

Determining Promotion Media based on Customer Characteristic using Clustering Analysis and Marketing Mix Strategy

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Abstract

Along with social distancing rules during the pandemic, online shopping activities in Indonesia are increasing. With the increase in online business players, of course, the competition is also getting tougher. Creating an effective marketing strategy is something that must be done to survive in the competition. Promotional media is one of important aspects in marketing strategy that needs to be optimized. Customer characteristics need to be considered in creating attractive promotional media. Attractive promotional media are expected to increase sales and increase customer loyalty and satisfaction. This study tried to implement clustering analysis using K-means algorithm to determine customer characteristics and designing suitable marketing strategies based on customer characteristics using the marketing mix method. Before implementing K-means algorithm, Davies Bouldin Index (DBI) method was used to determine the optimum number of clusters. 236 customer data were clustered by considering 8 indicators. There results indicated 5 clusters with specific customer characteristics. Then, those results would be further analyzed to determine suitable promotion media based on the marketing mix method. The result of the study are expected can help business to achieve customer satisfaction.

Keywords

Customer Characteristics, Clustering, K-means, Davies Bouldin Index, Marketing Mix Analysis.

1. Introduction

The Indonesian economy and even the world experienced a crisis that occurred after the pandemic began at the end of 2020. This crisis had an impact on the demand and supply side which of course had a negative impact on economic growth (Modjo, 2020). Other factors that aggravate the economic growth due to the pandemic are a decrease in economic activity which results in a lack of public consumption, a decrease in the use of transportation services which results in price increases, disruption of supply chains, and many more (Damuri and Hirawan, 2020).

The role of the economy is very influential on a country. The economy will help people to meet their daily needs (Yamali and Putri, 2020). Consumptive behavior of society will increase the need and give rise to various products. (Gunawijaya, 2017). However, the pattern of increasing people's needs has decreased when the initial period of the pandemic appears at the end of 2020. One alternative that can improve the Indonesian economy during the pandemic as solution of physical distancing policy is online business. Online business continues to grow along with the development of technology and trends in social media users (Saefuloh, 2020). Online business trends are predicted to continue increase as shown by Figure 1.

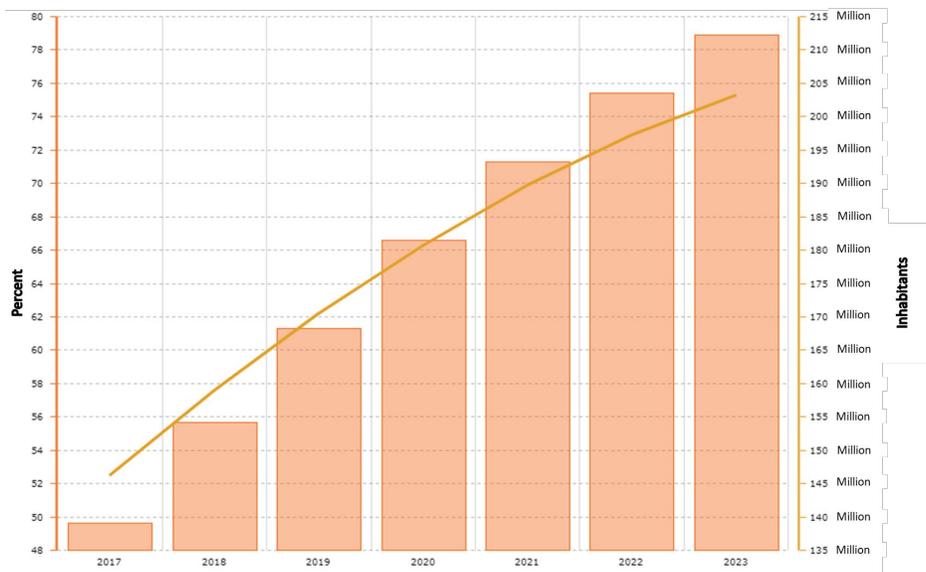


Figure 1: Trends in the use of E-Commerce in Indonesia
 (Source: Statista 2019)

Most online businesses are conducted through e-commerce. E-Commerce is an implementation of the business online concept which has experienced a drastic increase during a pandemic and has become the main need of the community (Sudaryono et al., 2020). This fact can be strengthened based on data from Bank DBS Indonesia that showed the purchase of non-food products has increased from 24% to 66% through e-commerce. With the increase in online business players, of course, the competition is also getting tougher. Business people need to make effective business marketing strategies to be able to compete and survive. Marketing strategy must be made by considering the need of the customer. Business people can optimize the use of social media to understand customer characteristics in order to obtain and evaluate the product to be sold (Sari et al., 2020). Having a good understanding of customer characteristics will provide an overview about what kind of products that meet customer desires to achieve customer satisfaction (Hikmawati et al., 2016). One of the essential aspects in designing a marketing strategy is promotion media. Promotion media needs to be optimized to attract customer buying. Customer characteristics need to be considered in creating effective promotion media. Attractive promotional media are expected to increase sales and increase customer loyalty and satisfaction.

This research tried to determining promotion media based on customer characteristics. customer characteristics can be understood by dividing data into several groups based on the similarity of their characteristics to find out what actions can be given to provide satisfaction (Hidayat and Putro, 2020). These characteristics will certainly help to find out customer behavior (Hilman and Miangi, 2020). One technique that can be used to divide customer groups is clustering analysis. Clustering analysis can be determined as a technique to help group several objects based on their similarity (Talakua et al., 2017). There are several popular clustering algorithms including K-means, Fuzzy C-means, Hierarchical clustering, mixture of Gaussians and several others (Wakhidah, 2010). this research will apply the K-means algorithm.

According to Ediyanto and Satyahadewi (2013) the K-means algorithm is often used in the clustering process because it can provide results with high accuracy. Therefore, the use of K-means is expected to produce an optimal clustering process. Before doing clustering, the DBI method will be carried out to determine the best number of clusters that must be implemented during the clustering process (Badruttamam et al., 2020). After determining the number of clusters using DBI, it will proceed to the clustering process. The process clustering will produce several groups with their respective characteristics. The characteristics of customers from each group will be used as a reference to help business people develop the right marketing strategy (Sulistyowati et al., 2018) So that based on the results of the characteristics of the group will be developed to find out the appropriate marketing strategy using the help of marketing mix and referring to 4 factors, namely 4P (Product, Price, Place, Promotion) (Wulandari, 2012).

Based on description above, the purpose of this study is to determine the characteristics of customers by dividing them into several groups according to their similar behavior. The results of the customer characteristics of several groups that have been formed are expected to provide an overview for online businesses, especially e-

commerce, to determine customer behavior in developing marketing strategies. The proposed marketing strategy hopefully can be utilized used to achieve customer satisfaction and loyalty , that will be used as a weapon to compete with competitors.

2. Literature Review

2.1 Customer Characteristic

Characteristics are an indicator to find out how customer behavior makes decisions (Elvivasari, 2019). The decision to buy a product will consider several things to choose several available alternatives (Hikmawati et al, 2016). When customers consider several things, of course, customer characteristics will be formed (Safitri, 2019).

2.2 Media Promotion

Every person will certainly introduce a product to be sold in various ways. The term for introducing a product to provide information about the product to making an invitation to buy is an activity of promotion (Puspitarini and Nuraeni, 2019). During promotion, of course, business actors must know the right promotional media to be able to make sales well (Barokah et al, 2021).

2.3 K-Means Clustering

Research conducted by Auliasari and Kertaningtyas (2019) uses the clustering method to classify and help target profitable customers. Several algorithms can be used to assist the clustering process, but K-means is one of the most popular and frequently used algorithms (Wakhidah, 2010). The algorithm used to assist the clustering process in this study is K-Means. The K-Means method in clusters will perform grouping by first determining the data center or called the centroid for each cluster group, then the data that has the closest distance will join each centroid (Dhuhita, 2015). Clustering using K-means has been widely applied, one of which is research conducted by Auliasari and Kertaningtyas (2019) using K-means to help segment customers. In addition, Yaumi et al. (2020) also use the K-means algorithm to cluster customer characters against trends in product selection.

2.4 Davies Bouldin Index (DBI)

One technique that can be used to determine the number of clusters is with the help of the DBI (Davies Bouldin Index) (Kusumah et al., 2017). DBI is an evaluation method that will assist in grouping by looking at the closeness of the data to the centroid cluster (Alith, 2015). The use of DBI will help determine the optimal number of clusters so that it will produce maximum results, as did Irhamni et al. (2014) to help optimize the sub-district grouping by looking at the educational factor using the clustering method and Davies Bouldin Index. If the DBI value is smaller, it will give better results for the clustering process (Adhitama et al., 2020). Application of the use of DBI has been carried out for several studies, one of which has been conducted by Widiarina and Wahono (2015) by comparing the value of DBI with Purity in mapping potential customers. While, Jollyta et al. (2019) compared the DBI value with the Sum of Square Error for stunting cases.

2.5 Marketing Mix

Marketing is included in the concept of a marketing strategy which is one of the factors in being able to excel with business competitors. A good marketing strategy will help influence the level of product demand. So that business people must be able to implement a good strategy for their business (Wibowo et al., 2015). The marketing mix is a marketing strategy that refers to 4 factors,

a. Product

Product is an object or something that is offered to meet needs or desires that can provide satisfaction when it can be fulfilled (Kotler and Keller, 2015).

b. Price

Price relating to the value of a product or service that is stated in the form of money (Hariyadi, 2016).

c. Place

Place is about how the flow and how a product is distributed to reach customers. So that this factor will discuss the distribution channels of these products (Kotler and Keller, 2015).

d. Promotion

Promotion is a tool to communicate with customers about the products offered. This communication is in the form of providing information and value from products that can influence customers to make purchases (Sutedjo, 2018).

Several studies have used the 4P marketing mix technique, one of which was carried out by Mas'Ari et al. (2020) to help formulate a strategy in the case study of PT. Riau's direction. Sunarti and Chandra (2019) also used a marketing mix to help determine customer purchasing decisions for a brand smartphone in Pekanbaru.

3. Methods

This study collected data using questionnaires. There are 8 indicators that are considered to obtain the clustering process. The indicators are used to determine the characteristics of customer groups and the appropriate marketing strategy. The 8 indicators were: age, income, social media used, duration of social media used, product frequently purchased, payment method, product Information source, purchase motivation, and information related with have ever never online shopping.

Ahmadi (2017) stated age can influence customers to buy or cancel product purchases and Edy et al. (2020) stated that income also affects decisions in purchasing a product. Then for the third and fourth indicators relate to the use of social media. Novita et al. (2020) stated that there is a positive relationship between the role of social media on purchasing decisions. In addition to the four indicators already mentioned, Supriyono et al. (2014) said that to generate profits, business people must pay attention to what product indicators are most often purchased by customers). In another study, Karismariyanti (2014) stated that customer purchasing decisions is also influenced by the type of payment method. The other indicators that can be used to know the characteristics of customers are product purchase motivation from rational and emotional factors according to Sigit (2002) in Wahyuni (2008), product information sources (Wahyuni, 2008), and the type of promotional media (Rangkuti, 2013). 236 customer data will be analyzed in this study by performing 2 steps. The first step is clustering analysis. Clustering is an application of data mining to group based on similar characteristics. The similarity of these characteristics causes the group to be homogeneous (Pramadhani and Setiadi, 2014). The results of the clustering analysis will be used in the second step to determine the marketing mix strategy in accordance with the characteristics of the customer group. Figure 2 illustrate the flow chart of this research.

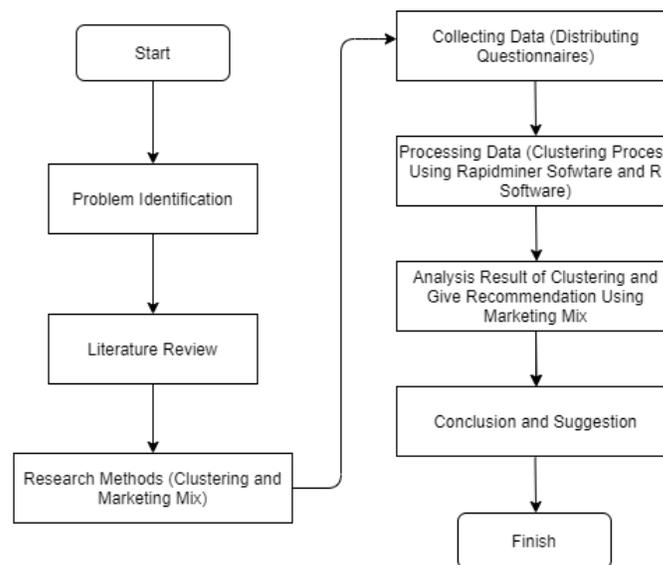


Figure 2: Flowchart of the research

4. Results and Discussion

Table 1 presents the collected raw data. There are 236 data with 8 indicators including information whether customer has ever or never shopped online.

Table 1: Raw data

No	Respondents	Age	Income	Social Media used for Shopping	Duration of use Social Media/day	Products frequently purchased	Method of Payment	Find out Product Information	Purchase Motivation	Ever Shopping Online?
1	Acad	15 - 25 year s old	1 - 3 Million	E-Commerce	1 - 2 hours	Fashion	Bank Transfer	Social Media	Emotional	Yes
2	Cantik	-	-	-	-	-	-	-	-	No
3	Jihan Afifah	15 - 25 year s old	1 - 3 Million	E-Commerce	1 - 2 hours	Fashion	Bank Transfer	Social Media	Rational	Yes
4	Enca	26 - 35 year s old	> 6 Million	E-Commerce	< 1 hours	Fashion	E-Money	Social Media	Rational	Yes
5	Wawan	26 - 25 year s old	> 6 Million	E-Commerce	1 - 2 hours	Appliances Electronic	Bank Transfer	E-Commerce	Rational	Yes
...
23 6	Agus	36 - 45 year s old	< 1 Million	E-Commerce	< 1 hours	Accessorie s	E-Money	Chat Application	Rational	Yes

5.1 Pre-processing Data Clustering

Pre-processing data was carried out before conducting the main stages of data mining. In this step, data was cleaned, so that the data obtained is data that is ready to be processed. The cleaning procedure is beneficial in removing data duplication, verifying data that falls into the inconsistent category, and correcting data that includes errors. For do the pre-processing data in the first step, software R is used. Table 2 present the data obtained after pre-processing step. There are 223 that will be used for further analysis.

Table 2: data obtained frompre-processing step

No	Respondents	Age	Income	Social Media used for Shopping	Duration of use Social Media/day	Products frequently purchased	Method of Payment	Find out Product Information	Purchase Motivation	Ever Shopping Online?
1	Acad	15 - 25 year s old	1 - 3 Million	E-Commerce	1 - 2 hours	Fashion	Bank Transfer	Social Media	Emotional	Yes
2	Jihan Afifah	15 - 25 year s old	1 - 3 Million	E-Commerce	1 - 2 hours	Fashion	Bank Transfer	Social Media	Rational	Yes
3	Enca	26 - 35 year s old	> 6 Million	E-Commerce	< 1 hours	Fashion	E-Money	Social Media	Rational	Yes
4	Wawan	26 - 25 year s old	> 6 Million	E-Commerce	1 - 2 hours	Appliance s Electronic	Bank Transfer	E-Commerce	Rational	Yes
5	FA	27 - 25 year s old	> 6 Million	E-Commerce	2 - 2 hours	Accessorie s	Credit Card	E-Commerce	Rational	Yes

...
223	Agus	36 - 45 years old	< 1 Million	E-Commerce	< 1 hours	Accessories	E-Money	Chat Application	Rational	Yes

5.2 Transforming Variable

A data transformation was performed after the data cleaning step. Data transformation is done so that data may be processed easily throughout the data mining process. Software to help the process of transforming variables is Microsoft Excel. Table 3 below divides converting variables into many categories:

Table 3: Formation of variable categories

Age	15 - 25 years old	1	Products frequently purchased	Food and Beverage	1
	26 - 35 years old	2		Fashion	2
	36 - 45 years old	3		Household	3
	> 45 years old	4		Appliances Electronic	4
Income	< 1 million	1		Accessories	5
	1 - 3 million	2		Devices Daily Equipment	6
	3 - 6 million	3	Method of Payment	Cash	1
	> 6 million	4		E-money	2
Social Media used for Shopping	Chat Application	1		Credit Card	3
	E-Commerce	2	Bank Transfer	4	
	Instagram, Facebook	3	Find out Product Information	Friends/Neighbors	1
	Website	4		Social Media	2
Duration of use social media/ day	< 1 hours	1		Chat Application	3
	1 - 2 hours	2		E-Commerce	4
	3 - 5 hours	3	Print Media (Billboard, brochure, etc.)	5	
	> 5 hours	4	Purchase Motivation	Rational	1
		Emotional		2	

5.3 Discretization of Data

The 223 data were acquired after the data was cleansed, and the respondent's name was changed from respondent 1 to respondent 223. After that, the data is discretized using the transformation rules. Discretization is used to transform the cleaned data into something that can be used in the data mining process. The result of data discretization is as shown in Table 4:

Table 4: Result of data discretization

No	Respondents	Age	Income	Social Media used for Shopping	Duration of use Social Media/day	Products frequently purchased	Method of Payment	Find out Product Information	Purchase Motivation
1	Respondents 1	1	2	2	2	2	4	2	2

2	Respondents 2	1	2	2	2	2	4	2	1
3	Respondents 3	2	4	2	1	2	2	2	1
4	Respondents 4	2	4	2	2	4	4	4	1
5	Respondents 5	2	4	2	2	5	3	4	1
...
22 3	Respondents 223	3	4	2	1	5	2	3	1

5.4 Determination of the Number Clusters

The number of clusters was determined by carrying out many clustering studies and comparing the Davies-Bouldin Index values (DBI). DBI was implemented using Rapid Miner Software and the result is presented in Table 5. It can be seen that cluster number 5 has the smallest DBI value. Then, this result will be used in the clustering analysis.

Table 5: DBI value

Total Cluster	DBI Value
3	2,700
4	2,451
5	2,210
6	2,244

5.4 Clustering Analysis

The main process for clustering uses software R to help find the result of clustering. Table 6 below show the number of members for each cluster:

Table 6: Number of cluster member

Clusters	Number of members
1	27
2	67
3	42
4	48
5	39

From processing 223 data using R software, each cluster has a different number of members. Cluster 1 consists of 27 members, cluster 2 has 67 members, cluster 3 has 42 members, cluster 4 has 48 members, and cluster 5 has 39 members. More details on the members for each cluster can be found in the Figure 3 below:

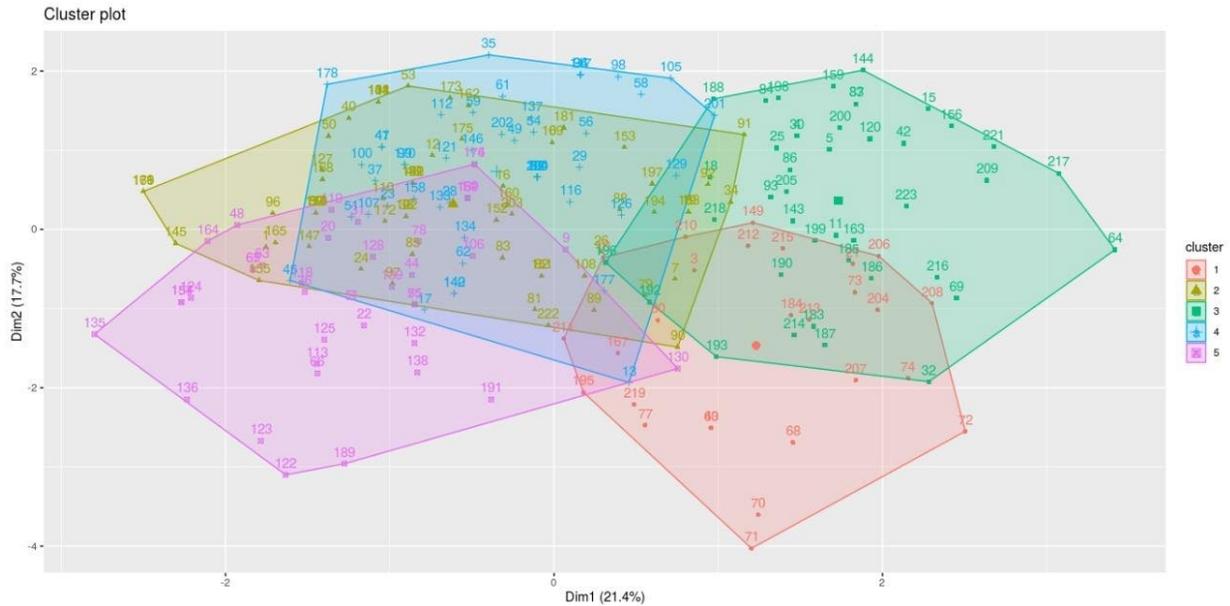


Figure 3: Cluster plot

These members become one cluster according to the Squared Euclidean Distance. From Figure 3, it can be seen more clearly visual information about the grouping of respondents into 5 clusters according to their similarities. From the results of the cluster visualization, it can be seen that there is overlap between one cluster and another or called overlapping. Overlapping can occur because there are members who can be part of more than 1 cluster (Abdurrahman, 2019). This indicates that the members who are part of the overlapping have characteristics that are adjusted for more than 1 cluster. Table 7 shows the mean results of several variables for each cluster. These results were obtained from data processing using R software, where the data on each variable was categorized before data processing.

Table 7. The mean results of the variables of each cluster

Cluster	Age	Incom e	Social Media used for Shopping	Duration of use Social Media/day	Products frequently purchased	Method of Payment	Find out Product Information	Purchase Motivation
Cluster 1	3.333	3.333	1.630	1.740	2.074	1.703	2.222	1.148
Cluster 2	1.418	2.373	2.104	1.850	1.866	3.955	2.627	1.269
Cluster 3	2.929	3.524	2.000	1.786	4.904	3.071	3.000	1.048
Cluster 4	1.083	1.646	1.833	1.646	5.146	2.875	2.688	1.063
Cluster 5	1.154	1.590	1.923	2.102	1.513	1.590	2.462	1.282

Cluster 1, the members of the age range 36 - 45 years have a duration of opening online shopping media for 1-2 hours/day, getting information about fashion products through social media. With the motivation to buy products on a rational basis, the income range is IDR 3,000,001 - IDR 6,000,000, and chooses e-commerce as a shopping medium and e-money payment method.

Cluster 2, the members of the age range 15-25 years have a duration of opening online shopping media for 1-2 hours/day, getting information about fashion products through the chat application. With the motivation to buy products on a rational basis, the income range is IDR 1,000,000 - IDR 3,000,000, and chooses e-commerce as a shopping medium as well as a bank transfer payment method.

Cluster 3, the members of the age range 36 - 45 years have a duration of opening online shopping media for 1-2 hours/day, getting information about products about accessories through the chat application. With the motivation to buy products on a rational basis, a larger income range of IDR 6,000,000, and choosing e-commerce as a shopping medium and credit payment method.

Cluster 4, with members aged 15-25 years, has a duration of opening online shopping media for 1-2 hours/day, getting information about products about accessories through the chat application. With the motivation to buy products on a rational basis, the income range is IDR 1,000,000 - IDR 3,000,000, and chooses e-commerce as a shopping medium and credit payment method.

Cluster 5, with members aged 15-25 years, has a duration of opening online shopping media for 1-2 hours/day, getting information about fashion products through social media. With the motivation to buy products on a rational basis, the income range is IDR 1,000,000 - IDR 3,000,000, and chooses e-commerce as a shopping medium and e-money payment method.

5.5 Marketing Mix

From the results of data processing that has been obtained, then an analysis is carried out using the marketing mix method. This marketing mix is generally used by companies to influence customer responses from certain segments (Mas'ari et al., 2020). The following is a marketing effort that will be carried out using the marketing mix method:

1. Product

Based on the result, products that can be marketed in the first cluster are fashion products such as shirts, skirts, dresses, jackets and so on with models that are suitable for ages 36 to 45 years. Furthermore, just like the first cluster, second cluster and fifth cluster, it is also suitable to be given a fashion product that is suitable for the age range of 15 to 25 years. Meanwhile, in the third cluster, products are suitable to be marketed in the form of accessories such as bags, glasses, wall hangings and so on which are suitable for the age of 36 to 45 years old. Fourth cluster can also offer accessories products that are suitable for the age range of 15 to 25 years old.

2. Price

The product prices that can be offered in the first cluster are prices that match the income range of IDR 3,000,001 to IDR 6,000,000. In the second, fourth, and fifth cluster products are offered according to the income of the customer, which is in the range of IDR 1,000,000 to IDR 3,000,000. Meanwhile, in the third cluster, customers have the highest income among others. So, the third cluster can be offered a price that matches the income range above IDR 6,000,000.

3. Place

According to data processing, it was found that the purchase of products by all cluster members through e-commerce. This can be seen from the duration of opening online shopping media for 1 to 2 hours/day. In the first and fifth cluster, products can be offered through social media, such as Instagram and Facebook, with the e-money payment method. In the second cluster, products can be offered through chat applications such as WhatsApp and Line, with the bank transfer payment method. Meanwhile, in the third and fourth cluster, products also can be offered through a chat application, but with a credit payment method.

4. Promotion

To increase sales, promotions can be given to the first and fifth cluster by providing discounts, free shipping and cashback for every payment via e-money such as Link, Ovo and Gopay. In the second cluster the promotion can be done through chat applications such as WhatsApp by providing several offers for products such as free shipping, discounts with minimum purchases as well as giving a discount every time you make a payment via bank transfer. Meanwhile, in the third and fourth cluster, sales can be made through e-commerce by providing several offers such as discounts, free shipping and a discount when making credit payments and also can be done through chat applications during access hours or around 12.00 and 20.00. This promotion can be used to influence the psychology of customers who previously bought a product when it was needed rationally to become irrational or just a desire.

6. Conclusion

Based on the clustering of the data, it is inferred that customers between the ages of 15 to 25 are more likely to be offered product offers in the form of fashion products such as shirts, skirts, dresses, and jackets with contemporary models tailored to today's young people's interests. The price of the marketed product can then be changed to fit the budgets of students, and sales can be made via e-commerce. Efforts to enhance sales can be made through chat programs like WhatsApp by offering a variety of product offers such as free delivery, discounts with minimal purchases, and a discount every time you make a bank transfer payment. The second group, consisting of dominating

customers aged 36 to 45 years, can be supplied accessories such as wall hangings, purses, glasses, cell phone covers, and other items based on their monthly budget, which can range over IDR 3,000,000. Offers can be made through chat applications and can lead to e-commerce purchases as well as credit card payments. Giving discounts in the form of a minimum purchase and free shipping can help boost sales. Cluster members of this productive age can be offered during breaks such as 12.00 or 20.00.

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