms is typically used to help clarify the hierarchy process.

2) Non-Hierarchical Method

This method starts by first determining the number of clusters wanted. After the number of clusters is determined, a new cluster process is performed without following the hierarchy process. This method is arguably called K-Means Cluster.

V. RESEARCH METHOD

The present study used conjoint analysis method by spreading questionnaires to find out the product's attribute, and validity and reliability tests were also conducted. Furthermore, utility and relative importance value was determined for each product attribute using conjoint analysis. Cluster analysis is used to determine segments (groups) formed based on consumer preferences on laptop products.

VI. FINDING AND DISCUSSION

The result from the research data obtains 5 attributes and 3 highest brands becoming the consumer consideration in choosing or buying a laptop product. Below is the table that shows the results of the preliminary questionnaires as the initial sample.

On the basis of preliminary questionnaire outcome in Table 1, the determination of laptop attributes that will be used in this study, from 1 to 5 is: Memory RAM, Processor, Brand, Hard disc Capacity, Operating System. As for the laptop brand, the preliminary questionnaire outcome is shown in Table 2, from 1 to 3, namely Brands C, A and I.

Table 1. Laptop Attributes according to Importance Level

No	Attribute	Rating
1	Brand	3
2	Screen Size	8
3	Processor	2
4	VGA	6
5	RAM Memory	1
6	Hard disc	4
7	Operating System	5
8	Laptop Weight	9
9	Design	7
10	Battery	11
11	Features	12
12	Camera	10

Table 2 - Level of Laptop's Brand Attributes

No	Brand	Rating
1	A	2
2	B	5
3	C	1
4	D	8
5	E	4
6	F	9
7	G	7
8	H	6
9	I	3

Conjoint aggregate analysis shows the overall consumer preference over laptop products (Table 3). The important attribute value of aggregate analysis shows relative

importance level of each attribute for the consumer as a whole.

Table 3. Level of Relative Interest Attributes and Utility Value in Overall Conjoint Analysis (Aggregate)

Sub-file Summary			
Importance	Factor	Level	Utility
21,06	RAM	8GB	.203
		4GB	-.103
		2GB	-.100
11,53	Processor	AMD	-.146
		Intel	.146
32,79	Merk	C	.505
		I	-.083
		A	-.422
17,67	HDD	1TB	.197
		750GB	.018
		500GB	-.215
16,93	OS	Windows	.285
		Linux	-.285
Constant		2,303	
Pearson's R	0.952		Sig : 0.000
Kendall's tau	0.778		Sig : 0.000

(Source : Data Processing)

Table 4. Output of Aggregate SPSS Correlations

Correlations <sup>a</sup>		
	Value	Sig.
Pearson's R	.952	.000
Kendall's tau	.778	.000

Predictive Accuracy measurement can be seen from the correlation output with Pearson and Kendall's methods, i.e. 0.952 and 0.778 (above 0.5) and the correlation really exists because of significant value below 0.0: (0.000 and 0.000). It shows that there is a strong correlation between estimation and actual results, or there is predictive accuracy in Conjoint analysis process (Table 4).

To identify the preference variations among different clusters, grouping analysis uses Cluster Analysis.

From the cluster process result on Table 5, there are 2 respondent clusters. Each cluster has different characteristic from each other.. The distribution of the respondents' number in each cluster is: 29 on cluster 1, and 71 on cluster 2.

Table 5. Number and Member of Each Cluster

Cluster	Respondents	Number
1	3, 4, 6, 11, 16, 19, 28, 29, 34, 38, 39, 41, 42, 43, 48, 49, 53, 57, 59, 61, 62, 68, 72, 74, 78, 81, 93, 96, 97, 98, 99, 100	29
2	1, 2, 5, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 30, 31, 32, 33, 35, 36, 37, 40, 44, 45, 46, 47, 50, 51, 52, 54, 55, 58, 60, 63, 64, 65, 66, 67, 69, 70, 71, 73, 75, 76, 77, 79, 80, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 94, 95	71

Source : Data Processing

REFERENCES

Table 6. Final Cluster Centers

	Cluster	
	1	2
8 GB	.00	.29
4 GB	-.25	-.05
2 GB	.25	-.24
AMD	-.10	-.17
Intel	.10	.17
C	.28	.60
I	.33	-.25
A	-.61	-.34
1 TB	.27	.17
750 GB	-.04	.04
500 GB	-.23	-.21
Windows	.19	.32
Linux	-.19	-.32

From Table 6, it can be seen that respondents in Cluster 1 tend to prefer laptop with 2 GB RAM specification, Intel Processor, Brand I, HDD with 1 TB capacity, and Windows Operating System. Respondents in Cluster 2 tend to prefer laptop with RAM capacity specification of 8 GB, Intel Processor, Brand C, HDD capacity of 1 TB, and Windows Operating System.

VII. CONCLUSION

Based on the analysis that has been done, it can be drawn some conclusions as follows:

1. The service quality valued at 0.84 or less than the value 1 means that the service quality of the companies have not met expectations. The level of satisfaction of motor vehicle owners to the service quality of company is still low with the gap in every variable and SERVQUAL dimension.
2. Tangible dimension has -0.13 gap, Reliability dimension has -0.13 gap, Responsive dimension has -0.14 gap, Assurance dimension has -0.11 gap and Empathy dimension has -0.11 gap.
3. Overall, the gap between perception and expectation is -0.13, which means that service quality is still low.
4. Based on the results of significance test, it can be seen that there is a difference between expectations and perceptions.

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