

## CLUSTERING ANALYSIS OF SALES OF NARUNA CUPS ON SHOPEE USING THE K-MEANS METHOD (CASE STUDY ON PT. NARUNA KERAMIK STUDIO)

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### Abstrak

Naruna Keramik Studio merupakan perusahaan di Salatiga, Jawa Tengah yang memproduksi dan menjual berbagai jenis produk berbahan dasar tanah liat. Produk yang dihasilkan antara lain piring, gelas, teko, mangkok, talenan, sendok berbagai warna dan produk peralatan makan keramik lainnya. Penjualan produk Naruna juga dilakukan di platform e-commerce, salah satunya adalah Shopee. Banyaknya jenis produk yang dihasilkan menyebabkan penimbunan beberapa produk karena ada beberapa produk yang kurang diminati pelanggan dan dampak dari COVID-19 juga. Oleh karena itu, perusahaan perlu mengelompokkan setiap produk untuk menentukan produk mana yang paling diminati dan produk mana yang kurang diminati. Pengelompokan ini akan dilakukan dengan metode analisis cluster menggunakan K-Means Clustering. Analisis cluster dilakukan dengan mengumpulkan data-data yang diperlukan terlebih dahulu, menentukan jumlah cluster, dan melakukan clustering menggunakan metode K-Means. Dapat diperoleh bahwa cluster 1 berisi 13 produk, cluster 2 berisi 2 produk, dan cluster 3 berisi 5 produk. Tingkat perbedaan variabel cluster yang terbentuk dari proses clustering produk cup Naruna relatif tinggi.

**Kata Kunci:** Naruna Keramik Studio, Peralatan Makan, Data Mining, Clustering, Algoritma K-Means.

### Abstract

Naruna Keramik Studio is a company in Salatiga, Central Java that produces and sells various types of products made from clay. The products produced include plates, cups, teapots, bowls, cutting boards, spoons in various colors and other ceramic tableware products. Sales of Naruna products are also available on e-commerce platforms, one of which is Shopee. The large number of types of products produced causes stockpiling of several products because there are several products that are less desired by customers and the impact of COVID-19 as well. Therefore, companies need to group each product to determine which products are most desired and which products are undesirable. This grouping will be carried out using the cluster analysis method using K-Means Clustering. Cluster analysis is carried out by collecting the necessary data first, determining the number of clusters, and clustering using the K-Means method. It was found that cluster 1 contained 13 products, cluster 2 contained 2 products, and cluster 3 contained 5 products. The level of variable differences in the clusters formed from the Naruna cup product clustering process is relatively high.

**Keywords:** Naruna Keramik Studio, Tableware, Data Mining; Clustering; K-Means Algorithm.

## INTRODUCTION

Naruna Ceramic Studio is a company in Salatiga, Central Java that produces and sells various types of products made from clay. The products produced include plates, cups, teapots, bowls, cutting boards, spoons in various colors and other ceramic tableware products. Naruna Ceramic Studio is a part of PT Gyan Creative Indonesia which acts as a producer of ceramic products (Indah, 2022). Sales of Naruna products are also available on e-commerce platforms, one of which is Shopee. The large number of types of products produced causes stockpiling of several products because there are several products that are less desired by customers and the impact of

COVID-19 as well (Ovezmyradov, 2022). Therefore, companies need to group each product to determine which products are most desired and which products are undesirable. This grouping will be carried out using the cluster analysis method using K-Means Clustering.

Cluster analysis is a method used to group several objects into groups based on their characteristics (Hair et al., 2006). The definition of a cluster is a group of objects that are similar and grouped together. There are several types of cluster analysis methods, one of which is a non-hierarchical method or usually called K-Means Clustering. The K-Means method is used as an alternative to the cluster method for large types of data (Cai et al.,

2013). In forming a K-Means Cluster, there are several steps that must be taken, namely determining the number of clusters to be formed, generating the initial cluster centroid, calculating the distance of each object to the initial cluster centroid, inserting objects into the cluster with the closest distance, determining the centroid of new cluster, and carry out steps three to five until there is no longer any transfer of objects between clusters (Ramdhani et al., 2015).

In carrying out research, the first step taken is to determine the desired number of clusters. In this research, Naruna products are divided into three clusters, where the three clusters represent the most popular, moderately popular and least popular products. By using the help of the SPSS application, products will be obtained that are included in cluster 1, cluster 2, or cluster 3. From these results, it will be easier for the Naruna Ceramic Studio company to plan product stock and prevent product hoarding.

## LITERATUR REVIEW

Data mining is the process of observing data to find new, unknown information in big data. The data produced is increasingly different in almost all sectors, such as data in the government sector, education sector, financial sector and other sectors. This various data is then developed to share real understanding. Data mining is divided into two categories: descriptive mining and predictive mining. Descriptive mining is a method used to find characteristics of data in a database. Data mining techniques included in descriptive mining are clustering, association, and sequential mining. Meanwhile, predictive mining is a method for obtaining patterns from data using several other variables in the future. One of the techniques contained in predictive mining is classification. (Amin et al., 2022).

According to (Metisen & Sari, 2015) and (Kuo et al., 2005), clustering is a method used to divide a number of data into several groups based on predetermined similarities. Clusters contain a group of data that have similarities to each other in the same cluster and differences to data in different clusters. Clustering can help to find relationships in data.

According to (Harahap, 2019), K-Means Cluster is a non-hierarchical method that groups several data into groups where one group has the

same characteristics. Data formed in one group has similar characteristics and greater differences with other groups. Therefore, different data will be put into different groups. This method aims to look for patterns and group data where each data must be included in a certain cluster (Novianti et al., 2017). The goal of K-Means is to minimize the distance between data and centroids (Likas et al., 2003).

Based on the opinion of (Younus et al., 2015), the following are the steps for forming clusters in the K-Means Cluster method:

1. Determine the number k as the cluster you want to form.
2. Determine a number of k data as initial centroids randomly.
3. Calculate the distance of each data to each centroid using Euclidean Distance with the following calculations (Fithri & Wardhana, 2021):

$$d(x, y) = \sqrt{\sum_{i=1}^n (x_i - y_i)^2}$$

d : Euclidean distance

$x_i$  : Data point

$y_i$  : Centroid in the  $i^{\text{th}}$  cluster

n : Amount of data

4. Group each data based on its proximity to the centroid.
5. Determine the new centroid by calculating the average of the data in the cluster.
6. Repeat steps 3 to 5 so that no cluster data changes.

## METHOD

The data used is accumulated sales data for 20 types of cups Naruna Ceramic on Shopee. The data period starts from the start of sales until November 22<sup>nd</sup>, 2023. In determining the characteristics of each cluster, this research used two variables, namely the stock quantity and the sold quantity.

The steps used in the research include:

1. Collect the data needed for the clustering process.
2. Determine the desired number of k clusters.
3. Determine the initial number of k centroids.
4. The distance of each data to each centroid is calculated using Euclidean distance.
5. Each data is grouped based on its proximity to the centroid.

6. Determine the new centroid and calculate the distance and grouping until there is no data movement within the cluster.
7. Determine the characteristics of each cluster.
8. Analyzing the level of differences in variables in the clusters formed.

## RESULTS AND DISCUSSION

It is known that the sales data for 20 cups of Naruna products is shown as follows.

**Table 1.** Sales Data for 20 Naruna Cup Products

Name of Product	Stock Quantity	Sold Quantity
Naruna Cangkir Keramik Uvo	142	111
Naruna Cangkir Keramik Unhandle	1067	848
Naruna Cangkir Keramik Latte	803	777
Naruna Cangkir Keramik Dipta Series	64	46
Naruna Cangkir Keramik MB Series	433	407
Naruna Cangkir Keramik Handle Ring	288	259
Naruna Cangkir Keramik Sea Sand Series	295	238
Naruna Cangkir Ekspresso	237	80
Naruna Cangkir Keramik Flute	194	179
Naruna Cangkir Keramik Auora Series	194	123

Naruna Cangkir Keramik Snowwhite Series	68	52
Naruna Cangkir Keramik Handle 300 ml	34	30
Naruna Cangkir Keramik Bilur Series	137	52
Naruna Cangkir Keramik Uvo dengan Handle	180	122
Naruna Cangkir Spot Vertikal Horisontal Series	444	225
Naruna Cangkir Batik Series	127	48
Naruna Cangkir Keramik Janur	66	36
Naruna Cangkir Keramik Ragam Series Pasir	557	54
Naruna Cangkir Kayu Jati	102	65
Naruna Cangkir Keramik Octagon Series	178	38

First of all, a standardization process is carried out first because the data has unit variability or differences in scale ranges. Standardization is a technique for making scale changes where the data held is changed so that it has an average of zero and a standard deviation of one. The standardization results are as follows.

**Table 2.** SPSS Standardization Results

Name of Product	Stock Quantity	Sold Quantity
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Naruna Cangkir Keramik Uvo	-0,51964	-0,33456
Naruna Cangkir Keramik Unhandle	2,95085	2,80650
Naruna Cangkir Keramik Latte	1,96036	2,50390
Naruna Cangkir Keramik Dipta Series	-0,81228	-0,61159
Naruna Cangkir Keramik MB Series	0,57216	0,92697
Naruna Cangkir Keramik Handle Ring	0,02814	0,29621
Naruna Cangkir Keramik Sea Sand Series	0,05440	0,20670
Naruna Cangkir Ekspresso	-0,16321	-0,46668
Naruna Cangkir Keramik Flute	-0,32454	-0,04475
Naruna Cangkir Keramik Auora Series	-0,32454	-0,28342
Naruna Cangkir Keramik Snowwhite Series	-0,79727	-0,58602
Naruna Cangkir Keramik Handle 300 ml	-0,92484	-0,67978
Naruna Cangkir Keramik Bilur Series	-0,53839	-0,58602
Naruna Cangkir Keramik Uvo dengan Handle	-0,37706	-0,28768

Naruna Cangkir Spot Vertikal Horisontal Series	0,61343	0,15130
Naruna Cangkir Batik Series	-0,57591	-0,60307
Naruna Cangkir Keramik Janur	-0,80478	-0,65421
Naruna Cangkir Keramik Ragam Series Pasir	1,03739	-0,57749
Naruna Cangkir Kayu Jati	-0,66971	-0,53061
Naruna Cangkir Keramik Octagon Series	-0,38457	-0,64569

Next, clustering was carried out using the K-means method. The analysis was carried out with the help of SPSS software with the desired number of clusters being three clusters. This is because in this research we want to obtain groups of products that are most popular, moderately popular and less popular by consumers. The results obtained from cluster formation and determining the initial centroid are shown in Figure 1 below.

Initial Cluster Centers

	Cluster		
	1	2	3
Zscore: Jumlah Stok	-.92484	2.95085	.57216
Zscore: Jumlah Terjual	-.67978	2.80650	.92697

Figure 1. Initial Cluster Centroid from SPSS

Iteration History<sup>a</sup>

Iteration	Change in Cluster Centers		
	1	2	3
1	.418	.518	.735
2	.000	.000	.000

Figure 2. Iteration History from SPSS

Final Cluster Centers

	Cluster		
	1	2	3
Zscore: Jumlah Stok	-.55513	2.45560	.46111
Zscore: Jumlah Terjual	-.48570	2.65520	.20074

Figure 3. Final Cluster Centroid from SPSS

From Figure 1, it can be interpreted that the initial centroid of cluster 1 is the Naruna Cangkir Keramik Handle 300 ml product, cluster 2 is the Naruna Cangkir Keramik Unhandle product, and cluster 3 is the Naruna Cangkir Keramik MB Series product. The clustering process was carried out in a total of two iterations as shown in the SPSS results in Figure 2. From Figure 3, it can be interpreted that cluster 1 contains products that have stock amounts and quantities sold below the average, cluster 2 contains products that have quantities of stock and quantities sold above the average, and cluster 3 contains products that have stock amounts and sales quantities that are above the average but are still below cluster 2. Thus, it can be concluded that cluster 1 contains products that are less popular with consumers, cluster 2 contains products that are most popular with consumers. consumers are interested in, and cluster 3 contains products that are quite popular with consumers. The stages of cluster formation are shown through the following iterations.

#### Iteration 1

The initial centroid is chosen randomly. The results of the initial centroid selection are as follows.

**Table 3.** Initial Centroid

Initial Centroid	Cluster		
	1	2	3
Stock Quantity	-0,92484	2,95085	0,57216
Sold Quantity	-0,67978	2,8065	0,92697

The distance of each data to each centroid was measured using Euclidean distance to obtain the following table.

**Table 4.** Distance of Each Data to Each Centroid  
Iteration 1

Name of Product	Data Distance to Centroid 1	Data Distance to Centroid 2	Data Distance to Centroid 3
Naruna Cangkir Keramik Uvo	0,53231935	4,68087158	1,66837801
Naruna Cangkir Keramik Unhandle	5,21297623	0	3,03163308

Naruna Cangkir Keramik Latte	4,29653318	1,035682	2,10090634
Naruna Cangkir Keramik Dipta Series	0,13160406	5,0837473	2,06974418
Naruna Cangkir Keramik MB Series	2,19605432	3,03163308	0
Naruna Cangkir Keramik Handle Ring	1,36408481	3,85276389	0,83295614
Naruna Cangkir Keramik Sea Sand Series	1,32089279	3,89209232	0,88705371
Naruna Cangkir Ekspreso	0,79088044	4,51786199	1,5757631
Naruna Cangkir Keramik Flute	0,87385536	4,34255757	1,32223699
Naruna Cangkir Keramik Auora Series	0,71934786	4,50286412	1,50635814
Naruna Cangkir Keramik Snowwhite Series	0,15831943	5,05545206	2,04070509
Naruna Cangkir Keramik Handle 300 ml	0	5,21297623	2,19605432
Naruna Cangkir Keramik	0,39766134	4,86661974	1,87682179

Bilur Series			
Naruna Cangkir Keramik Uvo dengan Handle	0,67365075	4,54410991	1,54155546
Naruna Cangkir Spot Vertikal Horisontal Series	1,74841887	3,53745944	0,77676712
Naruna Cangkir Batik Series	0,35726261	4,90542594	1,91287405
Naruna Cangkir Keramik Janur	0,12275271	5,10698251	2,09668642
Naruna Cangkir Keramik Ragam Series Pasir	1,96489435	3,88750788	1,57475041
Naruna Cangkir Kayu Jati	0,2955385	4,92389661	1,91488395
Naruna Cangkir Keramik Octagon Series	0,54134444	4,80027524	1,8408128

Next, the data is grouped into one of the clusters based on the shortest distance obtained so that the initial clustering results are obtained as follows.

**Table 5.** Results of Clustering Iteration 1

Cluster 1	Naruna Cangkir Keramik Uvo, Naruna Cangkir Keramik Dipta Series, Naruna Cangkir Keramik Ekspreso, Naruna Cangkir Keramik Flute, Naruna Cangkir Keramik Auora
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	Series, Naruna Cangkir Keramik Snowwhite Series, Naruna Cangkir Keramik Handle 300 ml, Naruna Cangkir Keramik Bilur Series, Naruna Cangkir Keramik Uvo dengan Handle, Naruna Cangkir Batik Series, Naruna Cangkir Keramik Janur, Naruna Cangkir Kayu Jati, and Naruna Cangkir Keramik Octagon Series.
Cluster 2	Naruna Cangkir Keramik Unhandle and Naruna Cangkir Keramik Latte.
Cluster 3	Naruna Cangkir Keramik MB Series, Naruna Cangkir Keramik Handle Ring, Naruna Cangkir Keramik Sea Sand Series, Naruna Cangkir Spot Vertikal Horisontal Series, and Naruna Cangkir Keramik Ragam Series Pasir.

### Iteration 2

A new centroid is calculated for each cluster by calculating the average variable for each data in each cluster. The new centroid is obtained as follows.

**Table 6.** New Centroid Calculation Results

New Centroid	Cluster		
	1	2	3
Stock Quantity	-0,555133846	2,455605	0,461104
Sold Quantity	-0,485698462	2,6552	0,200738

The distance of each data to each centroid was measured using Euclidean distance to obtain the following table.

**Table 7.** Distance of Each Data to Each Centroid Iteration 2

Name of Product	Data Distance to Centroid 1	Data Distance to Centroid 2	Data Distance to Centroid 3
Naruna Cangkir	0,15525027	4,21790797	1,11731945

Keramik Uvo			
Naruna Cangkir Keramik Unhandle	4,80941716	0,517841	3,60400205
Naruna Cangkir Keramik Latte	3,90709716	0,517841	2,74814915
Naruna Cangkir Keramik Dipta Series	0,28630897	4,62071307	1,51042497
Naruna Cangkir Keramik MB Series	1,80732498	2,55619718	0,73467432
Naruna Cangkir Keramik Handle Ring	0,97549435	3,38488111	0,44336523
Naruna Cangkir Keramik Sea Sand Series	0,92246796	3,42942236	0,4067477
Naruna Cangkir Ekspreso	0,39238502	4,0748407	0,91390085
Naruna Cangkir Keramik Flute	0,49760332	3,87542723	0,8231044
Naruna Cangkir Keramik Auora Series	0,30674109	4,04532987	0,92284639
Naruna Cangkir Keramik Snowwhite Series	0,26209603	4,59202601	1,48407994
Naruna Cangkir	0,41755273	4,74863138	1,64199656

Keramik Handle 300 ml			
Naruna Cangkir Keramik Bilur Series	0,10170923	4,41242713	1,27199702
Naruna Cangkir Keramik Uvo dengan Handle	0,26631111	4,08467057	0,97008816
Naruna Cangkir Spot Vertikal Horisontal Series	1,33090514	3,10855657	0,16014783
Naruna Cangkir Batik Series	0,11919617	4,45043892	1,31206148
Naruna Cangkir Keramik Janur	0,30119652	4,64567594	1,52754652
Naruna Cangkir Keramik Ragam Series Pasir	1,59516704	3,53010176	0,96837202
Naruna Cangkir Kayu Jati	0,12306397	4,4628443	1,34670346
Naruna Cangkir Keramik Octagon Series	0,23385747	4,35459169	1,19649692

Next, the data is grouped into one of the clusters based on the shortest distance obtained so that the initial clustering results are obtained as follows.

**Table 8.** Result of Clustering Iteration 2

Cluster 1	Naruna Cangkir Keramik Uvo,
	Naruna Cangkir Keramik Dipta
	Series, Naruna Cangkir Ekspreso,
	Naruna Cangkir Keramik Flute,
	Naruna Cangkir Keramik Auora
	Series, Naruna Cangkir Keramik
	Snowwhite Series, Naruna Cangkir
	Keramik Handle 300 ml, Naruna
	Cangkir Keramik Bilur Series, Naruna
	Cangkir Keramik Uvo dengan
Cluster 2	Naruna Cangkir Keramik Unhandle
	and Naruna Cangkir Keramik Latte.
Cluster 3	Naruna Cangkir Keramik MB Series,
	Naruna Cangkir Keramik Handle
	Ring, Naruna Cangkir Keramik Sea
	Sand Series, Naruna Cangkir Spot
	Vertikal Horisontal Series, and
	Naruna Cangkir Keramik Ragam
	Series Pasir.

Because there is no data movement within each cluster, the clustering stage has been completed with the members of each cluster as shown in Table 8. To see the level of differences in variables in the clusters formed, it is shown in Figure 4 below.

ANOVA					
	Cluster		Error		Sig.
	Mean Square	df	Mean Square	df	
Zscore: Jumlah Stok	8.565	2	.110	17	.77.833
Zscore: Jumlah Terjual	8.684	2	.096	17	.90.480

The F tests should be used only for descriptive purposes because the clusters have been chosen to maximize the differences among cases in different clusters. The observed significance levels are not corrected for this and thus cannot be interpreted as tests of the hypothesis that the cluster means are equal.

**Figure 4.** Varian Analysis Results from SPSS

Based on Figure 4, it can be seen that the F value for the stock quantity variable is 77.833 and for the sales quantity variable it is 90.48. The significance value of each variable is zero. This means that the differences

in variables in the clusters formed are very large. In cluster analysis, if the level of difference in variables in a cluster is greater, then the better the cluster formed. Details of the number of members for each cluster are shown in Figure 5 below.

Number of Cases in each Cluster	
Cluster	1
	2
	3
Valid	20.000
Missing	.000

**Figure 5.** Results Number of Members of Each Cluster from SPSS

## CLOSING

## CONCLUSION

Based on the discussion of research results regarding cluster analysis of several Naruna Ceramic cup products, it can be concluded that:

1. Naruna Ceramic cup products that are most popular with consumers include Naruna Cangkir Keramik Unhandle and Naruna Cangkir Keramik Latte. Naruna Ceramic cup products that are quite popular with consumers include Naruna Cangkir Keramik MB Series, Naruna Cangkir Keramik Handle Ring, Naruna Cangkir Keramik Sea Sand Series, Naruna Cangkir Spot Vertikal Horisontal Series, and Naruna Cangkir Keramik Ragam Series Pasir. Naruna Ceramic cup products that are less popular with consumers include Naruna Cangkir Keramik Uvo, Naruna Cangkir Keramik Dipta Series, Naruna Cangkir Ekspreso, Naruna Cangkir Keramik Flute, Naruna Cangkir Keramik Auora Series, Naruna Cangkir Keramik Snowwhite Series, Naruna Cangkir Keramik Handle 300 ml, Naruna Cangkir Keramik Bilur Series, Naruna Cangkir Keramik Uvo dengan Handle, Naruna Cangkir Batik Series, Naruna Cangkir Keramik Janur, Naruna Cangkir Kayu Jati, and Naruna Cangkir Keramik Octagon Series.
2. In the Naruna Ceramic cup product clustering process, cluster 1 contains 13 products, cluster 2 contains 2 products, and cluster 3 contains 5 products.

The differences in variables in the clusters formed from the Naruna cup product clustering process are



classified as high because they are based on Figure 2. The significance value of each variable is zero and the F value of the first variable is 77,833 and the second variable is 90,48.

#### SUGGESTION

In this research, clustering was carried out using the K-Means method. Further research can be carried out regarding clustering techniques using other methods as a comparison.

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