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Customer Clustering Using the K-Means Clustering Algorithm in the Top 5 Online Marketplaces in Indonesia

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Abstract

Tokopedia, Shopee, Lazada, Bukalapak and Orami are 5 marketplaces in Indonesia that focus on shopping activities using applications. The number of customer visits is very volatile so it is difficult to determine customer interest in purchasing a product. The purpose of this study is to identify the characteristics, product categories and merchant in the top 5 online marketplaces in Indonesia using the K-Means Clustering algorithm. There are three variables, namely customer characteristics, product categories, and merchant. Data processing is assisted by the application of SPSS V.25. Loyal customers of marketplace are cluster 10. In addition, the marketplace also has loyal customers in cluster 5. Loyal customers of marketplace the Shopee cluster 8. Then, marketplace also has loyal customers in 6 clusters, including cluster 2, cluster 3, cluster 4, cluster 6, cluster 7, and cluster 9. Loyal customers of marketplace the Lazada cluster 6. However, in cluster 6, the marketplace still excels as marketplace that is often used in cluster 6. The loyal customers of marketplace the Bukalapak cluster 7 However, in cluster 7, marketplace still excels as marketplace that is often used in cluster 7. Orami marketplace loyal customers are cluster 1.

Keywords
marketplace; data mining; customer clasterization; clustering, K-Means.

I. Introduction

The COVID-19 pandemic that has occurred for two years in Indonesia has had a significant impact. One of these impacts is affecting social life, work, travel plans, religious activities and shopping habits. All kinds of activities in society that are usually carried out offline are forced to switch to online activities. This is done as a form of effort to control the spike in cases exposed to the COVID-19 virus. Therefore, the use of technology for all kinds of aspects of life during the COVID-19 pandemic has increased quite rapidly. Some forms of activities that are usually carried out offline and switched online by utilizing technology are work and school that can be done at home with the help of the internet, smartphones, and laptops. Not only that, daily activities such as shopping can also be done online through e-commerce, which can be accessed using either a smartphone or laptop. The outbreak of this virus has an impact of a nation and Globally (Ningrum et al, 2020). The presence of Covid-19 as a pandemic certainly has an economic, social and psychological impact on society (Saleh and Mujahiddin, 2020). Covid 19 pandemic caused all efforts not to be as maximal as expected (Sihombing and Nasib, 2020).

Today, there are many types of e-commerce that are developing in the world, but there are only a few types of e-commerce that are growing rapidly in Indonesia. One type of e-commerce that is growing rapidly in Indonesia is the marketplace. A marketplace is a

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space where sellers can sell their products through electronic media, with the advantage that sellers do not need to create a website or personal online store. The seller only needs to provide a photo of the product and then upload the photo accompanied by a clear and detailed description of the product and price. In this study, researchers chose the top 5 online marketplaces in Indonesia, namely Tokopedia, Shopee, Lazada, Bukalapak, and Orami, which were used as research objects. The five marketplaces are the five online marketplaces that are most in demand by customers (iPrice, 2022).

Source: iprice.co.id (Browse Online Store Competition in Indonesia)
***Figure 1**. Top 5 Online Marketplaces in Indonesia, Quarter 4, 2021*

From the picture above, it can be seen that, as of Q4 2021, there are five online marketplaces in Indonesia that get the most visits every month. Tokopedia has the most monthly web visitors with a total of 157,443,300 visits per month. Shopee comes in second place, with 138,776,700 monthly visitors. Meanwhile, Lazada is in third place with a total of 28,173,300 visits per month. Following in fourth place is Bukalapak, with a total of 25,760,000/month. And, in fifth place, was Orami, who succeeded in shifting Blibli's position with a total of 16,683,300 visits/month.

The fluctuating number of customer visits that fluctuate every month in these 5 online marketplaces makes it difficult for the marketplace to determine customer interests or preferences in purchasing a product. This can happen because there is no customer grouping with the same characteristics. What's interesting about the five marketplaces that are included in the top five online marketplaces is that new players have emerged that have shifted one old marketplace, which shows that customer segmentation is needed so that the marketplace doesn't lose potential customers. Below, the researcher presents online store competition data per quarter, which can be an illustration of the ups and downs in the number of visits and the position of the marketplace being replaced by other marketplaces.

Source: iprice.co.id (Browse Online Store Competition in Indonesia)
***Figure 2.** Top 5 Online Marketplaces in Indonesia*, Quarter 3, 2021

In the picture above, it can be seen that the top 5 Q3 online marketplaces in Indonesia are occupied by Tokopedia, Shopee, Bukalapak, Lazada, and Blibli. In the 3rd and 4th quarters, the first and second places in the top 5 online marketplaces in Indonesia were still owned by Tokopedia and Shopee. However, the third order underwent a change which was originally occupied by Bukalapak in the third quarter. In the fourth quarter, it was successfully occupied by Lazada, and Bukalapak's position dropped to fourth. Likewise, Blibli's position, which was originally in the 3rd quarter, was included in the Top 5 online marketplaces in Indonesia. In the 4th quarter, it had to hand over its position to Orami, who managed to enter the Top 5 online marketplaces in Indonesia. Therefore, there is a need for customer segmentation to be able to understand consumer behavior, which, of course, can help the marketplace be able to implement the right marketing strategies to increase business revenue. One solution that can be used to solve customer segmentation problems is to use data mining techniques.

Data Mining (DM) is a step in Database Knowledge Discovery (KDD), which is a way to analyze information and extract large and complex hidden data. The result of KDD is the output of information in the form of features or patterns. And, one method of data mining analysis is cluster analysis. Cluster analysis is also known as clustering. One of the most popular and widely studied clustering techniques to minimize point clustering errors in Euclidean space is called the K-means clustering method. Clustering is one of the techniques in data mining that is part of a sub-category of data mining. The process in data mining is where the same sample is divided into groups called clusters. Each cluster, including samples where the members are similar to each other and different from the available samples from other groups, includes samples (Priati & Fauzi, 2017).

The K-means method is included in the clustering partition type. K-means classifies specific data determined by a set of clusters (k-clusters). The K-means algorithm is one of the algorithms with partitional K-means is based on determining the initial number of groups by defining the initial centroid value (Madhulatha, 2012). The K-means algorithm will group data items in a data set into clusters based on the closest distance to the randomly selected initial centroid value, which is the starting center point (Bangoria *et al*, 2013). All this data will be used to calculate the distance using the Euclidean Distance formula. Data that is a short distance from the centroid will create a cluster and this process continues until there is no change in each group (Agrawal & Gupta, 2013).

Research from Yaumi et al regarding the clustering of consumer characters on product selection using the K-mean in 2020 shows that the K-mean method is a method that has more accurate distribution results. This research focuses on the type of product x that is widely used by consumers and customers. Another study conducted by Silvi (2018) This study employs gap statistics to determine the optimal number of ideal clusters, which divide provinces into seven clusters based on HIV/AIDS indicators. The results of this study conclude that for data that has outliers, the clustering method using the centroid linkage gives more appropriate results than the K-means method. The Sw/Sb ratio of the K-means method is 0.112232 and the Sw/Sb ratio of the centroid linkage method is 0.067307. The centroid linkage method produces a more homogeneous group so that the resulting ratio value is smaller. This means that the centroid linkage method has a better group accuracy quality than the K-means method. In addition, other research conducted by Rahmawati dkk (2016) with the title Clustering analysis using the K-means method and hierarchical clustering resulted in 16 clusters. The results of cluster analysis show that the expertise of the lecturers influences the variety of research themes carried out by students.

Based on the description above, the purpose of this study is to identify customer characteristics, product categories and merchant categories in the top 5 online marketplaces in Indonesia using the K-means Clustering algorithm.

II. Review of Literature

Data clustering is divided into two purposes, referring to Tan et al. (2006), namely clustering for understanding and clustering for use. If the goal is to understand, then the cluster that is formed must be able to capture the natural structure of the data. Usually, the clustering process with this goal is only an initial process and then followed by the summarization process (mean, standard deviation), class labeling in each group to be used as classification training data, and so on. Meanwhile, if the purpose is for use, then the main goal is to find the most representative cluster prototype for the data and provide an abstraction for each data object in the cluster where the data is in it.

Segmentation is the process of grouping the entire heterogeneous market into groups or segments that have similarities in terms of needs, desires, behavior, and/or responses to strategic marketing programs (Tjiptono et al., 2008). According to Kotler and Keller (2012), customer segmentation is a group of customers with the same needs and wants. Customer segmentation is the process of grouping customers with similar needs and characteristics. There are 4 types of customer segmentation, namely as follows:

2.1 Demographic Segmentation

Demographics are statistics that measure observable aspects of a population, such as height, age, and gender; ethnic group; income; education; occupation; and family structure. This demographic factor is the most common basis for classifying consumer groups.

2.2 Geographic Division

Kotler et al. (2009) stated that geographic segmentation divides the market into geographical units such as countries, states, regions, and neighborhoods. Companies can choose to do business in one or more geographic countries according to their needs and desires to carry out marketing activities. This is done by dividing the market into various geographical units such as regions, population, density, and climate.

2.3 Psychographic Grouping

Psychology uses demographic data to determine the behavior and preferences of certain population groups. Psychology studies lifestyle, such as where to go on vacation, where to shop, and how to spend the extra cash. Psychology is included in dynamic attribute segmentation, a way of looking at the market based on dynamic characteristics that reflect customer characteristics. This segmentation defines the market based on psychographics and behavior (Oentoro, 2012).

2.4 Behavioral Segmentation

Consumer market segmentation is a matter based on behavioral segmentation. This is done by grouping consumers into market segments based on behavioral variables or people's behaviors that influence and reflect knowledge. Attitudes, use, or reactions to certain products (Assauri, 2015). Another way to categorize markets by behavior is to look at usage opportunities, or when consumers use the product the most.

A marketplace is an internet-based online medium, which is a place to conduct business activities and transactions between buyers and sellers. Buyers can find as many

suppliers as possible with the desired criteria, so they get prices that are in accordance with the market. Meanwhile, suppliers and sellers can find out which companies need their products and services (Opiida, 2014). According to Rahmadi et al. (2015), the marketplace is an inter-organizational information system, where buyers and sellers in the market communicate information about prices and products and are able to complete transactions through electronic communication channels.

III. Research Method

The population in this study is the population of Indonesia, amounting to 272,682.5 thousand people based on statistical publications in 2022 (BPS, 2022). Based on the sample calculation above, the number of samples that can be used as respondents in the study is 399.9995, but is rounded up to 400 respondents. Then, for the sampling technique used in this study, the probability sampling method, which is a sampling technique that provides equal opportunities or opportunities for each element or member of the population to be selected as a sample. In this technique, there are several ways of selecting samples, namely: random random sampling, systematic sampling, proportionate stratified random sampling, disproportionate stratified random sampling, and cluster sampling (Sugiyono, 2013).

IV. Result and Discussion

4.1 Respondent's chosen marketplace

In the table below, the authors present the marketplaces that are most chosen/most often used by respondents in conducting online shopping transactions to meet various needs. The respondent's chosen marketplace is arranged from the most to the least.

Table 1. Respondent's Choice Marketplace

No.	***Marketplace***	**Amount**	***Persentase***
1.	Shopee	444	63%
2.	Tokopedia	188	26%
3.	Lazada	46	6%
4.	Bukalapak	21	3%
5.	Orami	11	2%
Amount		**710**	**100%**

Source: Primary Data Processing by the Author (2022)

Based on the table above, it can be seen that Shopee ranks first as the most frequently used marketplace by respondents, namely 444 people with a percentage of 63%. Tokopedia is in second place with 188 people or 26% and is followed by Lazada with 46 people or 6%. The fourth position is occupied by Bukalapak with 21 people or 3%. Finally Orami with 11 people or 2%.

4.2 Cluster Analysis with K-Means

This study uses 3 variables to segment the top 5 online marketplace customers in Indonesia using K-Means Clustering. The three variables are the Customer Characteristics variable (X1), Product Category (X2), and Merchant Category (X3). Before running the K-Means Cluster test, the research data was turned into a "dummy variable" to make the process of dividing customers into groups easier.

a. Cluster 1

Cluster 1 has 2% of the total population, and the customer is a woman named Lindya, aged 35-44 years, who works as a private employee/employee. Married status and domiciled in East Java The last education is Masters, with a monthly income of IDR 6,000,000-IDR 10,000,000. Choose to shop online at Orami by using a payment method, namely a credit card. Online shopping information is obtained from influencers with a frequency of online shopping in a year that is above 12 times with a total online shopping expenditure of IDR 6,000,000-IDR 10,000,000. The favorite merchants chosen were Mark and Spencer. Cluster 1 is named "Food Lovers." To make it easier to describe the research discussion, the author makes a picture of the results of the discussion, which can be seen in the following picture.

Source: Author's Results (2022)
Figure 3. *Food Enthusiasts*

b. Cluster 2

Cluster 2 has 9% of customers from the total population, and the customer is a woman named Setyowati Cahyani, aged 35-44 years old who works as a civil servant (PNS). Married status and domiciled in East Java The last education is S1 with a monthly income of IDR 3,000,000-IDR 6,000,000. Choose to shop online at Shopee by using bank transfer, ATM, or virtual account payment methods. Online shopping information is obtained from social media with the frequency of online shopping in a year, which is 7-9 times with a total online shopping expenditure of Rp 1,000,000–Rp 3,000,000. The favorite merchants chosen were MayOutfit, Zara, and Hush Puppies. Cluster 2 is named "An Extravagant and Colorful Citayam Fashion Week".

Source: Author's Results (2022)

Figure 4. *Cluster 10 An Extravagant and Colorful In Citayam Fashion Week*

c. Cluster 3

Cluster 3 has 12% of the total population, and the customer is a woman named Erna Gusti Lestari, aged 15–24 years, who works as a private employee or employee. Status: unmarried (single) and domiciled in DKI Jakarta. The last education is high school with a monthly income of IDR 3,000,000-IDR 6,000,000. Choose to shop online at Shopee by using bank transfer, ATM, or virtual account payment methods. Online shopping information is obtained from social media with the frequency of online shopping in a year being above 12 times with a total online shopping expenditure of IDR 1,000,000-IDR 3,000,000. The favorite merchants chosen were Skintific, Avoskin, and Maybelline. Cluster 3 is named "Beauty Living".

Source: Author's Results (2022)

Figure 5. *Cluster 3 Beauty Living*

d. Cluster 4

Cluster 4 has 13% of customers from the total population, and the customer is a woman named Nadya Kesuma, aged 25–34 years, who works as a private employee/employee. Married status and domicile in DKI Jakarta. The most recent

education is S1 with a monthly income of more than IDR 10,000,000. Choose to shop online at Shopee by using a payment method, namely a digital wallet (ShopeePay). Online shopping information is obtained from social media with the frequency of online shopping in a year being above 12 times with a total online shopping expenditure of IDR 6,000,000-IDR 10,000,000. The favorite merchants selected were Sweety, Mommy Pokok, Unilever, and Nestle. Cluster 4 is named "The Passionate Young Mom."

Source: Author's Results (2022)
***Figure 6**. Cluster 4 The Passionate Young Mom*

e. Cluster 5

Cluster 5 has 15% of the total population, and the customer is a male named Ega, aged 25–34 years, who works as a private employee/employee. Married status and domicile in DKI Jakarta. The last education is S1, with a monthly income of IDR 6,000,000-IDR 10,000,000. Choose to shop online at Tokopedia by using the payment method, namely bank transfer, ATM, or virtual account. Online shopping information is obtained from social media with the frequency of online shopping in a year, which is 7-9 times with a total online shopping expenditure of Rp 1,000,000–Rp 3,000,000. The favorite merchants chosen are H&M and Xiaomi. Cluster 5 is named "Manly Digital Savvy."

Source: Author's Results (2022)
Figure 7. Cluster 5 Manly Digital Savvy

f. Cluster 6

Cluster 6 has 9% of customers from the total population, and the customer is a woman named Atika Dinita, aged 25–34 years old who works as a housewife. Married status and domiciled in East Java The last education is S1 with a monthly income of IDR 1,000,000-IDR 3,000,000. Choose to shop online at Shopee by using the payment method, namely bank transfer, ATM, or virtual account. Online shopping information is obtained from social media with the frequency of online shopping in a year, which is 4-6 times with a total online shopping expenditure of Rp. 1,000,000–Rp 3,000,000. The favorite merchants chosen were Bebelove and Fluffy. Cluster 6 is named "Budget Saving Young Mom".

Source: Author's Results (2022)

Figure 8. Cluster 6 Budget Saving Young Mom

g. Cluster 7

Cluster 7 has 14% of customers from the total population, and a female customer named Febriana Tabaluyan is 15–24 years old and still a student. Status: unmarried (single) and domiciled in West Java. The last education is high school with a monthly income below IDR 1,000,000. Choose to shop online at Shopee by utilizing the payment method, namely pay on the spot or Cash On Delivery (COD). Online shopping information is obtained from social media with a frequency of online shopping in a year, namely 4-6 times with a total online shopping expenditure of under Rp. 1,000,000. The favorite merchants chosen are Jiniso, Npure, and Whitelab. Cluster 7 is named "Chick Urban Teneegars."

Source: Author's Results (2022)
Figure 9. Cluster 7 Chick Urban Teenagers

h. Cluster 8

Cluster 8 has 11% of the total population, and the customer is a woman named Ahmad Fauzan, aged 25–34, who works as a private employee/employee. Status: unmarried (single) and domiciled in Gorontalo. The last education is S1 with a monthly income of IDR 1,000,000-IDR 3,000,000. Choose to shop online at Shopee by utilizing the payment method, namely pay on the spot or Cash On Delivery (COD). Online shopping information is obtained from social media with the frequency of online shopping in a year, which is 4-6 times with a total online shopping expenditure of under Rp. 1,000,000. The selected favorite merchants are 3Second, SixtyOne, and Nivea. Cluster 8 is named "Millennial TikTok Boy."

Source: Author's Results (2022)
Figure 10. *Cluster 8 Millenial TikTok Boy*

i. Cluster 9

Cluster 9 has 9% of customers from the total population, and the customer is a male named Rilo Pambudi, aged 25-34 years old who works as an employee. Status: unmarried (single) and domiciled in DKI Jakarta. The last education is S1, with a monthly income of IDR 6,000,000-IDR 10,000,000. Choose to shop online at Shopee by using the payment method, namely bank transfer, ATM, or virtual account. Information on online shopping is obtained from social media with the frequency of online shopping in a year, which is above 12 times with a total online shopping expenditure of Rp 1,000,000–Rp 3,000,000. The favorite merchants chosen were Eiger and Casio. "The Counting Mountain and Adventure Man."

Source: Author's Results (2022)

Figure 11. *Cluster 9 Adventure Man and The Counting Mountain*

j. Cluster 10

Cluster 10 has 7% of the total population, and the customer is a male named Heri Herliana, aged 45–54 years, who works as a civil servant (PNS). Married status and domicile in DKI Jakarta. The last education is a Master's with a monthly income above IDR 10,000,000. Choose to shop online at Tokopedia by using the payment method, namely bank transfer, ATM, or virtual account. Online shopping information is obtained from social media with the frequency of online shopping in a year being above 12 times with a total online shopping expenditure of IDR 3,000,000-IDR 6,000,000. The favorite merchants chosen were Nike, Under Armour, and Adidas. Cluster 10 is named "Sugar Daddy."

Source: Author's Results (2022)

Figure 12. *Cluster 10 Sugar Daddy*

V. Conclusion

Based on the results of the discussion that has been analyzed, it can be said that the top 5 online marketplaces in Indonesia have the following results: the Tokopedia online marketplace meets the standards as a loyal customer of the Tokopedia marketplace, cluster

10. The product categories that are often purchased are toys & hobbies and fashion & lifestyle products. The favorite merchants chosen were Nike, Under Armour, and Adidas. In addition, Tokopedia's online marketplace also has loyal customers in cluster 5. Shopee's online marketplace meets the standards as a loyal customer of Shopee's online marketplace. Cluster 8 is the product category that is often purchased, namely fashion and lifestyle products. The favorite merchants chosen are 3 Second, Sixty-One, and Nevia Men. In addition, Shopee's online marketplace also has loyal customers in 6 other clusters, namely cluster 2, cluster 3, cluster 4, cluster 6, cluster 7, and cluster 9. On Lazada's online marketplace, based on the results of the analysis and discussion, conclusions can be drawn. The cluster that meets the standards as a loyal customer of Lazada's online marketplace is cluster 6. However, in cluster 6, Shopee's online marketplace is still superior as an online marketplace that is often used in cluster 6. Based on the results of analysis and discussion, it can be concluded that cluster 7. Those who meet the standards as loyal customers of Bukalapak's online marketplace are cluster 7. However, in cluster 7, Shopee's online marketplace still excels as an online marketplace that is often used in cluster 7. In Orami's online marketplace, the product category that is often purchased is food and beverage products. The chosen favorite merchant is Mark & Spencer Cookies.

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