

Analysis of User Interface Design Component in E-Marketplace of Village Comodity Product Using K-Means Clustering

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Abstract— E-marketplaces are electronic-based markets where sellers and buyers can interact online based on media. To find out whether the e-marketplace is in accordance with user needs or not, especially the e-marketplace for village commodity products, an analysis needs to be done. The analysis conducted in this study uses the principle of user interface design as an indicator, namely Consistency, Hierarchy, Layout, Type, Imagery, Color, Personality, and Control and Affordances. K-Means Clustering was used in this study to determine the quality level of e-marketplaces for village commodity products. This method produces 3 clusters namely the first cluster as a very good cluster produces a value of 72% with indicators of Consistency, Hierarchy, Layout, Type, Imagery, Color, Personality, and Control and Affordances, the second cluster is less good by 13% with Personality, Color indicators Imagery and the third cluster are good at 15% with indicators being Consistency, Hierarchy, Layout, Type, Color.

Keywords— E-Marketplace, user interface design principles, K-Means, clustering.

I. INTRODUCTION

The use of smartphones in Indonesia has increased significantly from 2016 to 2019. In addition to smartphone users, based on the results of an Indonesian Polling study in collaboration with the Indonesian Internet Service Providers Association (APJII) internet users in Indonesia recorded an increase in 2018, the number of internet users in Indonesia grew by 10.12 percent. %. This is an opportunity for business people to use the internet, including the internet for village commodities. The internet captures users more and more and reaches to villages.

The concept of e-marketplace conventionally can be analogous to traditional markets, many trading activities, the difference is that sellers and buyers do not meet directly. E-marketplace is electronic-based markets where sellers and buyers can interact directly based on online media. In e-marketplace both sellers and buyers can carry out activities as in the market in general without the limitations of place and time.

Farmers can market the results of their agricultural commodities without having to require excess effort, where usually a farmer will sell his agricultural products on condition that they must be harvested first and must be transported to the market without any guarantee that the agricultural products will be sold or not so that the costs incurred will be not a little and has an impact on the price of these agricultural products,

besides that many agricultural products are wasted or deliberately discarded because it is not suitable for consumption due to the absence of buyers or too long in the market, because of this many farmers prefer to sell their agricultural products to collectors because collectors usually live close to the existing farmers or come directly to the farmers, but collectors usually buy a lot at a price below the offer in the traditional market and the profits that farmers get are few.

The high operational costs that must be spent by farmers to sell the results of agricultural commodities makes many farmers lose and do not expect much profit, so usually these farmers will only plant their land if the agricultural produce is in accordance with the existing season or there is a lot of market demand.

Farmers who sell their agricultural commodities on the market are large farmers who own a lot of land or who work with other farmers for profit sharing. Difficult to get buyers and small profits make many farmers consume their own agricultural products.

So to overcome this the village through its village apparatus will only open the market on certain days to minimize the losses of farmers and attract farmers to market their agricultural products to the market. With the marketing of an online market-based commodity that is not limited in space and time and at least the operational costs incurred by farmers are expected to motivate farmers to be more courageous and enthusiastic in selling their agricultural products through e-marketplaces.

There are already several e-marketplaces for village commodity products. To increase user satisfaction, an analysis of e-marketplace for village commodity products is needed by using K-Means and user interface design principles as indicators namely consistency, Hierarchy, Personality, Layout, Type, Color, Imagery and Control and Affordances. It aims to be input to build e-marketplaces of village commodity products or improve existing ones so that it suits the needs of users.

II. LITERATURE REVIEW

A. E-MarketPlace

E-marketplace is an online buying and selling places that is managed by one party, but its products and information are provided by third-party sellers.

Brunn, Jensen and Skoovgard (2002) define that the marketplace is divided into 2, namely the horizontal marketplace and the vertical marketplace:

1. Horizontal Marketplace is categorized based on the products it sells that can usually be reached by many general consumers. Can be interpreted as a market that is used for general industry. Like the smartphone, PC, clothing market. Transaction costs incurred are lower.
2. Vertical Marketplace is categorized based on special products sold only to meet the special needs of other companies. Like the concrete, steel sales market.

E-marketplaces are internet-based online media where sellers and buyers meet and carry out various types of transactions. Here people make the transaction process by exchanging goods and services to make money without having to meet in person because it has been connected by online media. In general, e-markets are made up of buyers or businesses and suppliers or sellers. Buyers can find as many suppliers as possible with the desired criteria available in the application, so that they get according to market prices. Whereas suppliers / sellers can find out which companies need their products.

B. User Interface Design Principles

The appearance of a computer or machine that interacts directly with the user is referred to as the user interface (UI). To create a nice appearance, the interface's layout and design must be taken into account. Schlatter (2013) provides a guide to compiling an easy-to-use application design by dividing it into several influential components as follows:

1. Consistency
Consistency of the appearance of the user interface
2. Hierarchy
Arrangement of the hierarchy of interests of the objects contained in the application
3. Personality
The first impression seen on an application that shows the characteristics of the application.
4. Layout
The layout of the elements in an application.
5. Type:
Typography used in an application
6. Color
The use of the right color used in an application.
7. Imagery
Use of images, icons, and the like to convey information in an application.
8. Control and Affordances
The user interface's components that enable users to communicate with the system via a screen.

C. Clustering

Clustering is a method of automatically grouping data that aims to group similar or similar data to one another into the same group as well as data with different types in separate

groups. The greater the similarity of data in one group and the greater the differences in each group, the better the quality of cluster analysis will be better. This is in accordance with the explanation (Larose, 2005) regarding clustering, where clustering refers to the grouping of data, observations or cases based on the similarity of the object under study. A cluster is a collection of data that is similar to another or dissimilar data in another group.

There are two categories of clustering, according to Tan (2006): hierarchical algorithms and partitional algorithms clustering:

1. Partitional Clustering is making division of data objects or partitions into groups that do not overlap so that each data is in one cluster. Partition-based methods include K-means, K-mode, K-medoids.
2. Hierarchical clustering is a group of clusters that nest like a tiered tree (hierarchy) of data sets. The hierarchy-based methods include distance measurement, BIRCH, Chameleon.

D. K-Means Clustering

K-Means Clustering is a non-hierarchical data clustering method that partitions data into one or more clusters / groups, so that data that has the same characteristics are grouped in the same cluster and data that has different characteristics are grouped into other groups (Agusta, 2007).

K-Means Clustering is included in the partition algorithm approach where the partitions are created and then grouped into several criteria or clusters. From these criteria we get cluster centers, where cluster centers can be in the form of average data, the mode of all objects in a particular order with values that can change according to the number of iterations and the iteration process will stop if the center value is no longer change again and from this in the grouping of similar characteristics can be based on the number of clusters that have been set.

III. METHOD

The steps that will be taken in conducting this research can be seen in Figure 3.1.

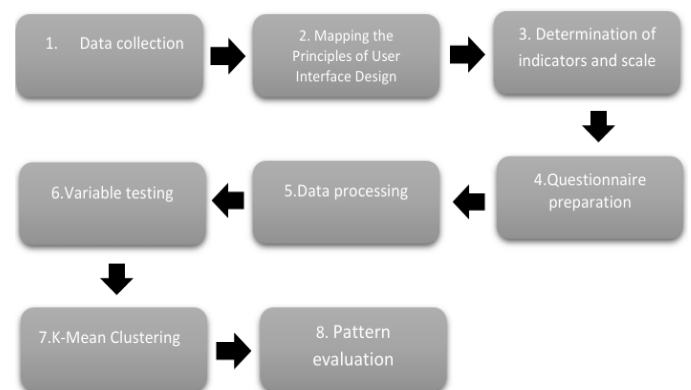


Figure 3.1 Research Methodology

Figure 3.1 explains the stages of the research conducted beginning with the stage of data collection then mapping

based on user interface design principles, determining indicators and scale, conducting questionnaires, processing data on the results of questionnaire distribution, the next step is to test variables with validity test and reliability test, then do a grouping with K-mean clustering to see which groups are less good so it is recommended to do the development or if you want to build a new e- marketplace application so the results will be better.

A. Data Collection

The first stage of the research is the collection of data through literature and field studies that will be used in the process of preparing the questionnaire. Literature study is done by searching literature and journals related to research. Field studies of research material that will be examined by knowing the existence of a problem so that it can be formulated into research to then be made a solution for the problem. Field studies were carried out by distributing questionnaires to users of the regopantes.com and sayurbox.com websites.

The next process is the preparation of the questionnaire. After completing the questionnaire, then determine the population, sample data, and data sampling techniques.

a. Population

Population is a collection of objects that have the same characteristics. The population in this study is the e-marketplace website of the village commodity product Sample.

b. Sample

Sample is a portion of the population to be conducted for research, data or results from this study are considered to be representative of the population as a whole. Many Indonesian e-marketplace websites are included in the study's sample, such as regopantes.com and sayurbox.com.

c. Sampling Technique

The sampling technique used in this study is simple random sampling. Simple random sampling technique is a sampling technique from members of the population that is done randomly without regard to strata that exist in that population (Sugiono, 2001).

The number of samples for this study 162 respondents with the reason for determining the amount based on the opinion of Roscoe a decent sample size in the study is between 30 to 500 on the majority of studies have been represented (Sekarang, 2006).

Sampling was carried out using a questionnaire distributed to users of e-marketplace sites for village commodity products in Indonesia with a simple random sampling technique. This research is to analyze e-marketplace websites by referring to user interface design principles.

B. User Interface Design Principles

Figure 3.2 is a user interface design principle that will be mapped in the preparation of the questionnaire.

C. Analysis with K-Means

Algoritma K-Means Clustering:

- 1) First, determine the value of K as the sum of the number of clusters. If necessary, set a threshold for changing the objective function (the limit that determines the number of iterations to be performed and the iteration process stops or not).

WSS formula:

$$WSS(K) = \sum_{i=1}^n \sum_{k=1}^K 1(x_i \in C_k) \cdot \|x_i - \mu_k\|^2$$

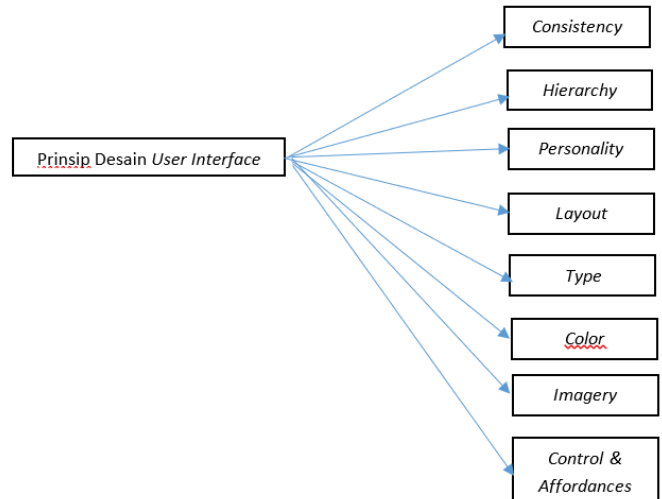


Figure 3.2 Mapping user interface design principles

- 2) Second, select K from the X data set as a random centroid.

k-means++ initialization:

$$\mu_1 \text{ (first centroid)} = \text{Random point from data}$$

For the next centroids:

$$\mu_k = \arg \min_{x_i \in X} \left(\min_{\mu_j} \|x_i - \mu_j\|^2 \right), \text{ for } k = 2, 3, \dots, K$$

- 3) Third, allocate all data to the nearest centroid that has been predetermined.

Cluster assignment:

$$C_k = \{x_i : \|x_i - \mu_k\| \leq \|x_i - \mu_j\| \text{ for all } j \neq k\}$$

where $\|x_i - \mu_k\|$ is the Euclidean distance from the data point to the centroid.

- 4) Fourth, recalculate the centroid based on data that follows the respective clusters that the iteration process has performed.

Centroid recalculation:

$$\mu_k = \frac{1}{|C_k|} \sum_{x_i \in C_k} x_i$$

where C_k is the set of points in cluster k .

- 5) Fifth, repeat steps 3 and 4 until the condition is reached, namely (a) there is no data that moves the cluster or (b) changes in the centroid position are below the threshold or (c) the centroid value has not changed

anymore.

It is important to know that, K is meant in the process of K-means above is the number of partitions, so this algorithm classifies each point in the X data in one of the K partitions that have been determined. The greater the K value has an impact on the number of clusters to group X data. The K value is also a parameter or criteria needed by the K-means algorithm, there is no absolute determination how to determine the optimal K value. Usually, the determination of the K value is based on previously known information about how many data clusters appear in the data X or how many groupings are based on the desired characteristics. Whereas centroid is the midpoint value or center point of a cluster, where the initial centroid value is determined randomly and then the selection is based on the latest cluster value according to the results of the iteration.

IV. DISCUSSION

A. Data Processing Result

From the results of data collection and data processing based on a distributed questionnaire, several important points were produced. The points include:

a. Experience in Using a Website Can Give a Good Impression.

Regarding experience in using a website can give a good impression in Figure 4.1 can be seen as many as 41% of respondents answered strongly agree with the good impression obtained after using the website sayurbox and regopantes, 42% of respondents answered agree with the experience, 15% of respondents answered less agree, and respondents answered disagree and strongly disagree as much as 2% each. Based on the total of the data, 83% of the majority respondents liked the ease of using the two websites, which was derived from the experience of the users themselves, while the remaining 17% lacked the experience.

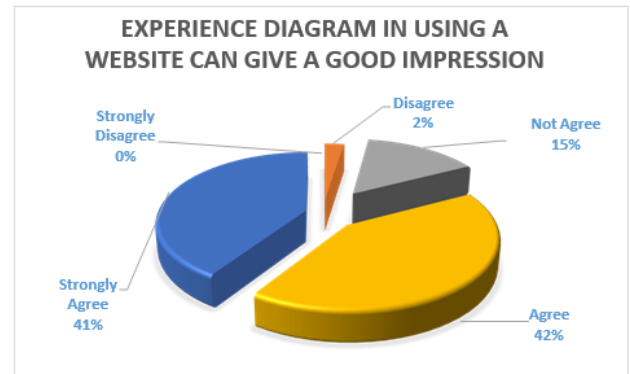


Figure 4.1 Experience Diagram in Using a Website Can Give a Good Impression

- b. The use of bright colors as an attraction of the application In Figure 4.2 regarding the use of bright colors as an attraction, a score of 12% of respondents answered strongly agrees, 32% of respondents answered agree, while 12% of respondents answered strongly disagreed, 14% of respondents answered disagreed, and 30% of respondents answered less agree shows that as much as 56% of all respondents did not see if the two e-marketplace websites apply bright colors as an attraction displayed by both websites.

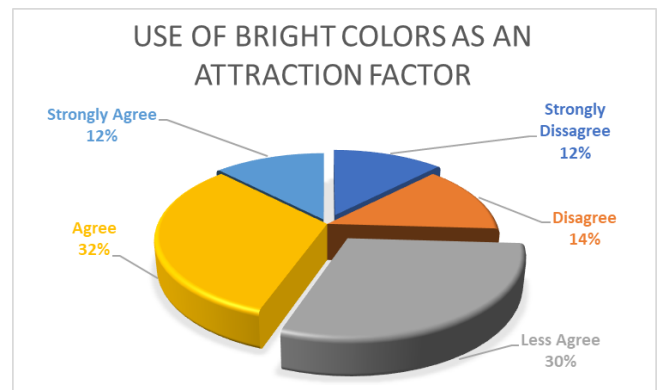


Figure 4.2 Use of Bright Colors As An Attraction Factor